Technical Specification Group Services and System Aspects ***TSGS#2(99)014***
Meeting #2, Fort Lauderdale, 2-4 March 1999

Source: **TSG_SA_WG1**

Title: **ETSI SMG Contributions (Specifications and reports)**

Document for: **Approval**

Agenda Item: **9.1**

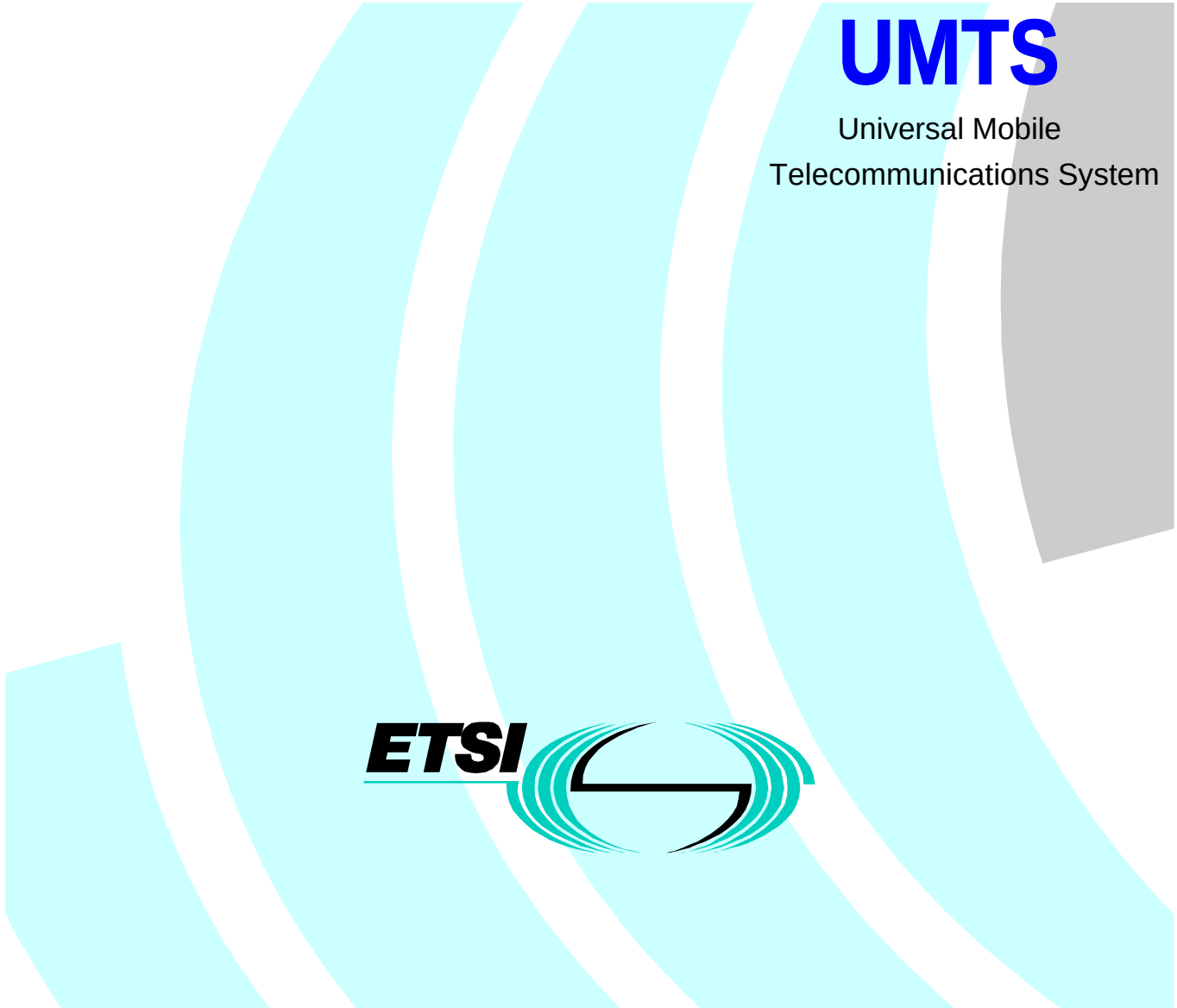
The following Specifications and reports are attached:

TSG_SA_WG1 Tdoc	Specifications and Reports
005	TS 2200v300 (UMTS Phase 1 -
	TS 2201v340 (Services…. with SMG#28 Approved CRs Applied)
035	TS 2205v320 (Service Capabilities …. with SMG#28 Approved CR applied)
008	TR 2207v311 (Terminals …
037	TS 2215v300 (Charging & Billing …
009	TR 2224v310 (Charging & Accounting …
010	TR 2225v310 (QoS …
011	TR 2260v300 (Mobile Multimedia …
012	TR 2270v300 (VHE …
013	TR 2271v310 (Roaming …
014	TR 2275v300 (Addressing …

UMTS 22.00 V3.0.0 (1999-03)

Technical Specification

Universal Mobile Telecommunications System (UMTS);
UMTS phase 1
Approved at SMG#28 (UMTS 22.00 version 3.0.0)



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Contents

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Foreword

This draft Technical Specification has been produced by the Special Mobile Group (SMG) Technical Committee of the European Telecommunications Standards Institute (ETSI).

The contents of this TS is subject to continuing work within SMG and may change following formal SMG approval. Should SMG modify the contents of this TS, it will be re-released by SMG with an identifying change of release date and an increase in version number as follows:

Version 2.y.z

where:

x the first digit:

1 presented to SMG for information;

2 presented to SMG for approval;

3 Indicates SMG approved UMTS document.

y the second digit is incremented for all other types of changes, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the specification;

1 Scope

The UMTS system will be defined in a phased approach. This document specifies the content of the first phase of requirements for UMTS. Some requirements affecting phase 1 to ensure a smooth transition to later releases are also indicated.

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.

2.1 Normative references

This document is the starting point of the set of specifications that define the UMTS Service Requirements for UMTS Phase 1. The UMTS Service requirements for UMTS phase 1 are defined in the following normative specifications.

[1] UMTS 22.01: "Universal Mobile Telecommunications System (UMTS): Service aspects; Service principles".

[2] UMTS 22.05: "Universal Mobile Telecommunications System (UMTS); Services and Service Capabilities".

[3] UMTS 22.15: "Universal Mobile Telecommunications System (UMTS); Service Aspects: Charging and Billing".

[4] UMTS 22.20: "Universal Mobile Telecommunications System (UMTS); VHE Stage 1".

[5] [UMTS TS ??.??, Handover requirements between UMTS and GSM or other Radio System]".

These specifications may refer (directly or indirectly) to further specifications which provide detailed descriptions of service requirements incorporated in UMTS. In particular the service requirements of any GSM component of a UMTS system are specified by reference to GSM service requirements specifications.

3 Definitions, and abbreviations

3.1 Definitions

Definitions applicable to current document :

CAC (Connection Admission Control) : is a set of measures taken by the network to balance between the QoS requirements of new connections request and the current network utilisation without affecting the grade of service of existing/already established connections.

Capability Class : is a piece of information which indicates general UMTS mobile station characteristics (e.g. supported radio interfaces,...) for the interest of the network.

Connection mode : characterizes the type of association between two endpoints as required by the bearer service for the transfer of information. A bearer service is either connection-oriented or connectionless. In a connection oriented mode, a logical association called *connection* needs to be established between the source and the destination entities before information can be exchanged between them. Within the connection, information is delivered to the destination entity in the same order as it was provided by the source entity. Connection oriented bearer services lifetime is the period of time between the establishment and the release of the connection.

In a connectionless mode, no connection is established beforehand between the source and the destination entities ; the source and destination network addresses need to be specified in each message. Transferred information cannot be guaranteed of ordered delivery. Connectionless bearer services lifetime is reduced to the transport of one message.

FC (Flow Control) : is a set of mechanisms used to prevent the network from becoming overloaded by regulating the input rate transmissions.

GSM BSS : refers in this specification to the GSM/GPRS access network.

GSM core network : refers in this specification to the GSM NSS and GPRS backbone infrastructure.

Home environment : enables a user to obtain UMTS services in a consistent manner regardless of the user's location or terminal used (within the limitations of the serving network and current terminal).

Performance : is concerned with the ability to track service and resource usage levels and provides feedback on the responsiveness and reliability of the network.

Serving network : provides the user with access to the services of home environment.

UMTS core network : refers in this specification to an evolved GSM core network infrastructure or any new UMTS core network infrastructures, integrating circuit and packet switched traffic..

UMTS mobile termination : part of the UMTS Mobile Station which provides functions specific to the management of the radio interface (Um).

UMTS network: refers to a network operated by a single network operator and consisting of :
UTRAN access networks (WCDMA and/or TD-CDMA),
optionally GSM BSS access networks,
an UMTS core network.

UPC (Usage Parameter Control) : is a set of actions taken by the network to monitor and control the offered traffic and the validity of the connection with respect to the traffic contract negotiated between the user and the network.

Further definitions [Tbd]

3.2 Abbreviations

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

BSS	Base Station System
CDMA	Code Division Multiple Access
GPRS	General Packet Radio Service
GSM	Global System for Mobile communications
NSS	Network Sub System
PC	Personal Computer
QoS	Quality of Service
SIM	GSM Subscriber Identity Module
TD-CDMA	Time Division-Code Division Multiple Access
UICC	UMTS IC Card
UMTS	Universal Mobile Telecommunications System
USIM	User Service Identity Module

UTRAN	UMTS Terrestrial Radio Access Network
VHE	Virtual Home Environment
WCDMA	Wideband Code Division Multiple Access

4 UMTS phasing and releases overview

The UMTS system will be defined in a phased approach. This specification addresses the UMTS phase 1 capabilities for RELEASE '99.

The UMTS phase 1 requirements can be met by the capabilities of GSM phase 2+ release 99 including specific enhancements for UMTS. Additional developments to fully meet the requirements for UMTS phase 1 standardisation are listed in this specification.

The fundamental difference between GSM and UMTS phase 1 resides in the support of high bit rate bearer services with the notion of negotiated traffic and QoS characteristics. UMTS phase 1 shall in particular support bursty and asymmetric traffic in an efficient way. This shall allow UMTS phase 1 to support single- and multi-media N-ISDN applications and single- and multi-media IP applications.

The phase 1 USIM is developed on the basis of the phase 2+ release 99 SIM. When UMTS specific requirements have not been stated in this specification it is assumed that the GSM phase 2+ release 99 specifications for the SIM is adopted for the UMTS phase 1 requirements.

No specific requirement is addressed for the mobile termination since it relates to the UMTS access stratum and to the UMTS core network (depending whether peer entities end either in the access or in the core).

Regarding the phase 1 standardisation of UMTS access network, only the UTRAN (including all UTRA modes if several modes are defined) is considered as being part of the UMTS access network. Other types of access networks are for further consideration. UTRAN is a new access network and as such all the UTRAN requirements are defined in this specification. This includes in particular the interoperability requirements put on the UTRAN and GSM BSS access networks to cater with UMTS networks operating the two types of access networks.

UMTS phase 1 shall be developed in such a way that it supports compatibility with an evolved GSM network from the point of view of roaming and handover. This could be achieved by evolving from a GSM phase 2+ network but does not exclude other developments. An overall UMTS system approach is needed for UMTS phase 1 development as it is more than the addition of a UTRAN to a GSM Phase 2+ architecture. Requirements to the GSM phase 2+ core network for UMTS should be incorporated.

It should be noted that the advanced bearer capabilities of the phase 1 UMTS access network may not be fully supported by the phase 1 UMTS core network. This however guarantees the viability of the UMTS access network to allow the scope within phase 1 to support broadband bearer services.

A standard default speech codec shall be standardised for UMTS phase 1. UMTS should support tandem free operation from day 1 to enable lower transmission and equipment costs and for higher speech quality. Crossphase compatibility issues in transcoder location should be considered when moving from Phase 1 UTRAN to later releases.

4.1 Post UMTS Phase 1 operation

After phase 1, the new capabilities of UMTS shall be defined in annual releases where each release constitutes a coherent set of specifications covering UMTS mobile station, access network and core network .

UMTS phase 1 should facilitate evolution towards a single integrated core network infrastructure.

The introduction of Phase 1 UMTS shall not limit or restrict the evolution to later UMTS releases, however, the different starting points to introduce UMTS need to be taken into account.

Cross Phase compatibility shall be considered from day 1 and should include the following aspects:

1) Terminals (e.g. support of phase1 terminals in later releases of UMTS networks and vice-versa).

2) Signalling and protocols, including UTRAN to Core Network, inter network and terminal to network.

3) Security aspects (e.g. the relationship of GSM and UMTS security mechanisms).

5 Services

UMTS phase 1 will enable the introduction of a range of new services (e.g. Internet services and Multimedia) and applications with the concept of service capabilities. The service capabilities are bearer services defined by parameters (e.g. QoS attributes) and mechanisms needed to realise services.

5.1. Teleservices and supplementary services

UMTS phase 1 shall at least support the following GSM teleservices currently handled by GSM : speech, emergency call and SMS. UMTS phase 1 shall support these teleservices as stated below :

Speech: A default speech codec shall be specified to provide speech service across the UTRAN and GSM access networks. The selected speech codec shall operate with no discernible loss of speech on handover between the GSM access network and the UTRAN.

***Short Message Service*:** A short message service shall be provided seamlessly (as far as the user or the users terminal equipment is concerned) across the UMTS and GSM access network. Additional features are planned for SMS in **Release 99.**

Supplementary Services : The standard shall support GSM Release '99 supplementary services. The control of such supplementary services shall be the same as for GSM, from the user's perspective.

NOTE : Transfer of data to/from facsimile machines in the PSTN/ISDN should be supported seamlessly (as far as the user or the user's terminal is concerned) across the UMTS and GSM access network. It is envisaged that the main use of fax in the mobile environment will be via PCs. UMTS will not support direct end-to-end communication using T.30. Instead a store and forward service is envisaged where some kind of file transfer program is used to transfer text or images to a store and forward unit for subsequent delivery to the facsimile machine in the PSTN/ISDN. The user (or the users PC) may receive notification of successful delivery of the fax. No standardisation of a fax store and forward service is planned and it is envisaged that roaming subscribers will be supported via the VHE.

5.2. Bearer services

UMTS phase 1 shall support GSM phase 2+ Release '99 data bearer services :

***Circuit switched data*:** Circuit switched data services and "real time" data services shall be provided for interworking with the PSTN/ISDN so that the user is unaware of the access network used (UMTS and GSM access network or handover between access networks). Both transparent (constant delay) and non-transparent (zero error with flow control) services shall be supported. These data services shall operate with minimum loss of data on handover between the GSM access network and the UTRAN.

Packet switched data: Packet switched data services shall be provided for interworking with packet networks such as IP-networks and LANs. The standard shall provide mechanisms which ensure the continuity of packet based services upon handover e.g. between GSM and UMTS.

6 UTRAN capabilities

NOTE : The term performance refers in this clause to the realisation of the QoS objectives inside the UTRAN.

UTRAN capabilities for UMTS are the complete set of bearer capabilities and bearer control specified in UMTS 22.05. The UTRAN shall have the following capabilities :

1) A UTRAN shall be contained within only one UMTS network. (In the case of a network with a phase 1 UMTS core network consisting of an evolved GSM core network, it shall be possible to connect the UTRAN to the GSM NSS and GPRS backbone infrastructures or only one of them.)

2) The UTRAN shall support the set-up, re-negotiation and clearing of connections with a range of traffic and performance characteristics. The re-negotiation may result from an upper layer request or a change in the radio conditions (handover, cell load modification,...) and may be mobile station or network initiated. It shall be possible for the UTRAN to apply the following traffic policing mechanisms such as :
   . connection admission control (CAC) during connection set-up and re-negotiation,
   . flow control (FC) on a connection during its lifetime,
   . usage parameter control (UPC) on a connection during its lifetime..

3) The UTRAN shall support a range of traffic and performance characteristics for the connectionless traffic.

4) The range of traffic and performance characteristics that shall be supported by UTRAN for connection oriented and connectionless traffic is indicated in TS 22.05 sections 5.2 to 5.4.

5) The UTRAN shall allow one mobile termination to handle more than one bearer service simultaneously and to have bearer services of different connection modes. It is nevertheless expected that the terminal and network capabilities will put some limitations on the number of bearer services that can be handled simultaneously. It shall be possible for each connection to have independent traffic and performance characteristics. It shall be possible for each connectionless message to have independent traffic and performance characteristics.

6) Seamless handover of active bearer service(s) from a single mobile termination, between cells of one UTRAN shall be supported. This shall result in an imperceptible loss of speech (if any) for the user of telephony services and without incurring degradation of QoS for data services.

7) At least one Capability Class shall be standardised for mobile terminals supporting more than one UTRA mode (e.g. UTRA FDD and TDD modes). It shall support monitoring of the different types of cells in idle mode (cell reselection procedure) and active mode (handover preparation procedure).

8) For UMTS networks composed of UTRANs with different UTRA modes, the cell selection and the paging procedures shall accommodate to the fact that service areas may be covered by cells supporting one specific mode (e.g. FDD or TDD mode), and cells supporting more than one mode (e.g. FDD and TDD modes).

9) Handover of one mobile termination handling one or more bearer services between cells of two UTRANs using different UTRA modes and operated by one single UMTS network operator shall be supported in both directions. Furthermore, handover between cells using two different UTRA modes should be supported similarly to handover within one mode.

10) The UTRAN shall facilitate determination of the location of a UMTS mobile termination. The realisation of a positioning service can be determined by several methodologies, namely *mobile-based positioning*, *network-based positioning*, or a *hybrid position* architecture. It shall be possible for the location precision to be a UMTS network operator choice, with the precision of the location varying from one part of the service area to another. It shall be possible to achieve a minimum precision of around 50 meters in all types of terrestrial radio environments. Location requirements are detailed in UMTS 22.05 subclause 8.5.

11) The UTRAN shall support the Localised Service Area (LSA) concept. It shall facilitate user-dependent radio resource selection based on LSA (e.g. when user is located at his office, radio coverage provided with indoor radio solutions should be preferred). Corresponding GSM feature has been specified in GSM 02.43.

12) The optimisation of the UTRAN radio interface shall be based upon the objectives expressed in UMTS 22.05 clause 5.

13) Standardised protocols shall be defined for the operation, administration and maintenance of each of the UTRAN components in UMTS phase 1 in cooperation with ETSI TMN.

14) The USIM requirements defined for later releases of UMTS should be taken into account in the design of UTRAN (for any impact).

7 UTRAN and GSM BSS relationship

There is a special relationship between the UTRAN and GSM access networks as it is expected that UTRANs will start as islands in a sea of GSM BSS. GSM BSS access networks will be a key element for service continuity in UMTS networks. The requirements are the following for UMTS phase 1 :

1) UMTS phase 1 shall support dual mode UMTS/GSM terminals. At least one Capability Class shall be standardised for mobile terminals supporting the GSM and UTRA modes. It shall support monitoring of cells belonging to the two types of access networks in idle mode (cell reselection procedure) and active mode (handover preparation procedure).

2) Cell selection and paging procedures shall be designed to accommodate to the fact that networks may consist of GSM BSS cells, UTRAN cells or a combination of both.

3) For UMTS networks composed of both GSM BSS and UTRAN access networks, handover of bearer services shall be supported between GSM BSS and UTRAN cells, in both directions (i.e. UTRAN to GSM BSS and GSM BSS to UTRAN). Some traffic flows may be re-negotiated, temporarily released or re-established during these handover procedures because of the different bearer capabilities of the GSM BSS and UTRAN access networks.

8 UMTS Core Network

NOTE 1: The term performance refers in this clause to the resource level usage and reliability of the UMTS core network.

NOTE 2: SMG1 does not use the (circuit switched) notion of call to define UMTS phase 1 core network capabilities. If SMG12 decides to use this notion to fulfil SMG1 requirements, it shall be noted that it is not required for phase 1 UMTS core networks to support calls with multiple connections. Multiple connections for a single mobile could be realised through several calls.

In the first phase of UMTS, the UMTS core network capabilities are a superset of the phase 2+ release 99 GSM core network capabilities. The additional requirements for the phase 1 UMTS core network are the following :

1) The phase 1 UMTS core network shall support circuit switched data service capability of at least 64 kbit/s per user. *This shall not limit the user from choosing lower data rates.*

2) The phase 1 UMTS core network shall support packet switched data service capabilities of at least 2 Mbit/s peak bit rate per user. *This shall not limit the user from choosing lower data rates.*

3) The phase 1 UMTS core network shall enable set-up, re-negotiation and clearing of connections with a range of traffic and performance characteristics. It shall be possible to apply traffic policing (e.g. connection admission control, flow control, usage parameter control...) on a connection during its set-up and lifetime.

4) The phase 1 UMTS core network shall support a range of traffic and performance characteristics for connectionless traffic.

5) The range of traffic and performance characteristics that shall be supported by the phase 1 UMTS core network for connection oriented and connectionless traffic shall be at least those of GPRS phase 2+ release 99. This means that the support of the full set of bearer services defined in TS 22.05 section 5.2 to 5.4 is not required for the phase 1 UMTS core network.

6) Point to multipoint communication configurations as defined in TS 22.05 shall be supported by the phase 1 UMTS core network.

7) The phase 1 UMTS core network shall allow one mobile termination to handle more than one bearer service simultaneously and to have bearer services of different connection modes. It is nevertheless expected that the terminal and network capabilities will put some limitations on the number of bearer services that can be handled simultaneously. It shall be possible for each connection to have independent traffic and performance characteristics. It shall be possible for each connectionless message to have independent traffic and performance characteristics.

8) In order to facilitate the development of new applications, it shall be possible to address applications to/from a phase 1 UMTS mobile termination in connection oriented and connectionless traffic modes (e.g. the notion of Internet port).

9) Operator specific services based on the VHE concept shall be provided by the phase 1 UMTS core network. This functionality could be provided through available toolkits (such as CAMEL, MExE, WAP and SIM Toolkit).

10) If UMTS authentication is invoked while a user has services active, the authentication shall not degrade the user services.

11) The phase 1 UMTS core network shall support the generation of standardised charging records based upon parameters such as the dialled number, call duration, traffic (volume, bit rate) and perceived Quality of Service provided to the user.

12) The phase 1 UMTS core network shall support on-line billing. Billing of 3rd party value added services with the concept of one-stop-billing shall be supported by the phase 1 UMTS core network through standardised procedures.

13) The phase 1 UMTS core network shall support both bilateral and (possibly via 3rd party) automatic roaming procedures to UMTS networks with improved security as defined by SMG10.

14) The phase 1 UMTS core network shall support interworking with PSTN, N-ISDN, GSM, X.25 and IP networks with their respective numbering schemes.

15) It shall be possible for the standardised classes of phase 1 UMTS mobile terminals supporting the GSM BSS and UTRAN radio interfaces to roam in GSM networks and receive GSM services.

16) Standardised protocols shall be defined for the operation, administration and maintenance of the UMTS phase 1 core network in cooperation with ETSI TMN.

17) The USIM requirements defined for later releases of UMTS should be taken into account in the design of the phase 1 UMTS core network.

9 USIM

In the first phase of UMTS, the USIM shall be developed on the basis of the phase 2+ release 99 GSM SIM. The additional requirements for the phase 1 UMTS USIM are as follows :

1) USIM shall provide new and enhanced security features (e.g. mutual authentication...) as defined by SMG10.

2) The UMTS mobile terminal shall support phase 2 and phase 2+ GSM SIMs as access modules to UMTS networks. The services that can be provided in this case may be limited to GSM like services provided by that UMTS network. UMTS mobile terminals shall not support 5V SIMs. It shall be up to the UMTS network operator to accept or reject the use of GSM SIM as access modules in its network.

3) It shall be possible to have multiple applications on the UMTS IC Card (UICC). There shall be a secured and easy mechanism for application selection. An authorised access for each application is mandatory, however it shall be possible to have shared directories between applications where appropriate. The UICC shall be capable of supporting SIM and USIM applications.

4) Simultaneous activation of several USIMs on one mobile terminal need not be supported in UMTS phase 1.

5) A standardised mechanism allowing highly secure transfer of applications and/or associated data to/from the UICC shall be supported in UMTS phase 1.

10 Security Features

With respect to the GSM security mechanisms the following additional features may be implemented for UMTS phase 1 if required by SMG10 :

1) Mutual authentication between user and serving network, between user and home environment and between serving network and home environment

2) Confidentiality of user and signalling data to and within the access network (and possibly into the core network)

3) End to end encryption (as an optional service) between UMTS users, with access to plaintext for lawful interception purposes

4) TTP (trusted 3rd party) mechanisms, including public key techniques and associated certificates and signing, verification and revocation procedures used, for example, before accessing 3rd party services.

5) Authentication, confidentiality and integrity of signalling between UMTS network (both core and access) nodes

6) Confidentiality of the user identity on the radio interface.

Annex A (informative) : Change history

Change history					
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SMG#28				Version 3.0.0	Approved

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6th of november 1998	v.1.2.0	section 5 completed during Rome meeting
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UMTS 22.01 V3.4.0 (1999-03)

Technical Specification

Universal Mobile Telecommunications System (UMTS): Service aspects; Service principles (UMTS 22.01 version 3.4.0)

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Contents

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1 Scope

This ETSI Technical Specification (TS) describes the Service Principles of the Universal Mobile Telecommunications System (UMTS).

The European initiative to develop UMTS should be seen as part of the policy to provide more advanced capabilities than can be anticipated for pre-UMTS systems. UMTS provides integrated personal communications services. UMTS operates in parallel with pre-UMTS technologies (e.g. GSM, DCS 1800, DECT, TETRA etc.) which must be allowed to achieve their full potential. UMTS is a system that will support different applications ranging from narrow-band to wide-band communications capability with integrated personal and terminal mobility to meet the user and service requirements of the 21st century.

UMTS is the realisation of a new generation of mobile communications technology for a world in which personal communications services should allow person-to-person calling, independent of location, the terminal used, the means of transmission (wired or wireless) and the choice of technology. Personal communication services should be based on a combination of fixed and wireless/mobile services to form a seamless end-to-end service for the user.

UMTS should be in compliance with the following objectives:

a) to provide a single integrated system in which the user can access services in an easy to use and uniform way in all environments;

b) to allow differentiation between service offerings of various serving networks and home environments;

c) to provide a wide range of telecommunications services including those provided by fixed networks and requiring user bit rates of up to 2 Mbits/s as well as services special to mobile communications. These services should be supported in residential, public and office environments and in areas of diverse population densities. These services are provided with a quality comparable with that provided by fixed networks such as ISDN;

d) to provide services via hand held, portable, vehicular mounted, movable and fixed terminals (including those which normally operate connected to fixed networks), in all environments (in different service environments - residential, private domestic and different radio environments) provided that the terminal has the necessary capabilities;

e) to provide support of roaming users by enabling users to access services provided by their home environment in the same way even when roaming.

f) to provide audio, data, video and particularly multimedia services;

g) to provide for the flexible introduction of telecommunication services;

h) to provide within the residential environment the capability to enable a pedestrian user to access all services normally provided by fixed networks;

i) to provide within the office environment the capability to enable a pedestrian user to access all services normally provided by PBXs and LANs;

j) to provide a substitute for fixed networks in areas of diverse population densities, under conditions approved by the appropriate national or regional regulatory authority.

k) to provide support for interfaces which allow the use of terminals normally connected to fixed networks.

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.

2.1 Normative References

[1] ETSI TR 22.25 “Universal Mobile Telecommunications System (UMTS): Quality of Service and Network Performance”

[2] ETSI TS 22.05 “Universal Mobile Telecommunications System (UMTS): Service Capabilities related to Service Usage”

[3] UMTS 22.XX: "Universal Mobile Telecommunications System (UMTS): Virtual Home Environment (VHE), Stage 1"

2.2 Informative references

[1] ITU-T Draft Recommendation F.700: "Framework Recommendation for audio-visual/multimedia services";

[2] ITU-T Draft Recommendation F.SFEA: "Service Features and Operational Provisions in IMT-2000".

[3] GSM 02.01: "Digital cellular telecommunications system (Phase 2+); Principles of telecommunication services supported by a GSM Public Land Mobile Network (PLMN)".

[4] GSM 02.04: "Digital cellular telecommunications system (Phase 2+); General on supplementary services"

[5] GSM 02.30: "Digital cellular telecommunications system (Phase 2+); Man-Machine Interface (MMI) of the Mobile Station (MS)"

[6] GSM 02.66: "Digital cellular telecommunications system (Phase 2+); Support of Mobile Number Portability (MNP); Service description; Stage 1"

[7] GSM 02.79: "Digital cellular telecommunications system (Phase 2+); Support of Optimal Routing; Stage 1"

3 Definitions, symbols and abbreviations

3.1 Definitions

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

Authentication: a property by which the correct identity of an entity or party is established with a required assurance. The party being authenticated could be a user, subscriber, home environment or serving network.

Bearer: a bearer capability of defined capacity, delay and bit error rate, etc.

Bearer capability: a transmission function which the mobile station requests to the network.

Cipher key: a code used in conjunction with a security algorithm to encode and decode user and/or signalling data.

Confidentiality: the avoidance of disclosure of information without the permission of its owner.

Home Environment: the home environment is responsible for enabling a user to obtain UMTS services in a consistent manner regardless of the user's location or terminal used (within the limitations of the serving network and current terminal).

IC Card: a card holding an Integrated Circuit containing subscriber, end user, authentication and/or application data for one or more applications.

Integrity: (in the context of security) is the avoidance of unauthorised modification of information.

International mobile user number (IMUN): The International Mobile User Number is a diallable number allocated to a UMTS user.

Mobility: the ability for the user to communicate whilst moving independent of location.

Multimedia service: Multimedia services are services that handle several types of media such as audio and video in a synchronised way from the user's point of view. A multimedia service may involve multiple parties, multiple connections, and the addition or deletion of resources and users within a single communication session.

Number portability: where the provision of diallable numbers is independent of home environment and/or serving network.

One Stop Billing: one bill for all charges incurred using UMTS.

Quality of Service: the collective effect of service performances which determine the degree of satisfaction of a user of a service. It is characterised by the combined aspects of performance factors applicable to all services, such as:

- service operability performance;
- service accessibility performance;
- service retainability performance;
- service integrity performance;
- and other factors specific to each service.

Roaming: the ability for a user to function in a serving network.

Security: the ability to prevent fraud as well as the protection of information availability, integrity and confidentiality.

Service: is set of functions offered to a user by an organisation.

Service Control: is the ability of the user, home environment or serving environment to determine what a particular service does, for a specific invocation of that service, within the limitations of that service.

Serving Network: the serving network provides the user with access to the services of home environment.

Subscriber: the responsibility for payment of charges incurred by one or more users may be undertaken by another entity designated as a subscriber. This division between use of and payment for services has no impact on standardisation.

Supplementary service: is a service which modifies or supplements a basic telecommunication service. Consequently, it cannot be offered to a customer as a standalone service. It must be offered together with or in association with a basic telecommunication service. The same supplementary service may be common to a number of telecommunication services.

Teleservice: is a type of telecommunication service that provides the complete capability, including terminal equipment functions, for communication between users according to standardised protocols and transmission capabilities established by agreement between operators.

User: is a logical, identifiable entity which uses UMTS services.

User Profile: is the set of information necessary to provide a user with a consistent, personalised service environment, irrespective of the user's location or the terminal used (within the limitations of the terminal and the serving network).

Virtual Home Environment: the virtual home environment is a system concept for personalised service portability between serving networks and between terminals.

3.2 Abbreviations

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

BER	Bit Error Rate
B-ISDN	Broadband ISDN
DAM	DECT Authentication Module
DECT	Digital Enhanced Cordless Telecommunications
DTMF	Dual Tone Multiple Frequency
ECTRA	European Committee of Telecommunications Regulatory Affairs
ETNS	European Telecommunications Numbering Space
ETSI	European Telecommunications Standards Institute
FDD	Frequency Division Duplex
GSM	Global System for Mobile Communications
HF	Human Factors
IEC	International Electrotechnical Commission
IMT-2000	International Mobile Telecommunications 2000
IMUN	International Mobile User Number
IN	Intelligent Network
ISDN	Integrated Services Digital Network
ISO	International Organisation for Standardisation
ITU	International Telecommunication Union
LAN	Local Area Network
ME	Mobile Equipment
MMI	Man Machine Interface
MO	Mobile Origination
MS	Mobile Station
MT	Mobile Termination
O&M	Operations and Maintenance
PBX	Private Branch eXchange
PC	Personal Computer
PCMCIA	Personal Computer Memory Card International Association
PIN	Personal Identity Number
PNP	Private Numbering Plan
POTS	Plain Old Telephony Service
QoS	Quality of Service
SIM	Subscriber Identity Module
SMS	Short Message Service
TDD	Time Division Duplex
TE9	Terminal Equipment 9 (ETSI sub-technical committee)
UICC	UMTS IC Card
USIM	User Service Identity Module
UMTS	Universal Mobile Telecommunications System
VHE	Virtual Home Environment

4 General

4.1 Aims of UMTS

It shall be capable of delivering audio, text, video and graphics direct to people and provide them with access to the next generation of information based services. It moves mobile and personal communications forward from pre-UMTS systems, delivering mass market low-cost digital telecommunication services.

UMTS therefore seeks

- to enable users to access a wide range of telecommunications services, including many that are today undefined as well as multi-media and high data rates.
- to facilitate the provision of a high quality of service (particularly speech quality) similar to that provided by fixed networks;
- to facilitate the provision of small, easy to use, low cost terminals with long talk time and long standby operation;
- to provide an efficient means of using network resources (particularly radio spectrum).

4.2 Standardisation of Service Capabilities

Pre-UMTS systems have largely standardised the complete sets of teleservices, applications and supplementary services which they provide. As a consequence, substantial re-engineering is often required to enable new services to be provided and the market for services is largely determined by operators and standardisation. This makes it more difficult for operators to differentiate their services.

UMTS shall therefore standardise service capabilities and not the services themselves. Service capabilities consist of bearers defined by QoS parameters and the mechanisms needed to realise services. These mechanisms include the functionality provided by various network elements, the communication between them and the storage of associated data. Section 6 provides a conceptual description of a service architecture and architecture requirements which aim to provide service capabilities. It is intended that these standardised capabilities should provide a defined platform which will enable the support of speech, video, multi-media, messaging, data, other teleservices, user applications and supplementary services and enable the market for services to be determined by users and home environments.

The standardisation of service capabilities rather than the services themselves is a major differentiator between UMTS and pre-UMTS systems, see UMTS 22.xx.

4.3 Efficient Use of Network Resources

UMTS service capabilities shall take account of the discontinuous and asymmetric nature of most teleservices and user applications in order to make efficient use of network resources (particularly radio resources).

Service capabilities shall be provided in a wide range of radio operating environments (where a radio environment is characterised in terms of propagation environment, mobile station relative speeds and traffic characteristics - see [2]). Although UMTS aims to minimise the number of UMTS radio interfaces and to maximise commonality between them, UMTS may utilise several radio interfaces, each optimised for different environments. Each radio interface might provide differing service capabilities. For UMTS Phase1, a single radio interface supporting two modes (TDD and FDD) is defined.

If more than one radio interface is defined for UMTS, the UMTS standard shall provide a mechanism which will enable a UMTS terminal to adapt to different radio interfaces as necessary and to determine the service capabilities available. The standard shall also provide a mechanism which will enable a UMTS terminal to select radio interfaces capable of providing appropriate service capabilities.

4.4 Compatibility with Global Standards

UMTS aims to be compatible with IMT-2000 and to provide global terminal mobility (roaming), enabling the user to take his/her terminal to different regions of the world and to be provided with services. It is probable that different regions of the world will adopt different radio interface technologies. IMT-2000, as a global standard, should therefore enable a IMT-2000 terminal to determine the radio interface technology and the radio interface standard used in a region. Global terminal roaming also requires the global standardisation of service capabilities. As far as possible the method of indication of the radio interface standard and available service capabilities shall be aligned with IMT-2000.

UMTS shall enable users to access the services provided by their home environment in the same way via any serving network provided the necessary service capabilities are available in the serving network.

4.5 Virtual Home Environment

The above general principles plus the service architecture principles stated in section 6 specify all the capabilities of the virtual home environment (VHE).

UMTS aims to provide the user with a comprehensive set of services and features, which have the "same look and feel" wherever they are used. For further information see UMTS 22.xx Especially the VHE shall provide for:

- a generic set of services / features and access capabilities, if the required service capabilities are available in the visited network;
- the means for serving network, home environments and user to re-use existing system capabilities to define their own specific features / services;
- user personalisation of features / services;
- a personalised service set being used via all UMTS access and transport networks, subject to physical limitations;
- the ability for the user to have access to personalised services from any suitable UMTS terminal
- regional or network based variations / enhancements to the basic / standard UMTS;
- future evolution of UMTS itself.

4.6 Functionality of Serving Network and Home Environment

The following functionality shall be the responsibility of the home environment:

- User Authentication.
- USIM Issue.
- Billing.
- User Profile/VHE Management.

The following functionality shall be the responsibility of the serving network:

- Radio or other means of access.
- Transport and signalling.

The following functionality may be the responsibility of either the serving network, the home environment or an appropriate combination of both

- Service Control.
- QoS negotiation.
- Mobility management, including roaming.
- Automatic establishment of roaming agreements.

5 Principles for new service capabilities

5.1 General

The standard shall enable the user of a single terminal to establish and maintain several connections simultaneously. It shall efficiently cater for applications which have variable requirements relating to specific QoS parameters

(e.g.throughput) whilst meeting other QoS targets. It shall also cater for applications which are able to take adapt to a range of variations in QoS.

5.2 Multimedia

UMTS shall support multimedia services and provide the necessary capabilities.

Multimedia services combine two or more media components (e.g. voice, audio, data, video, pictures) within one call. A multimedia service may involve several parties and connections (different parties may provide different media components) and therefore flexibility is required in order to add and delete both resources and parties.

Multimedia services are typically classified as interactive or distribution services.

Interactive services are typically subdivided into conversational, messaging and retrieval services:

Conversational services are real time (no store and forward), usually bi-directional where low end to end delays (< 100 ms) and a high degree of synchronisation between media components (implying low delay variation) are required. Video telephony and video conferencing are typical conversational services."

Messaging services offer user to user communication via store and forward units (mailbox or message handling devices). Messaging services might typically provide combined voice and text, audio and high resolution images.

Retrieval services enable a user to retrieve information stored in one or many information centres. The start at which an information sequence is sent by an information centre to the user is under control of the user. Each information centre accessed may provide a different media component, e.g. high resolution images, audio and general archival information.

Distribution services are typically subdivided into those providing user presentation control and those without user presentation control.

Distribution services without user control are broadcast services where information is supplied by a central source and where the user can access the flow of information without any ability to control the start or order of presentation e.g. television or audio broadcast services.

Distribution services with user control are broadcast services where information is broadcast as a repetitive sequence and the ability to access sequence numbering allocated to frames of information enables the user (or the user's terminal) to control the start and order of presentation of information.

UMTS shall support single media services (e.g. telephony) and multimedia services(e.g. video telephony).All calls shall have potential to become multimedia calls and there shall be no need to signal, in advance, any requirement for any number of multimedia components. However, it shall be possible to reserve resources in advance to enable all required media components to be available.

5.3 Service Management Requirements

There will be increased demands for better customer care and cost reductions in managing mobile networks due to :

- the provision of sophisticated personal communications services;
- the expansion of the customer base beyond the business user base;
- the separation between entities of home environment and serving network; and
- drives for 'one stop' billing for a range of services.

In pre-UMTS mobile networks, Service Management has largely been concerned with the management of physical products (often from different vendors and having different network management interfaces). UMTS shall support standardised protocols enabling network management of functionality rather than network management of products and enabling:

- the support of Virtual Home Environment;

- management of user profiles;
- support of number portability;
- control, creation and subscription of service capabilities and services;
- provision of ‘one stop’ billing;
- quality of service.

6 Service architecture

In order to provide standardisation of service capabilities a service architecture shown by Figure 2 is envisaged

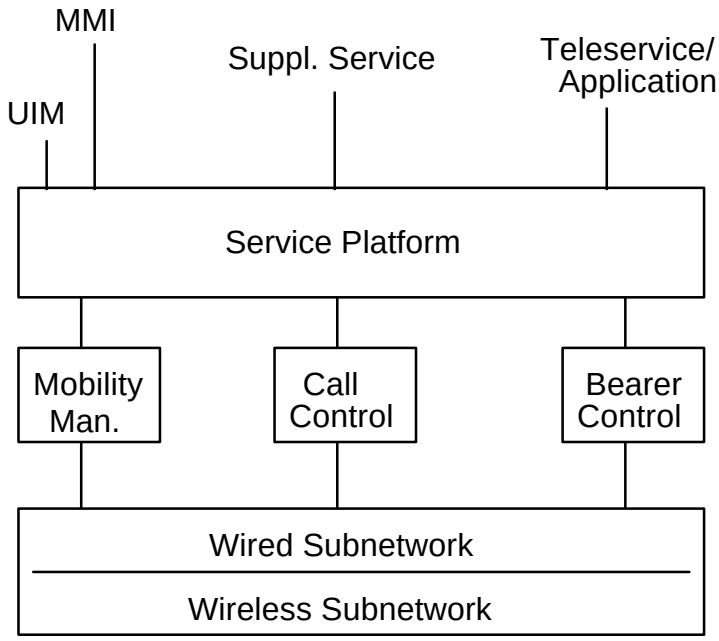

Figure 2: Service Architecture

A number of bearers shall be provided that can differ in flexibility and offer different capabilities. Bearers may be characterised by parameters such as “throughput”, “delay tolerance”, “maximum bit error rate”, “symmetry” etc. These bearers enable information to be transferred appropriate to the provision of teleservices, and end user applications generally, via subnetworks which typically provide different specified qualities of service. The assignment and release of bearers is provided by the bearer control function. Provision should be made for several bearers to be associated with a call and for bearers to be added to a call and/or to be released from a call following call establishment. The bearers provided by UMTS should be independent of radio environments, radio interface technology and fixed wire transmission systems.

Adaptation/Interworking functions are required in order to take account of the differences between the bearers used for the provision of a teleservice/application in the fixed network and the bearers provided by UMTS. Adaptation/Interworking functions are required which take account of the discontinuous and/or asymmetrical nature of most teleservices/applications.

The service platform shall provide interfaces (to serving networks and home environments) appropriate to the support, creation and control of supplementary services, teleservices and user applications. The service platform will also provide interfaces enabling subscribers to control supplementary services, teleservices and user applications.

Supplementary service provision and control provided by UMTS will be independent of radio operating environment, radio interface technology and fixed wire transmission systems.

As far as possible, the service platform is required to enable new supplementary services, teleservices and/or end user applications to be supported at minimum cost, with minimum disruption of service and within the shortest possible time.

7 Quality of Service (QoS)

The UMTS Quality of Service (QoS) parameters should be identified together with appropriate parameter values which set targets to be reached when designing UMTS standards, and which also will serve as guidelines for network design and service provision.

The QoS for call set-up time, as an example, can be defined in terms of a mean value and as a percentage of cases which should not exceed a certain time limit. Further information can be found in [3] and [4].

8 Security

This section covers service related security issues, more general security matters are considered in ETR 50901.

8.1 Security for the Serving Network and Home Environment

Charging information shall be incontestable and therefore require that the user be unambiguously identified, though there may be exceptions such as pre-paid cards. The UMTS IC Card (UICC) shall be physically present in order to make use of any services except for emergency calls.

The identification of the user should be based upon the UICC and steps should be taken to prevent fraudulent use of stolen IC Card's. As far as possible the usage of stolen terminals should be prevented.

The standard shall cater for the ability for UMTS networks to authenticate each other.

8.2 Control of User Profiles and Supplementary Services

Although supplementary services may not be standardised the control of supplementary services will need to be implemented in a secure manner; e.g. call diversions to international numbers may be barred or limited in number at the discretion of the serving network.

The home environment shall have control of all aspects of user profiles.

Any changes to user profiles shall be done in a secure manner.

8.3 Security for the user

It should be possible for the user to authenticate the network when registering and before initiating a service if desired.

Steps shall be taken to ensure the privacy and integrity of sensitive information transferred between the user and all other entities; e.g. user identity and user traffic.

8.4 Emergency calls

A UMTS terminal capable of making emergency calls shall be able to do so when there is no UICC physically present. The terminal shall be responsible for ensuring that only emergency numbers are attempted when no UICC is present to prevent the misuse of network resources. It will be left to the national authorities to decide whether the network should accept such calls. In addition networks may also validate that only emergency calls are accepted when no UICC is inserted in the terminal.

9 Numbering principles

The following list provides the requirements for numbering and identification of UMTS subscribers:

- Number portability;
- Evolution;
- User identification;
- Terminal Identification

- Billing;
- Service dependence and independence (Multiple and Single numbering scheme);
- Private Numbering;
- Multiple Profiles;
- Optimal Routing;
- Content Providers(for further study).

9.1 UMTS Number portability

The standard shall enable number portability on a home environment level, location level and service level. For further information see GSM 02.66.

9.1.1 Home Environment Level

An International Mobile User Number (IMUN) shall be allocated to each new user at the start of a UMTS subscription. This number may be allocated from one of several numbering domains. For example:

- national numbering scheme;
- regional numbering scheme;
- global numbering scheme.

A UMTS user shall be able to move subscription from one home environment to another without changing the IMUN provided that the new home environment offers service in the same geographic domain. It is envisaged that home environment s will be able to allocate IMUNs from each of these domains as required.

9.1.2 Location Level

It shall be possible for the user to be dialled independently from their location (i.e. mobility).

NOTE: This is fundamental to a mobile network but is not currently fundamental to a fixed network. It is listed here as it is a common principle used in numbering form.

9.1.3 Service Level

The standard shall enable where possible for the number dialled to communicate with a user to be independent from the service requested (see subclause 9.5).

9.2 Evolution path

Since UMTS aims to be aligned with IMT-2000, a primary goal in numbering is the provision of global user numbering in line with steps taken by the ITU - SG2.

(For UMTS Phase 1) It is required that is shall be possible to identify UMTS users using GSM identities, namely IMSI, MSISDN and possibly TMSI and IMEI.

The numbering scheme and network implementation chosen shall allow for international/global evolution.

9.3 User Identification

It is a requirement that the user can be uniquely identified by the home environment from which the service is being obtained. This identification may be unknown to the serving network on which the user is roaming.

9.4 Terminal Identification

It is a requirement that the terminal can be uniquely identified by the home environment.

9.5 Service dependence/independence

UMTS shall provide various methods to identify the service required, for example, via the number dialled or protocol headers. It shall be possible for the home environment to change serving network(s) without changing IMUNs.

It shall be possible for several numbers to be associated with a single subscription on a single UICC.

9.7 Private numbering

A user may wish to use private numbers for the purposes of calling frequent numbers. Therefore there is a requirement for the use, by the user, of Private Numbering Plans (PNPs). These schemes may belong to the user himself, to a home environment or a third party.

In addition, the user shall be able to choose the means to address the identity of a dialled number. For instance the number required to be dialled may be addressed by a spoken name.

NOTE: This may well be considered as a function of the equipment used to access the service and as such is not required to be standardised. However, the provision of such a facility needs to be provided across all terminal types used; fixed and mobile.

9.8 Optimal routing

The implementation of the numbering scheme used for UMTS shall allow for optimal routing; i.e. routing shall not take place simply on the number dialled. See GSM 02.79 for some scenarios.

10 Human Factors and user procedures

As defined in the Service Provision Concepts subclause of this ETS the UMTS system should meet future communication requirements and shall be designed to be adaptable to provide new services as and when they are defined.

The User Interface (MMI) from the end user's point of view should be as flexible as possible while still meeting the general service requirements of UMTS. In addition it should be capable of being updated so as to meet new services which are still to be envisaged.

In general the following principles should be encompassed:

- activation of UMTS services should be as simple as possible with minimum input expected from the user;
- feedback, to the user from the various UMTS services, should be meaningful;
- any error recovery procedures provided should be simple to understand and execute.

However, a detailed specification for the User Interface shall not be defined. In particular given the global nature of the third generation systems, for different regions of the world, different criteria will determine the implementation of the User Interface. Also it is unlikely that there will be a single common handset which will meet all the service requirements of UMTS and therefore a common User Interface would be impractical.

Given the flexibility of the UMTS services, there should be a wide range of User Interface possibilities. These possibilities include simple terminals with a single on/off button through to complex terminals providing support to hearing/visually impaired users.

Existing GSM supplementary services (GSM 02.04), may use MMI as specified in GSM 02.30.

11 UMTS IC Card, USIM and Terminal

This clause defines the functional characteristics and requirements of the User Service Identity Module (USIM) for use in UMTS. The USIM is an application residing on a UICC.

11.1 The USIM and User Profiles

11.1.1 The USIM

Every USIM shall have a unique identity and shall be associated with one and only one home environment.

It shall be possible for a home environment to uniquely identify a user by the USIM.

The USIM shall be used to provide security features.

For access to UMTS services, provided via a UMTS home environment, a valid USIM shall be required.

The USIM shall reside on a UICC, UMTS shall adopt both of the GSM SIM card physical formats. New UMTS terminals may require other formats also. USIM specific information shall be protected against unauthorised access or alteration.

It shall be possible to update USIM specific information via the air interface, in a secure manner.

11.1.2 User Profiles

It shall be possible for a user to be associated with one or a number of user profiles, which the user can select and activate on a per call basis. The user profile contains information which may be used to personalise services for the user.

It shall be possible for one or more user profiles associated with the same user to be active simultaneously so that the user may make or receive calls associated with different profiles simultaneously. Activation of profiles shall be done in a secure manner, for example with the use of a PIN.

For terminating calls the correct profile shall be indicated by the user address used (e.g. IMUN), each profile will have at least one unique user address associated with it. For originating calls the user shall be able to choose from the available profiles, the appropriate one for the call. A profile identity will need to be associated with the call for accounting and billing purposes. User profile identities need not be standardised but a standardised means is required for indicating that a particular profile is being used.

Simultaneous use of the same user profile on multiple terminals for the same type of service shall not be allowed.

User profiles associated with different home environments shall not share the same user address.

11.1.3 Multiple USIMs per UICC

The standard shall support the simultaneous use of more than one USIM per UICC even when those USIMs are associated with different home environments. For UMTS Phase 1 the support of only one USIM per UICC is required.

The standard must not prevent the coexistence of USIM applications, each associated with different home environments on the same UICC, so long as the security problems which arise from such a coexistence are solved when UMTS terminals and UICC are produced. Nevertheless, in the short term, it is safer to assume that only USIMs associated to one home environment will be stored on one UICC.

11.2 The UICC

Physical aspects of the UICC shall be defined by an appropriate committee. However there is a requirement to support access to services via GSM and UMTS with a single UICC.

11.2.1 The UMTS UICC and Applications other than the USIM

It shall be possible for the UICC to host other applications in addition to the USIM, see figure 3. Service providers, subscribers or users may need to establish additional data or processes on the UICC. Each application on an UICC shall reside in its own domain (physical or logical). It shall be possible to manage each application on the card separately. The security and operation of an application in any domain shall not be compromised by an application running in a different domain. Applications may need to use their own security mechanisms which are separate to those specified for UMTS e.g. electronic commerce applications.

Examples of other UICCapplications are: a more practical implementation of GSM Phase 2+ SIM items, off-line user applications like UPT, electronic banking, credit service, etc.

Applications should be able to share some information such as a common address book.

It shall be possible to address applications which reside on the UICC, via the air interface.

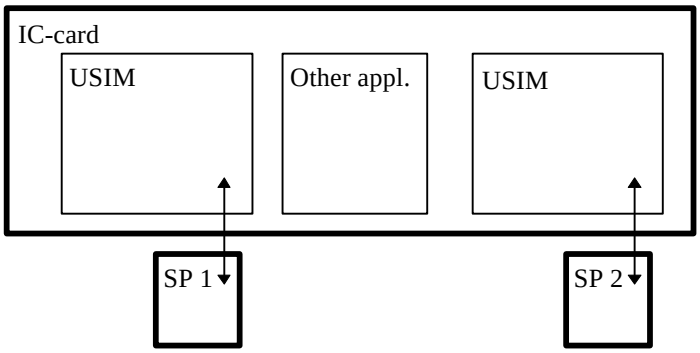

Figure 3 Example of a Multifunction UICC

11.3 Terminals and Multiple UICCs

The standard shall support multiple registration on a single terminal via insertion of multiple UICC, each with at least one unique USIM. In UMTS phase 1 the support of only one UICC is required. One or more of the USIMs may be active at the same time so that the terminal may be used to engage in more than one simultaneous call, possibly associated with different home environments. In UMTS phase 1 the activation of only one USIM at a time is required.

The standard shall allow a user to obtain services simultaneously from different home environments through a single network. It is understood that it may not always be possible to access all home environments through a given network.

If the UICC is removed from the mobile terminal during a call (except for emergency calls), the call shall be terminated immediately.

13 Service environment

The success of UMTS may depend upon its deployment in many regions of the world. Different regions of the world are likely to have widely different market needs for wireless based telecommunications, ranging from low cost provision of POTS (to users whose mobility is to be limited) to the provision of high bit rate and multimedia services (to highly mobile users).

The following scenarios should therefore be considered:

- use of UMTS to primarily provide wideband services (up to 2Mbps).

- use of UMTS to provide primarily telephony.
- use of UMTS for narrow (up to 64kbps) and wideband services.
- use of multi standard terminals to provide integrated services.

14 Evolution

14.1 Support of pre UMTS services

The UMTS standard shall be capable of supporting pre UMTS services in a manner which is transparent to the users of these services.

UMTS shall provide some mechanisms which permit pre UMTS users to roam easily onto UMTS and access the services. See Figure 5 for clarification.

UMTS shall provide some mechanisms which permit UMTS users to roam easily onto pre-UMTS systems and access the services.

14.2 Provision and evolution of services within UMTS

UMTS may be introduced before a complete set of UMTS standards is available. As one of the identified priority areas, UMTS service related standards need to be available at an early stage. If a phased approach to the completion of standards is adapted then the same general service principals shall apply at an early stage.

UMTS networks shall be capable of providing a specified core set of capabilities. Responsibility for providing this core set of capabilities should lie with the serving network.

The core set of capabilities should permit UMTS home environment to offer a range of distinctive services including those which cannot be implemented on pre-UMTS systems.

UMTS shall provide some mechanism which permits UMTS users to roam easily onto pre UMTS systems, with access to a minimum set of services.

It shall be possible for the home environment to develop services with full roaming capability. It should not be necessary for users to subscribe to more than one home environment in order to receive a particular service. For example a company may market an in car navigation/location system which uses UMTS as the core network. As far as users of the navigation service are concerned, that company is their home environment.

The radio interface should not unnecessarily restrict the development of new services (within physical limitations).

The standard shall provide a mechanism which allows a UMTS terminal to be easily upgraded so that it can access new services which are within the physical limitations of the terminal. Figure 4 shows as an example the support of roaming users between GSM and UMTS.

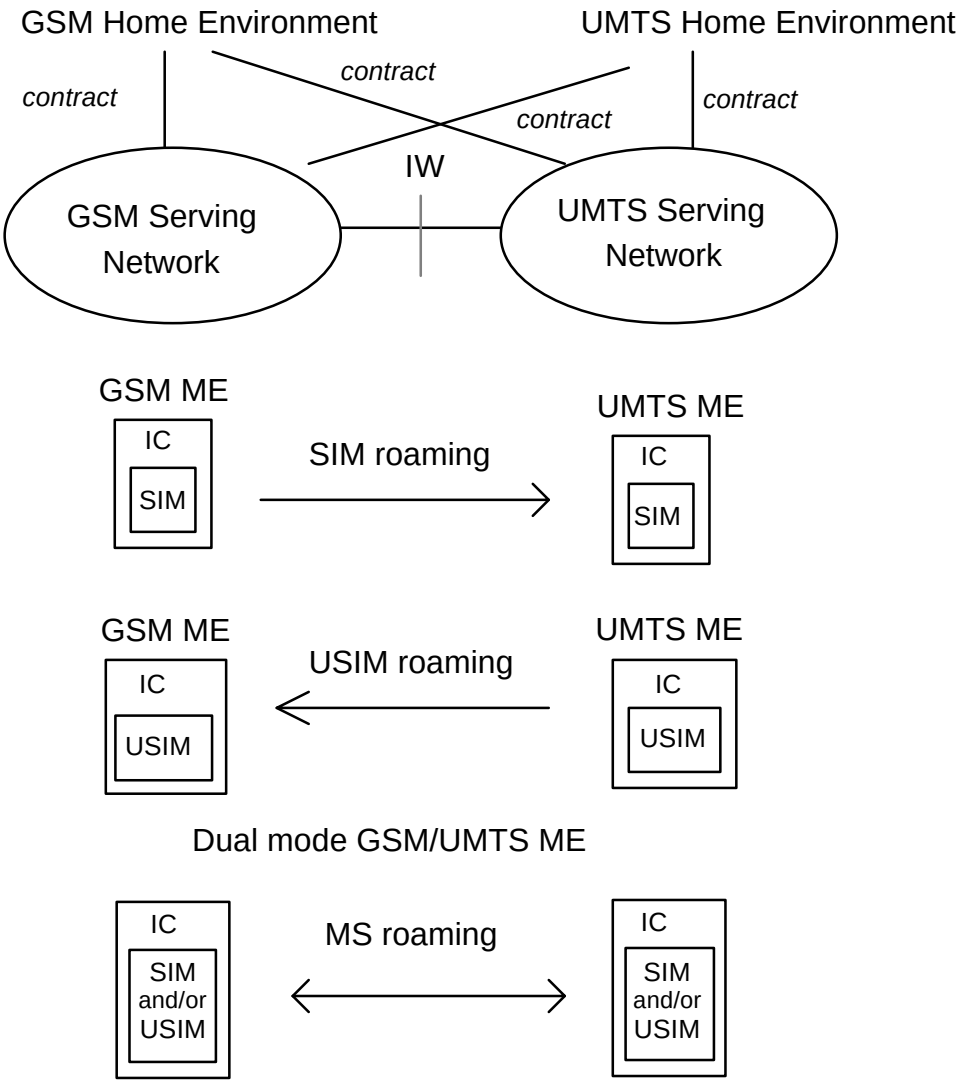

Figure 4 Roaming Users

15 Types of features of MSs

UMTS should support a wide variety of mobile stations, i.e. setting any limitations on terminals should be avoided as much as possible. For example mobile stations like hand-helds, personal digital assistants and laptop computers can clearly be seen as likely terminals for UMTS.

In order not to limit the possible types of mobile stations they are not standardised in UMTS. Anyhow some informative examples can be given to be the basis for mobile station discussions. The MS types could be categorised by their service capabilities rather than by their physical characteristics. Typical examples are speech only MS, narrowband data MS, wideband data MS, data and speech MS, etc.

In order to enhance functionality split and modularity inside the mobile station the interfaces of MS should be identified. Interfaces like UICC-interface, PCMCIA-interface and other PC-interfaces, including software interfaces, should be covered by references to the applicable interface standards.

MSs have to be capable of supporting a wide variety of teleservices and applications provided in UMTS environment. Limitations may exist on MSs capability to support all possible teleservices and information types (speech, narrowband data, wideband data, video, etc.) and therefore functionality to indicate capabilities of an MS shall be specified. MSs should be capable of supporting new supplementary services without any changes in MS.

The basic mandatory MS requirements are:

- Encrypted terminal-UICC interface
- Support for GSM phase 2 and 2+ SIM cards, phase 1 5V SIM cards shall not be supported
- Home environment and serving network registration and deregistration
- Location update
- Originating or receiving a connection oriented or a connectionless service;
- An unalterable equipment identification; IMEI, see GSM 02.16
- Basic identification of the terminal capabilities related to services such as; the support for software downloading, application execution environment/interface, MExE terminal class, supported bearer services.
- Terminals capable for emergency calls shall support emergency call without a USIM.
- Support for the execution of algorithms required for encryption;
- Support for the method of handling automatic calling repeat attempt restrictions as specified in GSM 02.07.
- At least one capability type shall be standardised for mobile terminals supporting the GSM BSS and UTRAN radio interfaces.
- Under emergency situations, it may be desirable for the operator to prevent MS users from making access attempts (including emergency call attempts) or responding to pages in specified areas of a UMTS network, see GSM 02.11.

16 Charging principles for UMTS

The cost of the call may cover the cost of sending, transporting, delivery and storage. The cost of call related signalling may also be included. Provision shall be made for charging based on time, destination, location, volume, bandwidth and quality. Charges may also be levied as a result of the use of value added services.

It shall be possible for information relating to chargeable events to be made available to the home environment at short notice. The requirements shall include:

- Immediately after a chargeable event is completed;
- At regular intervals of time, volume or charge during a chargeable event.

Standardised mechanisms of transferring charging information are required to make these requirements possible.

It should be possible for multiple leg calls (e.g. forwarded, conference or roamed) to be charged to each party as if each leg was separately initiated. However, in certain types of call, the originating party may wish/be obliged to pay for other legs (e.g. SMS MO may also pay for the MT leg.).

Provision shall be made for the chargeable party to be changed during the life of the call. There shall be a flexible billing mechanism which may include the use of stored value cards, credit cards or similar devices.

The chargeable party (normally the calling party) shall be provided with an indication of the charges to be levied (e.g. via the called number automatically or the Advice of Charge supplementary service) for the duration of the call (even though the user may change service environment)The user shall be able to make decisions about the acceptable level of accumulated charge dynamically or through their service profile.

If a user is to be charged for accepting a call then their consent should be obtained. This may be done dynamically or through their service profile.

17 Handover Requirements

Any handover required to maintain an active service while a user is mobile within the coverage area of a given network, shall be seamless from the user's perspective. However handovers that occur between different radio environments may result in a change of the quality of service experienced by the user.

It shall be possible for users to be handed over between different UMTS networks subject to appropriate roaming/commercial agreements.

Handover between UMTS and GSM systems (in both directions) is required, even if this requires changes to GSM specifications. In addition, a generic solution may be implemented in UMTS which allows calls to be handed over between UMTS and other pre-UMTS systems in both directions.

18 Network Selection

Three roles may be involved in UMTS network selection: the home environment, the serving network and the user. Services may be available to the user through a choice of several serving networks in a given location, possibly using different types of Radio Access Network, , however it is expected that a user terminal will communicate with one network at a given instant (there may be exceptions such as when an inter-network handover occurs).

All selection schemes make use of information provided by the serving networks, including the network name, the network capabilities and any restrictions. Other information such as terminal capabilities may also be required. This information may change with time but must be accurate and available at the time network selection is being made.

Procedures 1 and 2 below for network selection in UMTS shall be supported by all mobile stations. The user shall be able to choose which procedure to use at any given time.

1. Default Automatic Procedure

A default procedure for network selection shall be defined which selects a network from amongst those available based upon information such as network name/ID, network capabilities, signal strength and network type. The full list of parameters is FFS. The choice of which network to use should be developed from a procedure similar to that specified in GSM 02.11

2. Manual Procedure

The manual procedure consists in presenting to the user the list of all available networks and letting her make the selection. The user shall be able to make use of the manual selection procedure at any time.

3. Home Environment Specific Procedure

Optionally, if provisioned by the MS and selected by the user, the home environment can add the ability to define the behaviour when selecting the required network from those available. A standardised framework for over-the-air transfer of behaviour definition is required. If enabled by the user, it shall be possible for the home environment procedure to instruct the mobile station to search for a network which meets a given set of requirements, indicated by certain parameters or to compile a list of all available networks.

Other procedures may be offered by the MS.

Both automatic and manual network selection schemes are constrained by commercial agreements between the home environments and serving networks. If a roaming agreement does not exist and cannot be established using the procedure for automatic establishment of roaming agreements, then registration on the network will not succeed. Therefore the user must provide sufficient information to allow the serving network to identify the relevant home environment and to allow the home environment to identify the user.

A USIM shall be registered on one and only one serving network at any given time (there may be exceptions such as when preparing for an inter-network handover). Changing the serving network between two calls requires USIM de-registration from the current serving network and USIM re-registration on the newly selected serving network.

If simultaneous access to more than one home environment is required (through a card with multiple USIMs or through several cards in a multi-slot terminal), manual selection shall be invoked.

A procedure for handling network rejections is required, see GSM 02.07 Annex A for an example. During manual selection the user may be allowed to attempt to select any available network (subject to restrictions that may be specified by the home environment). Successful manual network selection shall update the procedure for preventing unnecessary network access attempts. A set of network access rejection causes shall be standardised.

It shall be possible for a network operator to control access to the network. This may be done for example to provide priority to emergency services or to control demand upon the access channel after a network failure, see GSM 02.11 for further details.

Annex A (informative):

Change history

Change history					
SMG No.	**TDoc. No.**	**CR. No.**	**Section affected**	**New version**	**Subject/Comments**
SMG#22	302/97	001	4.6 (Role Model)	3.1.0	SMG3 queried the separation of network operator into core and access, which, on examination, SMG1 find unhelpful
SMG#22	319/97 (SMG1 WPC 125/97)	002		3.1.0	Editorial Changes: FLMPTS was replaced by IMT 2000, 2 new references given, additional clarifications.
SMG#22	320/97	003	8.5, 9.3, 9.5, 17	3.1.0	Changes on Emergency Calls, User identification, Multiple profiles and additional handover requirements.
After SMG#23	SMG1 433u/97 965/97	004		Draft 3.2.0	Based on Approved Changes at SMG#22 Distributed at SMG1 in Dresden Nov 3-7, 97 to be Approved at SMG#24
SMG#24	966/97	005	Sections 8, 9, 11	3.2.1	Restructuring of sections 8,9 and 11 to gather all requirements relating to multiple subscriptions into one section and to improve the clarity.
SMG#24	967/97	006	Section 8.1	3.2.1	To improve the accuracy of text on numbering principles and minor editorial change to section 8.1
SMG#27	98-0551	007	Section 4.6 and misc.	3.3.0	Removal of commercial role model from the specification in order to improve clarity
SMG#27	*98-0552 (Not Approved)*	*008*	*New Section 18 (Not Applied)*	*3.3.0*	*To include requirements for network selection in service principles: NOT APPROVED > NOT APPLIED*
Pre- SMG#28	*(SMG1 Tdoc 98-0893)* 99-040	008 r4 Rejected	New Section 18 Applied	[Draft 3.4.0]	Added Network Selection section - Agreed by correspondence - Jan 13, 1999 - Prepared with CRs applied with revision marks
SMG#27	98-0553	009	Section 4.3	3.3.0	To remove unnecessary reference to IN and B-ISDN

SMG#27	98-0682	010	Section 11	3.3.0	To improve the clarity of service requirements for multiple user profiles
Pre- SMG#28	*(SMG1 Tdoc 98-0869)* 99-040	011	Sections 1, 2, 3, 4, 9, 10, 12, 17	Draft 3.4.0	Clean up for UMTS phase 1 Agreed at SMG1 Rome
Pre- SMG#28	*(SMG1 Tdoc 98-852)* 99-040	012	Sections 3,8,9,11,14 ,15	Draft 3.4.0	Changes in IC card and terminal service requirements Agreed at SMG1 Rome
Pre- SMG#28	*(SMG1 Tdoc 98-0894)* 99-040	013r1	Section 3.2 & 4.3	Draft 3.4.0	Clarification of general requirements for efficient use of radio resources Agreed by correspondence - Jan 13, 1999 - Prepared with CRs applied with revision marks
NOTE				**Draft 3.4.0**	**SMG1 agreed only**
pre- SMG#28	99-040	015 Rejected	17	**Draft 3.4.0**	According to the outcome of the SMG 1 ad-hoc meeting on handover issues it is proposed that inter-operator handover is not required for UMTS phase 1 [redacted]
SMG#28	99-305	008r5	Revised Section 18	**3.4.0**	Network Selection presented at SMG#28 in 2201_008r4 was further revised and Approved at SMG#28.
NOTE				**3.4.0**	Removal of Section 12 on UPT with CR 011 causes a skip section from Section 11 to 13.

History

Document history		
Date	**Status**	**Comment**
22 October 1995	Version 0.0.1	SMG 1 WPC output draft for editing purposes only
14 December 1995	Version 0.0.2	SMG 1 WPC output draft for editing purposes only
17th April 1996	Version 0.3.0	SMG 1 WPC Output Version
9th May 1996	Version 1.0.0	Version Following SMG 1 Plenary
13th June 1996	Version 1.0.1	Version following comments from SMG1 delegates
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28th August 1996	Version 1.2.0	SMG1 WPC meeting 27/28 August 1996 in Stuttgart, Germany
28th August 1996	Version 1.2.1	SMG1 WPC meeting 27/28 August 1996 in Stuttgart, Germany, presented to SMG1 Plenary for approval
30th August 1996	Version 2.0.0	SMG1 Plenary meeting August 1996, editorial changes prior to approval as Version 2.0.0
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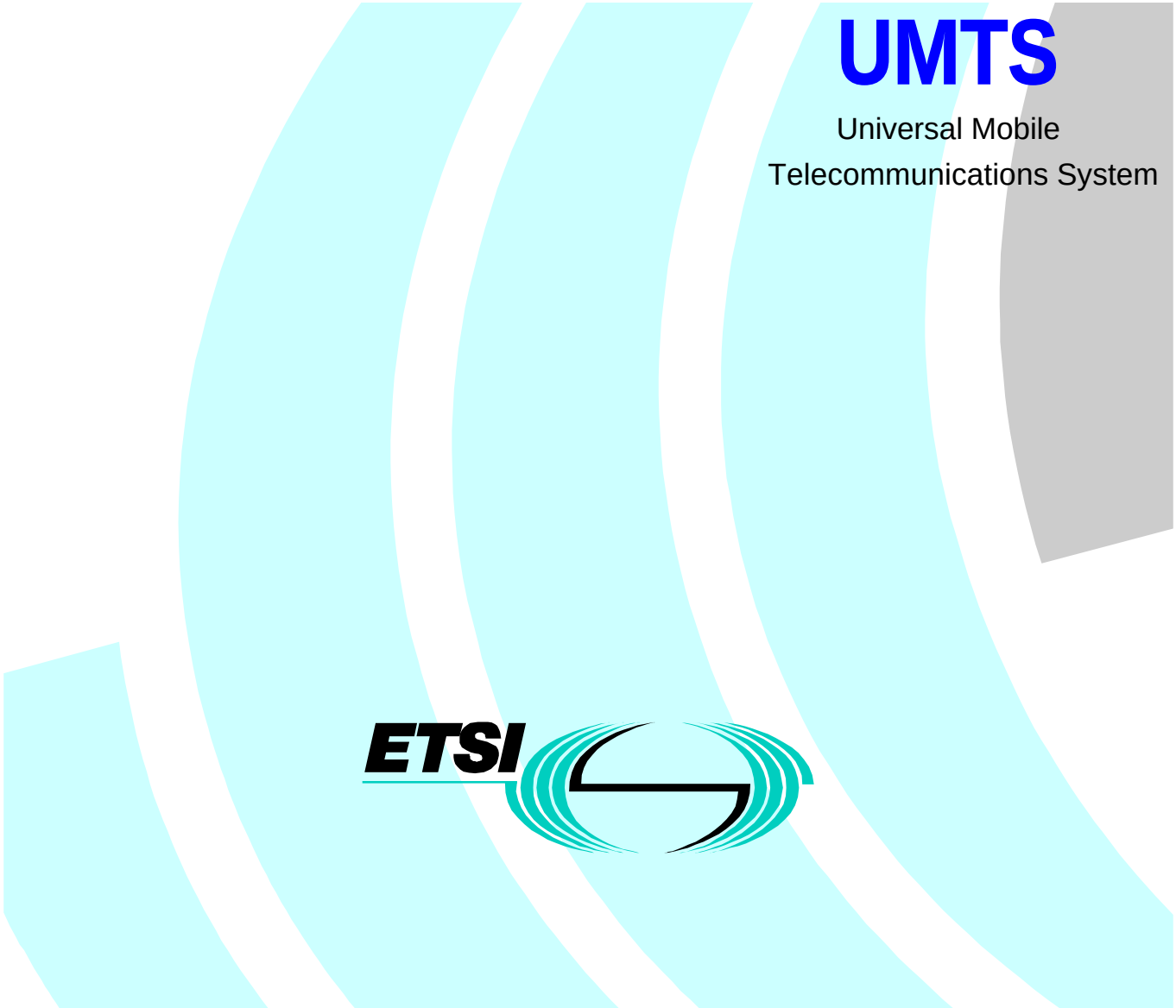
November 1997	Draft Version 3.2.0	Agreed by SMG1 Dresden, presented for information at SMG#24
January 1998	Version 3.2.1	2 CRs approved by SMG#24
October 1998	Version 3.3.0	3 out of 4 CRs were approved by SMG#27
January 1999	draft v3.4.0	SMG1 agreed CRs
January 1999	pre-draft v3.5.0	Further CR on Handover
March 1999	Version 3.6.0	Following SMG#28 revision and approval of Network Selection

UMTS 22.05 V3.2~~2~~1.0 (1999~~8~~-03~~1~~6)

Technical Specification

Universal Mobile Telecommunications System (UMTS); Services and Service Capabilities; (UMTS 22.05 SMG 1 proposed version 3.2~~1~~2.0)

SMG#28 Approved Version ~~***Version agreed by SMG 1 only***~~



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Contents

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Foreword

This draft Technical Specification has been produced by the Special Mobile Group (SMG) Technical Committee of the European Telecommunications Standards Institute (ETSI).

The contents of this TS is subject to continuing work within SMG and may change following formal SMG approval. Should SMG modify the contents of this TS, it will be re-released by SMG with an identifying change of release date and an increase in version number as follows:

Version 2.y.z

where:

- x the first digit:
  - 1 presented to SMG for information;
  - 2 presented to SMG for approval;
  - 3 Indicates SMG approved UMTS document.
- y the second digit is incremented for all other types of changes, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the specification;

1 Scope

Pre-UMTS systems have largely standardised the complete sets of bearer services, teleservices and supplementary services which they provide. One major difference between UMTS and pre-UMTS systems is that service capabilities rather than services are standardised for UMTS, allowing service differentiation and system continuity. This Technical Specification (TS) describes how and what kind of services the UMTS user has access to.

2 Normative references

References may be made to; 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] ITU-T recommendation F700 (V xx): "Framework recommendation for audio-visual/ multimedia services".

2.1 Normative references

[21] GSM 02.03: "Digital cellular telecommunications system (Phase 2+); "Teleservices supported by a GSM Public Land Mobile Network (PLMN)".

[3] GSM 02.04;2] GSM 02.04: "Digital cellular telecommunications system (Phase 2+); "General on supplementary services".

[3] GSM 02.42: "Digital cellular telecommunications system (Phase 2+); Network Identity and Timezone (NITZ); Service description; Stage 1".

[4] GSM 02.43: "Digital cellular telecommunications system (Phase 2+); Support of Localised Service Area (SoLSA); Service description; Stage 1".

[5] GSM 02.57: "Digital cellular telecommunications system (Phase 2+); Mobile Station Application Execution Environment (MExE); Service description; Stage 1".

[6] GSM 02.71: "Digital cellular telecommunications system (Phase 2+); Location Services (LCS); Service definition - Stage 1".

[7] GSM 02.78: "Digital cellular telecommunications system (Phase 2+); Customised Applications for Mobile network Enhanced Logic (CAMEL); Service definition - Stage 1".

[8] GSM 02.90: "Digital cellular telecommunications system; Unstructured Supplementary Service Data (USSD) - Stage 1".

[9] GSM 22.01: "Universal Mobile Telecommunications System (UMTS); Service aspects; Service principles".

[10] GSM 22.20: "Universal Mobile Telecommunications System (UMTS); Virtual Home Environment (VHE), Stage 1".

[11] GSM 23.10: "Universal Mobile Telecommunications System (UMTS); UMTS Access Stratum; Services and Functions".

2.2 Informative references

[1] ITU-T recommendation F.700: "Framework recommendation for audio-visual/multimedia services".

[2] GSM 02.01: "Digital cellular telecommunications system (Phase 2+); Principles of telecommunication services supported by a GSM Public Land Mobile Network (PLMN)".

3 Definitions and abbreviations

3.1 Definitions

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

Basic telecommunication service : this term is used as a common reference to both bearer services and teleservices.

Bearer service : is a type of telecommunication service that provides the capability of transmission of signals between access points.

Call : a logical association between several users (this could be connection oriented or connection less).

Connection : is a communication channel between two or more end-points (e.g. terminal, server etc.).

Mobile termination : the mobile termination is the component of the mobile station which supports functions specific to management of the radio interface (Um).

Multimedia service : Multimedia services are services that handle several types of media. For some services, synchronisation between the media is necessary (e.g. synchronised audio and video). A multimedia service may involve multiple parties, multiple connections, and the addition or deletion of resources and users within a single call.

Nomadic Operating Mode : Mode of operation where the terminal is transportable but being operated while stationary and may in addition require user co-operation (e.g. close to open spaces, antenna setup...).

Quality of Service : the collective effect of service performances which determine the degree of satisfaction of a user of a service. It is characterised by the combined aspects of performance factors applicable to all services, such as;

service operability performance;

- service accessibility performance;
- service retainability performance;
- service integrity performance; and
- other factors specific to each service.

Service feature : Standardised building block used to create services.

Supplementary service : is a service which modifies or supplements a basic telecommunication service. Consequently, it cannot be offered to a user as a standalone service. It must be offered together with or in association

with a basic telecommunication service. The same supplementary service may be common to a number of basic telecommunication services.

Teleservice; is a type of telecommunication service that provides the complete capability, including terminal equipment functions, for communication between users according to standardised protocols and transmission capabilities established by agreement between operators.

3.2 Abbreviations

For the purposes of this TS, the following abbreviations apply;

BER	Bit Error Rate
B-ISDN	Broadband ISDN
CAMEL	Customised Application for Mobile network Enhanced Logic
DTMF	Dual Tone Multiple Frequency
TR	Technical Report
TS	Technical Specification
ETSI	European Telecommunications Standards Institute
FAX	Facsimile
GSM	Global System for Mobile Communications
HE	Home Environment
IMUN	International Mobile User Number
IN	Intelligent Network
ISDN	Integrated Services Digital Network
ISO	International Organisation for Standardisation
ITU	International Telecommunication Union
LCS	Location Services
MExE	Mobile station Execution Environment
MMI	Man Machine Interface
MO	Mobile Origination
MS	Mobile Station
MT	Mobile Termination
O&M	Operations and Maintenance
PBX	Private Branch eXchange
PC	Personal Computer
PCMCIA	Personal Computer Memory Card International Association
PIN	Personal Identity Number
PNP	Private Numbering Plan
POTS	Plain Old Telephony Service
QoS	Quality of Service
USIM	User Service Identity Module
SMS	Short Message Service
SAT	SIM Application Toolkit
SN	Serving Network
SoLSA	Support of Localised Service Area
UMTS	Universal Mobile Telecommunications System

4 Framework for the description of telecommunication services and applications

4.1 General

Telecommunication services supported by UMTS are the communication capabilities made available to users by ~~network operators and service providers~~home environment andserving network. A UMTS network provides, in co-operation with other networks, a set of network capabilities which are defined by standardised protocols and functions and enable telecommunication services to be offered to users.

A service provision by a ~~service provider/network operator~~HE/SN to a UMTS user may cover the whole or only part of the means required to fully support the service. ~~The operational and commercial features associated with the provision of the service are included in the service concept.~~

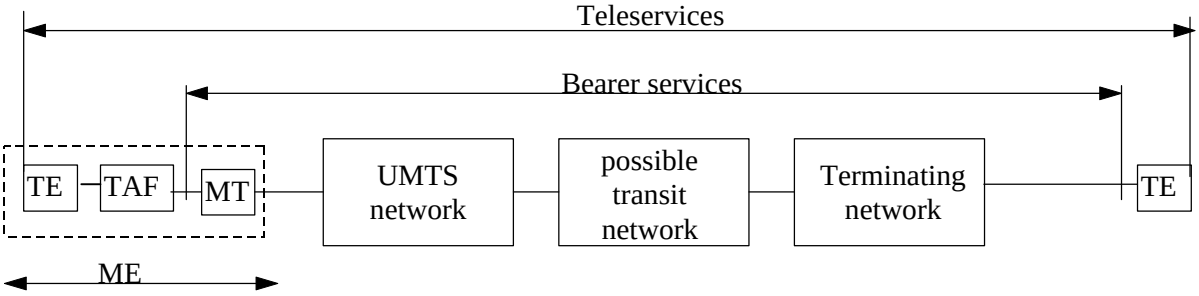
The service classification and description which follow are independent of different possible arrangements for the ownership and provision to the user of the means required to support a service.

4.2 Basic telecommunication services

Basic telecommunication services are divided in two broad categories;

- bearer services, which are telecommunication services providing the capability of transmission of signals between access points;
- teleservices, which are telecommunication services providing the complete capability, including terminal equipment functions, for communication between users according to protocols established by agreement between network operators.

Figure 1 illustrates these definitions.



ME: Mobile Station
MT: Mobile Termination
TE: Terminal Equipment
TAF: Teminal Adaption Function

NOTE 1: In order to limit the complexity of the figure, only one transit network is shown.

NOTE 2: The terminating network type may include a UMTS network, either the originating one or another one.

NOTE 3: The bearer service terminates in the mobile station.

Figure 1; Basic telecommunication services supported by a UMTS network

4.2.1 Bearer services

The characterisation of a bearer service is made by using a set of attributes. A bearer service attribute is a specific characteristic that distinguishes it from other bearer services. Particular values are assigned to each attribute when a given bearer service is described and defined.

The attributes define the service characteristics as they apply at a given reference point where the user accesses the bearer service. The description of a bearer service by the method of attributes is composed of technical attributes.

A list of definitions of attributes and values used for bearer services is contained in clause 5.

The bearer services are negotiable and can be used flexibly by applications.

4.2.2 Teleservices

Clause 6 defines both standardised and non-standardised teleservices. Some teleservices are standardised because that interworking with other systems have been recognised as a requirement. Other teleservices shall not be standardised. A decoupling between lower layer (i.e. bearer attributes) and higher layer capabilities will be necessary for the development of teleservices.

4.3 Supplementary services

A supplementary service modifies or supplements a basic telecommunication service. Consequently, it cannot be offered to a user as a stand alone service. It must be offered together or in association with a basic telecommunication service. The same supplementary service may be applicable to a number of basic telecommunication services.

Two methods are used for the characterisation of supplementary services;

- The first method is used for the description of existing standardised supplementary services. These services are specified through the detailing of each of the operations involved in service provision and service usage (the provision/withdrawal, registration/erasure, activation/deactivation, invocation and interrogation operations). Clause 7 lists these services.

- The second method enables the provision of ~~service provider/network operator~~HE/SN specific supplementary services. To make this possible, standardised building blocks referred to as service features are specified in clause 8. The combination and parametrisation of these service features allow the creation of supplementary services.

UMTS shall be able to handle multiple supplementary services within a call. Interactions shall be handled when several supplementary services are activated in the same call.. When multiple supplementary services can be activated concurrently, some prioritisation of the services will be necessary. Certain services may override or deactivate other services.

Interactions between operator specific supplementary services are not defined.

The following issues need consideration when interactions between services occur;

- Different phases of a call.

- A service spanning on more than one network.

- Service interactions that may occur between services offered to a single user, as well as between services offered to different interacting users.

NOTE: The methods defined for characterisation of services are description methods. They do not imply or restrict different implementations.

4.4 ~~Service features~~ Service features

UMTS service features are based on functionality and mechanisms such as provided by SAT, MExE, IN and CAMEL. These toolkits are the basic building blocks for the VHE. These features can be used both by standardised and non-standardised services~~.~~

through the UMTS Application Programming Interface. The UMTS services and applications get access to UMTS service capabilities ~~5~~(bearers) for transport of user data through the UMTS adaptation layer. This lowest layer of the VHE is responsible for the selection of appropriate service capabilities according to the requirements of services and applications.

High level service features requirements :

. support of wide range of user applications,

. support of rapid application/service development,

. support of easy deployment of new services,

. scalability.

5 Bearer Services

5.1 Definition of bearer services

Bearer services provide the capability for information transfer between access points and involve only low layer functions. These functions are sometimes referred as low layer capabilities (in reference to OSI layers). The user may choose any set of high layer protocols for his communication and the UMTS network does not ascertain compatibility at these layers between users.

5.2 Description of bearer services

Bearer services are characterised from a static point of view by a set of low layer attributes. This set has been chosen so that a bearer service can be entirely defined by giving a value to each attribute of the set. In particular, the set and the associated allowed values enable characterisation of future (not yet used or foreseen) transfer needs.

Giving one of the possible values to each attribute defines a possible bearer service. However, any combination is neither meaningful nor necessarily supported by the UMTS system. This section defines the attributes and their possible values. The authorised combinations are specified in the following sections.

The parameters of the set are grouped into two categories;

- Information transfer attributes, which characterise the network transfer capabilities required for transferring user information between two or more access points.
- Information quality attributes, which characterise the quality of the user information transferred between two or more access points.

Most of the attributes presented further down may be attributed several values when the bearer service required by an application involves more than one traffic type (connection/connectionless) or more than one connection.

It shall be possible to negotiate/re-negotiate all of the attributes presented in this clause at call set-up/ during the call (mobile or network initiated).

5.2.1 Information transfer attributes

Connection mode attribute

The two possible values for this attribute are connection oriented and connectionless. In a connection oriented mode, information is delivered to the destination entity in the same order as it was provided by the source entity, but an establishment/release phase is required at the beginning and the end of the information transfer. In a connectionless mode, information can directly be transferred, but with no guaranty of ordered delivery.

Traffic type attribute

The four possible values for this attribute are constant bit rate, variable bit rate, available bit rate and unspecified bit rate.

Symmetry attribute

The three possible values for this attribute are unidirectional, bi-directional symmetric and bi-directional asymmetric.

Communication configuration attribute

This attribute indicate the spatial arrangement for transferring information between the implicated access points. The possible values are point-to-point, and point-to-multipoint. When the value of the attribute is point-to-multipoint, it shall be further characterised as multicast or broadcast. The addresses of the source entity and the destination entities should also be provided. One multipoint address should be reserved for broadcasting.

Information transfer rate attributes

Information transfer rate is the amount of information transmitted per unit of time from a source access point to destination access point(s).

The three attributes used to characterise the information transfer rate are the peak bit rate, the minimum bit rate and the mean bit rate. . The possible values for these three attributes are not a limited set, but a continuous range of values. More parameters may certainly be needed, such as the sustainable bit rate or the occupancy (FFS).

5.2.2 Information quality attributes

Information quality attributes characterise the bit integrity and delay requirements of the applications.

Other parameters may be needed.

Maximum transfer delay attribute

This attribute sets the maximum transfer delay of the information. The two reference points for the maximum transfer delay are the Iu interface and the point located between the mobile termination and the terminal adaptation function. The possible values for this attribute are not a limited set, but a continuous range of values.

Delay variation attribute

This attribute sets the variation in the received information. This attribute is important for real-time services, e.g. video conference, where a value approaching 0 would typically be requested. The possible values for this attribute are not a limited set, but a continuous range of values.

Bit error ratio attribute

The ratio between incorrect and total transferred information bits. The possible values for this attribute are not a limited set, but a continuous range of values.

Error characteristics attribute

This attribute characterises the arrivals of errors. The two possible values are uniform and bursty.

5.3 Supported bit rates

It shall be possible for one application to specify its traffic requirements to the network by requesting a bearer service with any value for the connection mode, traffic type, symmetry and information transfer rate attributes. It shall be possible for the network to satisfy these requirements without wasting resources on the radio and network interfaces due to granularity limitations in bit rates.

It shall be possible for one mobile termination to have several active bearer services simultaneously, each of which could be connection oriented or connectionless.

The only limiting factor for satisfying application requirements shall be the cumulative bit rate per mobile termination at a given instant (i.e. when summing the bit rates of one mobile termination’s simultaneous connection oriented and connectionless traffic, irrespective of the traffic being real time or non real time) in each radio environment :

- At least 144 kbits/s in satellite radio environment (Note 1).
- At least 144 kbits/s in rural outdoor radio environment.

- At least 384 kbits/s in urban/suburban outdoor radio environments.
- At least 2048 kbits/s in indoor/low range outdoor radio environment.

NOTE 1 : This Peak Bit Rate may only be achieved in a nomadic operating mode.

5.4 Supported QoS

It shall be possible for one application to specify its QoS requirements to the network by requesting a bearer service with any value for the maximum transfer delay, delay variation, bit error rate and error characteristic attributes.

The following table indicates the range of values that shall be supported by UMTS for the QoS attributes. These requirements are valid for both connection and connectionless traffic. It shall be possible for the network to satisfy these requirements without wasting resources on the radio and network interfaces due to granularity limitations in QoS.

	Real Time (Constant Delay)	**Non Real Time (Variable Delay)**
Operating environment	**BER/Max Transfer Delay**	**BER/Max Transfer Delay**
Satellite (Terminal relative speed to ground up to 1000 km/h for plane)	Max Transfer Delay less than 400 ms BER 10-3 - 10-7 (Note 1)	Max Transfer Delay 1200 ms or more (Note 2) BER = 10-5 to 10-8
Rural outdoor (Terminal relative speed to ground up to 500 km/h) (Note 3)	Max Transfer Delay 20 - 300 ms BER 10-3 - 10-7 (Note 1)	Max Transfer Delay 150 ms or more (Note 2) BER = 10-5 to 10-8
Urban/ Suburban outdoor (Terminal relative speed to ground up to 120 km/h)	Max Transfer Delay 20 - 300 ms BER 10-3 - 10-7 (Note 1)	Max Transfer Delay 150 ms or more (Note 2) BER = 10-5 to 10-8
Indoor/ Low range outdoor (Terminal relative speed to ground up to 10 km/h)	Max Transfer Delay 20 - 300 ms BER 10-3 - 10-7 (Note 1)	Max Transfer Delay 150 ms or more (Note 2) BER = 10-5 to 10-8
NOTE 1; There is likely to be a compromise between BER and delay. NOTE 2; The Max Transfer Delay should be here regarded as the target value for 95% of the data. NOTE 3; The value of 500 km/h as the maximum speed to be supported in the rural outdoor environment was selected in order to provide service on high speed vehicles (e.g. trains). This is not meant to be the typical value for this environment (250 km/h is more typical).		

5.5 Supported topologies

It shall be possible for an application to specify its traffic topology requirements to the network by requesting a bearer service with any value for the communication configuration attribute. However, some combinations with the symmetry attribute are not authorised. The supported configurations are :

1) Point-to-Point
   - Uni-Directional

- Bi-Directional
  - Symmetric
  - Asymmetric

2) Uni-Directional Point-to-Multipoint
   - Multicast
   - Broadcast

A multicast topology is one in which sink parties are specified before the connection is established, or by subsequent operations to add or remove parties from the connection. The source of the connection will always be aware of all parties to which the connection travels.

A broadcast topology is one in which the sink parties are not always known to the source. The connection to individual sink parties is not under the control of the source, but is by request of each sink party.

In the case of a mobile termination with several active bearer services simultaneously, it shall be possible for each bearer service to have independent topologies and source/sink parties.

5.6 Radio Interface optimisation

The following requirements shall lead the radio interface optimisation process;

- support of high bit rate (around the Peak Bit Rate), bursty, asymmetric, non-real time bearer capabilities;
- support of high bit rate (around the Peak Bit Rate), bursty, asymmetric, real time bearer capabilities;
- the ability to extend or reduce bandwidth associated to a bearer capability in order to adapt to bit rate or radio condition variations, to add or drop service components.

However, the services provided by GSM (speech in particular) shall be supported in a spectrally efficient manner (at least as efficiently as in GSM) for the same quality of service.

In order to allow the support of flexible, bandwidth on demand services, bearer services should be provided with the finest possible granularity that can be efficiently supported.

6 Teleservices

6.1 Definition of teleservices

Teleservices provide the full capa~~city for communication~~bilities for communications by means of terminal equipment ~~and~~, network functions and possibly functions provided by dedicated centres.

6.2 Description of teleservices

The basic reference in UMTS for the description of teleservices is the ITU-T F700 recommendation. F700 provides a generic, network independent, description of multimedia services. The methodology used covers both monomedia and multimedia services, the monomedia services being a particular type of multimedia services. Multimedia services are classified into categories with similar functional characteristics. The six categories are multimedia conference services, multimedia conversational services, multimedia distribution services ,multimedia retrieval services, multimedia messaging services and multimedia collection services.

The rest of clause 6 describes the teleservices and options that will be provided by UMTS networks.

A teleservice can be viewed as set of upper layer capabilities utilising the lower layer capabilities described by the set of attributes in clause 5.

Multimedia teleservices support the transfer (and in some case retrieval, messaging, distribution) of several types of information (service components). For this reason, there are service attributes (relating to all the components of a teleservice) and service component attributes (relating to only one service component).

6.3 Support of teleservices in UMTS networks

The realisation of teleservices requires the association of terminal and network capabilities. In the terminals and in the network, both upper layer capabilities and lower layer capabilities are necessary. The term upper layer capabilities is used because it relates to the OSI upper layers. Decoupling between upper layers and lower layers (transfer) is required. Even if this de-coupling may impact radio interface optimisation, it is nevertheless the only way of designing a system that is not outdated;

- Each time the information rate associated with an already supported teleservice is decreased by more efficient source coding techniques.
- Each time a new service is introduced that requires transfer capabilities not used by currently available teleservices.

Taking the example of two application that exchange information through a teleservice, the upper layer capabilities can be located in various places;

- In the two terminals if the two applications are connected to a UMTS network.

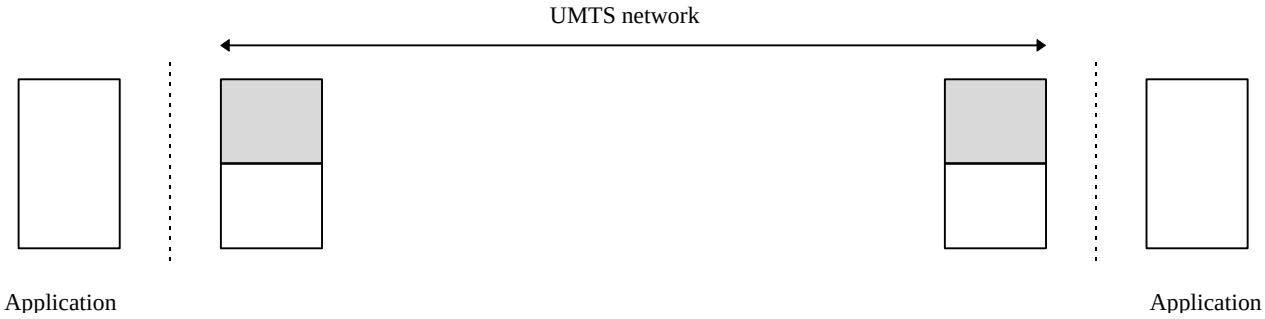


Figure 2; UMTS teleservice

In the terminal of the application connected to a UMTS network and in the upper layer interworking unit that is at the border of the UMTS network and the target network if one application is connected to a UMTS network and the other one is connected to another type of system. The upper layer interworking unit makes the adaptation between the UMTS network and the target network at a service level.

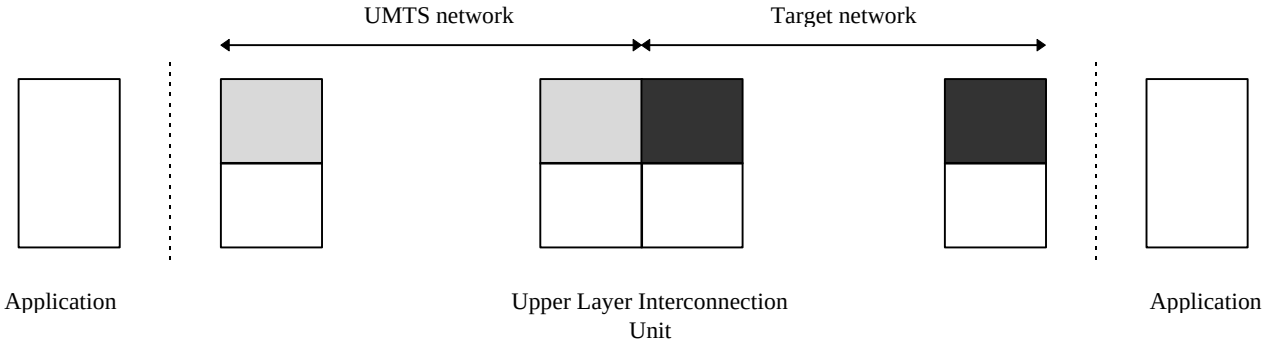


Figure 3; Teleservice with upper layer interworking

In the terminal of the application connected to a UMTS network and in the terminal of the application connected to a target network if one application is connected to a UMTS network and the other one is connected to another type of

system, but only lower layer interconnecting unit is used at the border of the two networks. In this case, the interconnecting unit makes the adaptation between the UMTS network and the target network at the transmission level.

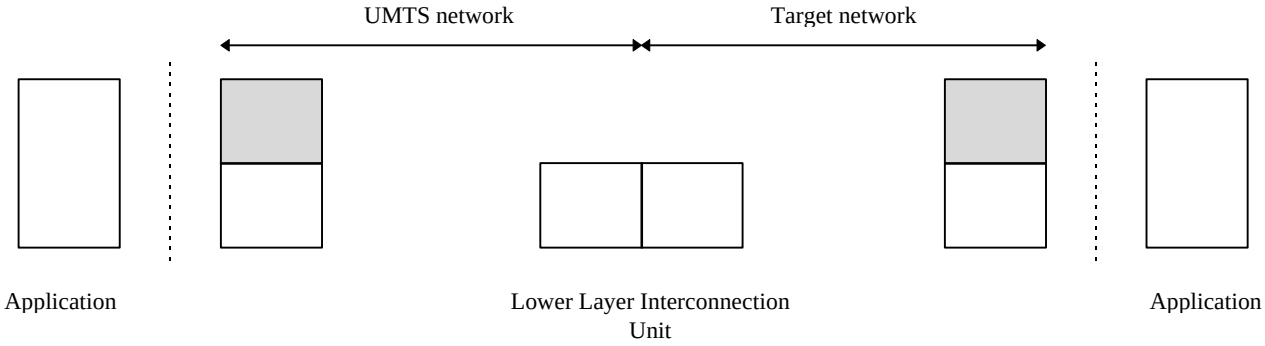


Figure 4; Teleservice with lower layer interworking

6.4 Existing Teleservices supported by UMTS networks

The subset of standardised teleservices shall be supported by UMTS for interworking with teleservices provided on other networks. The means to support the following set of teleservices will be standardised;

- Speech;
- Emergency call;
- Short message service;
- ~~Facsimile.~~

~~6.4.1~~ 6.4.1 Speech

The speech service as defined in international standards should be supported by UMTS. The international reference for the speech is ITU E.105 recommendation. UMTS networks should contain interworking units which allow calls to be received from or destined to users of existing networks like PSTN, ISDN, GSM. This will include interworking units for generation of DTMF or other tones (the entire DTMF tone set would at minimum be available) and detection of DTMF tones.

A default speech codec ~~is required for UMTS (refer to 22.25 for QoS)~~shall be specified to provide speech service across the UTRAN. The selected speech codec shall be capable of operating with minimum discernible loss of speech on handover between the GSM access network and UTRAN.

6.4.2 Emergency Call

This service will use components of Speech. There are however compared to Telephony reduced authentication requirements and a requirement for specific routing. Additionally Emergency Calls may have higher priority than normal calls, etc.. The reference for the emergency call service is GSM 02.03.

6.4.3 Short Message Service

The short message service as specified in ~~the GSM 02.03 shall be supported in UMTS~~GSM 02.03 shall be supported in UMTS. A short message service shall be provided seamlessly (as far as the user or the users terminal equipment is concerned) across the UMTS and GSM access network. Additional features are planned for SMS in Release 99.

~~6.4.4 Facsimile~~

~~Facsimile group 3, for interworking with fax in the fixed network, shall be supported. The Fax service is described in ITU F180 and F180 bis recommendations.~~

6.5 6.5 Internet Access

Internet is seen as the most important source of data traffic in UMTSUMTS shall provide means to interwork with external data networks. This interworking shall satisfy, within the constraints introduced by the mobile radio environment, the QoS requirements of the interworked-with network. For UMTS the Internet is seen as the most important interworked-with network, therefore the specification of an optimised access to Internet shall be part of the UMTS standard. The most important benefits achieved by the definition of Internet Access would be:

- Optimised transmission of IP traffic over the UMTS radio interface to minimise the amount of information transmitted.
- Optimised usage of encryption protocols/algorithms over the UMTS radio interface.
- Inter-operation of QoS mechanisms used in both, UMTS and in Internet.
- Provision of IP addresses for the UMTS users using Internet applications and accessing Internet.

For the purposes of optimised access to Internet one or more of the UMTS generic bearers will be used. On top of the bearer a UMTS protocol profile will be defined. This profile would be based on the work done by IETF or other relevant fora, and will consist of a recommended set of parameters and standardised protocols providing similar services than the Internet ones but optimised for wireless access. In the case of Internet traffic it would be possible for the user to select the encryption to be used (e.g. no encryption, end-to-end encryption, encryption over UMTS radio, etc.). The QoS mechanisms defined for UMTS packet access mode shall be harmonised with those defined for Internet (e.g. RSVP, RTP). UMTS users shall be provided with IP addresses for enabling the usageDifferentiated Services).

of IP applications.

7 Supplementary Services

Supplementary services are used to complement and personalise the usage of basic telecommunication services (bearer services and teleservices). The capabilities standardised in UMTS shall enable all the supplementary services specified in GSM 02.04 and the 02.8x set to be provided.

8 Service features

Service features are building blocks which can be used to create/control/delete services. The functionality offered by a service feature may depend upon the underlying service capability used to realise the service feature e.g. CAMEL, MExE etc.. Service features may be used to offer the user some control over a service such as the ability to modify a service, subscribe or unsubscribe to a service.

Service features are associated with call/session control, bearer control, mobility management. The term calls is used to encompass not only circuit-switched (e.g. voice) calls, but also virtual-circuit sessions set-up to handle packet data traffic.

The following service features are required;

- security/privacy;
- access control;
- address translation;
- call/session/bearer control;
- location;
- messaging;
- service control;

- user interaction.

8.1 Security/Privacy features

- presentation of or restriction of information associated with a party involved in a call or a session (e.g. calling line ID, calling name, location...);
- encryption of user data and signalling;

8.2 Access Control features

The access control features are defined to provide access to the UMTS network to the UMTS users over the serving network's air interface. These features include;

- user registration;
- user de-registration;
- ~~authentication (any actor in the role model shall be able to authenticate with any other actor with whom she has direct communication)~~muthual authentication.

8.3 Address Translation Features

~~The parties may be addressable via different means, they should be reachable independent of the medium. To support this requirements a new network functionality which can map the address, name (alpha string) / number (digits) and service type onto a service provider for call routing.~~

This address translation f~~unctionality~~eature shall allow UMTS to offer the wide range of addressing options including;

- E.164 Numbering (e.g. GSM MS-ISDN);
- ASEA Numbering (ATM);
- IP v6 Numbering;
- X.25 Numbering;
- Internet symbolic naming.

~~The content of this clause will be updated as the result of 22.75 conclusions.~~

8.4 Call/Session/Bearer Control Features

These features will be used to establish, handle and terminate calls. The following service features shall be supported;

- call/session set-up (point to point, point to multi-point, multi-point to multi-point);
- add/delete a party from a call/session;
- call/session termination;
- call/session establishment e.g. answering of calls;
- monitoring of call/session states and events;
- modification of the bearer service attributes.
- capability at initial call set-up to modify or reject the called party address;

- capability for an incoming call to modify or reject the called party address both at early and late stage of the call;
- capability to suspend and resume a call;
- capability to re-route a call;
- capability to be notified when a specified terminal is free or is ready to accept the call.

8.5 Location Features

Location ~~capabiliti~~features shall also be supported, to allow new and innovative location based services to be developed;

- to identify and report in a standard format (e.g. geographical co-ordinates) the current location of the user's terminal.

  The precision of the location shall be network design dependent, i.e. an operator choice. This precision may vary from one part of a network to another. It may be chosen to be as low as hundreds of meters in some place and as accurate as 5 meters in other place. It is required that a minimum precision of around 50 meters can be achieved in all types of terrestrial radio environment. Technical issues may constrain the precision to be mobile state dependent as well (mobile idle / mobile in communication). Several design optional features (e.g. size of the cell, adaptive antenna technique, path loss estimation technique...) shall allow the network operator to reach cost effectively the target precision.

  Because there may be very different uses of the location information;

  - It shall be possible to make the information available to the user, ~~network operator, service provider~~HE/SN and value added service providers. The user shall be able to restrict access to the location information (permanently or on a per call basis). The restriction can be overridden by the network operator when appropriate (e.g. emergency calls).
  - It shall be possible to set the delay to get the location information (the situation is quite different whether the information is needed for call routing or if it is needed by a user application).
  - It shall be possible to select the frequency of the location information update.

  If the terminal is switched off, then the last known position and time/date shall be available. The time of last known location shall be recorded and be made available in universal time.

- to identify and report when the user's terminal enters or leaves a specified geographic area.
- It shall be possible to specify the area as a circular zone (centre and radius) to a resolution that will be limited by the accuracy capability of the part of the serving network where the user is registered.

8.6 Messaging features

Messages are a block of data that may range from a few bytes to megabytes. Message delivery may involve store and forward of messages in transit. To be able to exchange and to control the exchange of messages between user the following service features shall be supported;

- capability to send messages;
- capability to receive messages;
- capability to request confirmation of receipt;
- capability to modify the content as well as the recipient of message;
- capability to reject a outgoing and/or incoming message;
- capability to re-route a message.

8.7 Service control features

To allow the support of service provider/network operatorHE/SN specific services the following service features shall be supported;

- capability to download service software to network nodes;
- capability to download service software to terminals;
- capability to download service software to the USIM;
- capability to negotiate of supported capabilities between USIM, terminals, serving network and service provider.HE and SN;
- capability to negociate bearer services and service capabilities

8.8 User Interaction Features

To allow the support of service provider/network operator specific user interfaces the following service features shall be supported;HE/SN specific user interfaces, databases containing user profiles shall be provided. This user profile functionality shall provide the following interaction features :

- capability to indicate information to the user;
- capability to collect user information;
- capability to activate and deactivate a special user profile;
- capability to change the user profile.

9 Standardised Protocols and Capabilities

This clause introduces a list of standardised protocols and capabilities that shall be supported by UMTS for the control and creation of services. The access protocols and the execution environment described below are essential for UMTS.

9.1 Access protocols

The access protocols shall allow the support of multimedia services. These services are characterised by the ability to dynamically change the number of participants and the number of connections during a call. The characteristics of the connections (confer the list of attributes used to describe a connection) may differ from one connection to another. They are negotiated during call set-up. They may be independently and dynamically re-negotiated on application (the telecommunication requirements of the application changes) or network initiative (change of network load conditions, during a handover procedure) during the call.

The application may require synchronisation between some of the connections. TLater, this synchronisation shall not be lost during handover procedures.

Whenever a call is terminated in other types of networks, the negotiation shall take into account the limitations of these networks. Interworking shall be possible with PSTN, GSM, ISDN, B-ISDN and Internet networks. Later it shall also be possible to interwork with B-ISDN networks.

The access protocols shall allow a mobile station to have several calls active simultaneously .

9.2 Execution Environment

The execution environment is a set of standardised capabilities that shall allow the support of service provider/network operatorHE/SN specific services (i.e. both applications, teleservices and supplementary services). The execution

environment shall be distributed between the IC card, terminal and network nodes. The terminal and the serving network capabilities shall be the only limiting factor for the support of the services designed to run on the execution environment. The execution environment is composed of the following building blocks;

- A standardised content description language for support of NO/SP specific user interfaces (both for information output and user input). This is intended only for platforms which are terminals.

- A standardised procedural language for support of NO/SP specific scripts. This language shall be common to all types of platforms. The scripts could be used for e.g. improving the user interface, adding new features to the terminal like the latest version of a codec, controlling the execution of a service.

- Standardised application programming interfaces for opening platform resources and capabilities to the scripts written with the standardised procedural language. These interfaces would be platform type dependent. The interfaces shall include primitives for accessing to the basic control functions, as illustrated on the figures 5 and 6 below.

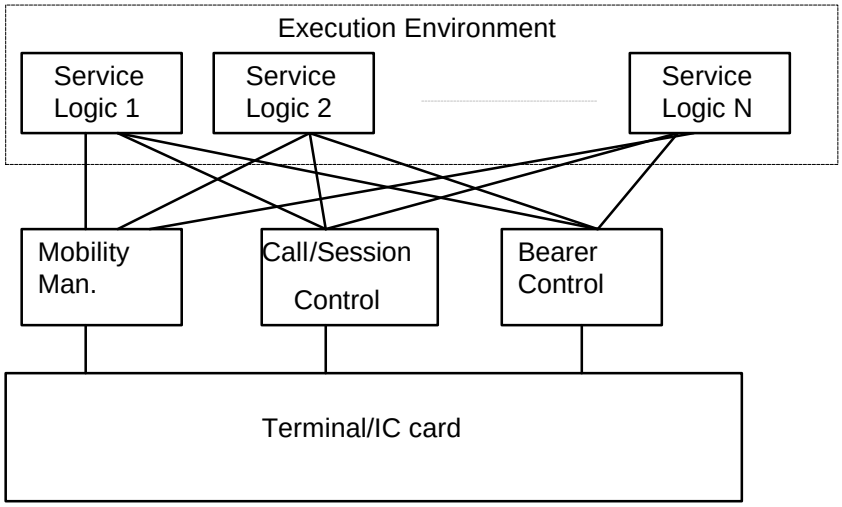


Figure 5: Execution Environment in the Mobile Station

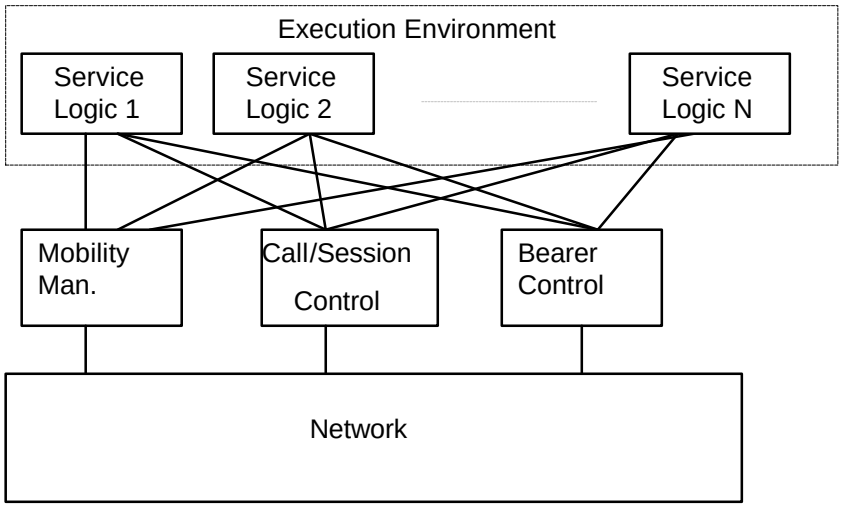


Figure 6: Execution Environment in the Network

- Call states, messages, information elements, values of information elements shall serve as triggers for subsequent interaction with service logic. The list of triggers is for further study and is likely to incorporate CAMEL, SIM Toolkit, MExE.

- Means to turn triggers on and off, and associate them with service logic shall be standardised.

- A standardised certification scheme and security model with several levels of trusts in order to control the scripts access rights to the platform resources and capabilities. This would be used to allow e.g. the SP and the SP only to access to USIM data.
- Standardised protocols for allowing the download of content description pages and scripts in the platform.

10 Existing GSM System features

Following GSM system features shall be supported by G-UMTS standards (for networks based on GSM evolution).

10.1 Network Identity and Time Zone (NITZ)

NITZ is specified in GSM 02.42.

10.2 Support of Localised Service Area (SoLSA)

SoLSA is specified in GSM 02.43.

Note : SoLSA modifications due to UTRAN related aspects are FFS.

10.3 Mobile station Execution Environment (MExE)

MExE is specified in GSM 02.57.

10.4 Location Services (LCS)

LCS is specified in GSM 02.71.

Note : LCS modifications due to UTRAN related aspects are FFS.

10.5 Customised Application for Mobile network Enhanced Logic (CAMEL)

CAMEL is specified in GSM 02.78.

10.6 Unstructured Supplementary Service Data (USSD)

USSD is specified in GSM 02.90

Note : USSD modifications due to UTRAN related aspects are FFS.

Annex A (informative): Examples of services built from service features

Call Barring

In standard GSM, the Call Barring services allow to prevent outgoing calls to certain sets of destinations, based on the number dialled and whether the user is roaming. In UMTS, it is proposed that this service allows to block outgoing calls based on a wider range of parameters which could include factors such as the time of day, day of week, location, type of call requested, cost of the service and/or destination. This would allow to develop Call Barring services tailored to business and personal markets to avoid abuse.

This service is invoked during the initial outgoing call set-up procedure and allow the call to be blocked prior to incurring any charges. This Service can be applied to any teleservice for both connection-oriented and connectionless-oriented services.

Call Filtering/Forwarding

In standard GSM, there is no call filtering service. All calls are presented to the user unless a call forwarding service is used to re-direct calls; there is no different call handling depending on the incoming call parameters (although differentiation on call type (voice/data) is possible).

In UMTS, the call filtering service allows the control of whether incoming calls are accepted, forwarded or terminated. The parameters which can be used to determine the final destination of a call may include the caller ID (CLI), original number dialled, time of day, current user location/network, user profile settings and current state of the terminal.

This service shall be two-stage; immediate call filtering (handled regardless of whether the terminal is online or not) and late call filtering (handled only if the terminal is online). It shall be possible to create and operate new call filtering services which can access any of the key parameters to handle calls in this way.

Hold

This service allows an established call to be maintained, whilst suspending use of the bearer from the incoming access point of the network. This saves on both air interface and network traffic resources when a call is temporarily suspended. The incoming access point in the network means either the originating UMTS terminal, or interworking point with another network.

Transfer

This service allows either an established or held call to be redirected to another destination. This may either be used by setting up a new call to the destination first, or simply redirecting the existing call to the new destination. It shall be possible to revert such a call back to the diverting terminal at any time before it is accepted (answered) by the new destination. The UMTS system shall ensure that an optimal traffic route is used after the call has been answered by its new (final) destination.

Call-back When Free

This service can be invoked where a call (or a connectionless message) cannot be delivered to its destination because it is in use. The UMTS system will inform the requesting entity when the destination is next able to accept the call, allowing a new call to be originated. This allows existing GSM services, such as Call-back When Free to be implemented. Where multiple requests are outstanding for a terminal which becomes available, the system will determine in which order the requests are handled, probably in a serial manner. Ideally, it shall be possible to create the service logic which determines the order used from a range of accessible parameters.

~~Annex B (informative):~~
~~Change history~~

Annex B (informative) : Description and analysis of communication schemes

This annex gives a high level classification and description of communications requirements from end users and applications.

B.1 Communication schemes

The requirements on bearer services are based on an analysis of user and application needs. Four end-user groups are identified according to four distinctly different communication schemes; *background traffic*, *interactive traffic*, *real time streams*, *real time conversation*. For each scheme one (or two) fundamental characteristic(s) for QoS is identified and the resulting overall requirement(s) is derived. Of course, when the requested service/application bearer requirements are converted into bearer service attributes (as defined in section 5.2), these fundamental characteristics are reflected in the values allocated to the bearer service attributes.

B.1.1 Background traffic

When the end-user, that typically is a computer, sends and receives data-files in the background, this scheme applies. Examples are background delivery of E-mails, SMS, download of databases and reception of measurement records.

Background traffic is one of the classical data communication schemes that on an overall level is characterised by that the destination is not expecting the data within a certain time. The scheme is thus more or less delivery time insensitive. Another characteristic is that the content of the packets must be transparently transferred (with low bit error rate).

Background traffic - fundamental characteristics for QoS:

- the destination is not expecting the data within a certain time
- preserve payload content

The resulting overall requirement for this communication scheme is to support non-real time services without any special requirement on delay.

B.1.2 Interactive traffic

When the end-user, that is either a machine or a human, is on line requesting data from remote equipment (e.g. a server), this scheme applies. Examples of human interaction with the remote equipment are: web browsing, data base retrieval, server access. Examples of machines interaction with remote equipment are: polling for measurement records and automatic data base enquiries (tele-machines).

Interactive traffic is the other classical data communication scheme that on an overall level is characterised by the request response pattern of the end-user. At the message destination there is an entity expecting the message (response) within a certain time. Round trip delay time is therefore one of the key attributes. Another characteristic is that the content of the packets must be transparently transferred (with low bit error rate).

Interactive traffic - fundamental characteristics for QoS:

- request response pattern
- preserve payload content

NOTE: Interactive applications might differ between interactive games and interactive data transfer such as web browsing.

The resulting overall requirement for this communication scheme is to support interactive non-real time serviceswith low round-trip delay.

B.1.3 Real time streams

When the user is looking at (listening to) real time video (audio) the scheme of real time streams applies. The real time data flow is always aiming at a live (human) destination. It is a one way transport.

This scheme is one of the newcomers in data communication, raising a number of new requirements in both telecommunication and datacommunication systems. First of all it is a unidirectional stream with high continuous utilisation (i.e. having few idle/silent periods.) It is also characterised by that the time relations (variation) between information entities (i.e. samples, packets) within a flow must be preserved, although it does not have any requirements on low transfer delay.

The delay variation of the end-to-end flow must be limited, to preserve the time relation (variation) between information entities of the stream. But as the stream normally is time aligned at the receiving end (in the user equipment), the highest acceptable delay variation over the transmission media is given by the capability of the time alignment function of the application. Acceptable delay variation is thus much greater than the delay variation given by the limits of human perception.

Real time streams - fundamental characteristics for QoS:

- unidirectional continuous stream
- preserve time relation (variation) between information entities of the stream

The resulting overall requirement for this communication scheme is to support streaming real time services having unidirectional data flows with continuous utilisation. (There are less hard requirements on delay and packet loss ratio, i.e. the ratio of lost or corrupted packets out of all packets sent.)

B.1.4 Real time conversation

The most wellknown use of this scheme is telephony speech (e.g. GSM), but with Internet and multimedia a number of new applications will require this scheme, for example voice over IP and video conferencing tools. Real time conversation is always performed between peers (or groups) of live (human) end-users. This is the only scheme where the required characteristics are strictly given by human perception (the senses). Therefore this scheme raises the strongest and most stringent QoS requirements.

The real time conversation scheme is characterised by that the transfer time must be low because of the conversational nature of the scheme and at the same time that the time relation (variation) between information entities of the stream must be preserved in the same way as for real time streams. The maximum transfer delay is given by the human perception of video and audio conversation. Therefore the limit for acceptable transfer delay is very strict, as failure to provide low enough transfer delay will result in unacceptable lack of quality. The transfer delay requirement is therefore both significantly lower and more stringent than the round trip delay of the interactive traffic case.

Real time conversation - fundamental characteristics for QoS:

- preserve time relation (variation) between information entities of the stream

- conversational pattern (stringent and low delay)

The resulting overall requirement for this communication scheme is to support conversational real time services with low transfer delay as given by the human perception. (There are less hard requirements on packet loss ratio.)

B.2 Adaptability and bearer service negotiation

Applications using the *interactive* or *real time conversational* communication schemes can also be described according to their possibilities for adapting to different environmental conditions as follows:

- Rigid applications; these applications can not adapt at all (e.g. GSM full rate speech.)
- Adaptive applications; these applications can adapt to the environment; they therefore require the network to support service negotiation. (e.g. multi-rate speech codecs)
- Elastic applications; these applications adapt totally to the environment and do therefore not require service negotiation (e.g. web browsing.)

The resulting overall requirement is to support service negotiation.

Annex C (informative) : Change history

Change history					
SMG No.	**TDoc. No.**	**CR. No.**	**Section affected**	**New version**	**Subject/Comments**
SMG#25				3.0.0	Approved at SMG#25 Sophia Antipolis 17-20 March 1998
SMG#26	98-0325	~~A~~001	Section 3.1 (a new definition is added) and section 5 (the current text is clarified).	3. ~~0.1~~1.0	Clarification of the sections where the bearer services are characterised.
Pre-SMG#28	SMG1 Tdoc 98-0864	A002	3.2, 4.1, 4.3, 4.4, 6.1, 6.4.1, 6.4.3, 6.4.4., 6.4.5, 8.2, 8.3, 8.5, 8.7, 8.8, 9.1, 9.2	Draft 3.2.0	SMG1 Agreed at this stage Aligning this specification with 22.00
Pre-SMG#28	SMG1 Tdoc 98-0870	003	Sections 2, 9	Draft 3.2.0	SMG1 Agreed at this stage References to relevant GSM specs has been added.
Pre-SMG#28	SMG1 Tdoc 0895 (865#5)	004	Annex B	Draft 3.2.0	SMG1 Agreed at this stage In line with views expressed by SMG2 and SMG12 about descriptions and analysis of communication schemes.
Pre-SMG#28		005	Section 8	Draft 3.2.0	Service features are only used to create services (as building blocks) and not to modify and delete services. (Added Jan 27, 1999)
SMG#28				Version 3.2.0	Approved Versions

History

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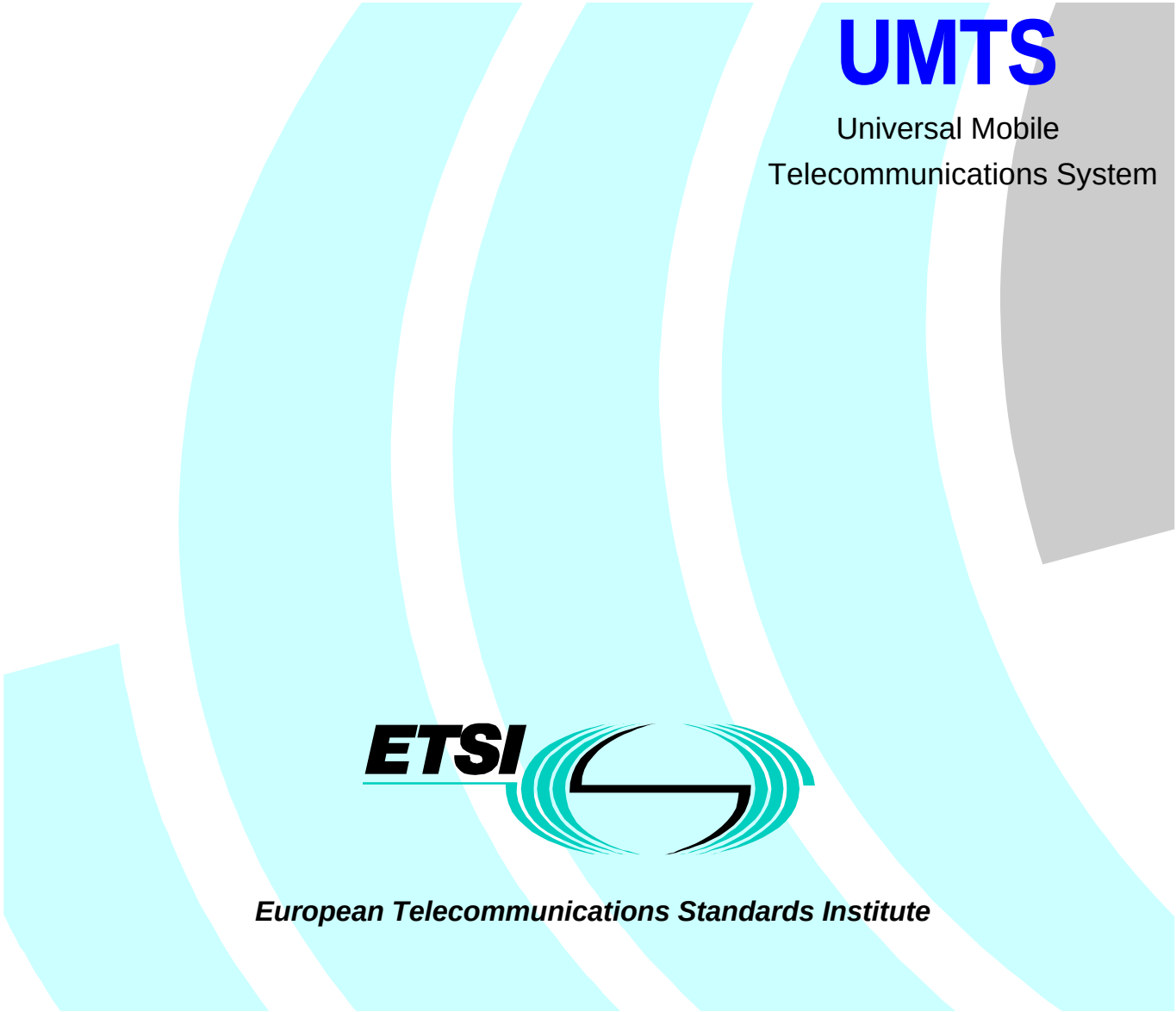
January 1999	**v.3.2.0 - with 43 CRs accepted by SMG1 - Presented to TSG SA WG1 - To be presented to SMG#28 for Approval**

UMTS 22.07 V3.1.1 (1998-10)

Technical Report

Universal Mobile Telecommunications System (UMTS);
Terminal and smart card concepts;
(UMTS 22.07 version 3.1.1)

Available SMG only



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Contents

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Foreword

This Technical Report has been produced by the Special Mobile Group (SMG) of the European Telecommunications Standards Institute (ETSI).

This TR specifies the stage 2 description of the subscriber data management.

The contents of this TR are subject to continuing work within SMG and may change following formal SMG approval. Should SMG modify the contents of this TR it will then be republished by ETSI with an identifying change of release date and an increase in version number as follows:

Version 3.x.y

where:

3 indicates UMTS document under SMG change control

x the second digit is incremented for changes of substance, i.e. technical enhancements, corrections, updates, etc.

y the third digit is incremented when editorial only changes have been incorporated in the specification;

1 Scope

This document is informative and applicable to standardisation work within ETSI SMG for UMTS. It discusses the issues related to terminal and smart card concepts in the UMTS environment. The report will provide guidance and input to the SMG specification work in the area of UMTS terminals and IC cards used for containing UMTS information and accessing UMTS services. It presents various options on the roles relating to IC cards and terminals as well as discussing their relationship in 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.

2.1 Normative references

[1] ETSI UMTS 22.01(V3.1.0): “Universal Mobile Telecommunications System (UMTS): Service Aspects; Service Principles”

[2] ISO - 7816-1, 1987: "Identification cards - Integrated circuit(s) cards with contacts, part 1: Physical characteristics";

[3] ISO - 7816-2, 1988: "Identification cards - Integrated circuit(s) cards with contacts, part 2: Dimensions and locations of the contacts";

[4] ISO - 7816-3, 1989: "Identification cards - Integrated circuit(s) cards with contacts, part 3: Electronic signals and transmission protocols";

[5] ISO - 7816-4, 1995: "Identification cards - Integrated circuit(s) cards with contacts, part 4: Inter industry commands for interchange";

2.2 Informative references

[6] ETSI TC SMG PT Mexe, “Mobile Station Execution Environment, Feasibility Study”, 24-25 September 1997;

3 Definitions and abbreviations

3.1 Definitions

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

USIM: User Service Identity Module is an application residing on the IC Card used for accessing UMTS services of a certain Service Provider.

3.2 Abbreviations

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

ADN	Abbreviated Dialling Numbers
API	Application Programming Interface
CPU	Central Processing Unit
GSM	Global System for Mobile Communications
IC	Integrated Circuit
JPEG	Joint Photographic Experts Group
MIPS	Million Instructions Per Second
MMI	Man Machine Interface
NO	Network Operator
PC	Personal Computer
SIM	Subscriber Identity Module
SP	Service Provider
SW	Software
UMTS	Universal Mobile Telecommunications System
USIM	User Service Identity Module
VASP	Value Added Service Provider

4 Introduction

UMTS aims to offer service capabilities that enable a wide variety of services to be implemented. Such services range from simple services like speech, to complex multimedia services containing several simultaneous media components that place totally different requirements on the system and on the terminal equipment. By standardising service capabilities rather than actual services, more flexibility is available for service providers/network operators to create unique services.. The same principle also applies for UMTS terminals, i.e. the types of terminals are not standardised and are therefore not limited in any way. A wide range of terminal types is likely in the UMTS environment, e.g. speech only terminals, videophones, data terminals, wideband data terminals, fax terminals, multi-band/multi-mode terminals and any combination of the aforementioned.

2nd generation digital cellular terminals already contain considerable complexity. There are two main reasons for this. Firstly, cellular systems themselves require a huge amount of functions to be fulfilled, from channel and speech coding to signalling and data protocols. In addition to those functions, all terminals have their own mobile system independent features, sometimes also called as Value Adding features. Examples of these are, memory databases, speech recognition, messaging features, display functions, and different source coding methods (e.g., JPEG).

Terminal development trends for today's terminals are mainly towards higher integration levels resulting in smaller size. The goal of "four 100's" has been a rule of thumb target for handsets, i.e., 100 hour standby, 100 cc size, 100 gram weight and also 100 MIPS performance. The size targets have already been achieved and any requirement for smaller terminals is questionable from the usability and physical size limitations perspective. The other target parameters have no maximum limitations. On the other hand, we can see the following further trends for near future terminals:

- Application specific terminals (smart traffic, vending machine radio, etc.);
- Increased number of value adding features (graphics, smart messaging, PC connectivity and compatibility);
- Support for higher number of source codecs (several speech codecs);
- Multiband terminals (e.g., GSM in 900MHz and DCS1800);
- Multimode terminals (e.g., GSM/DECT dualmode terminal);
- Dynamic SW configurability;

These trends are more than likely to continue in the future. Multiband and multimode terminals with high integration levels would be preferred by the users. Technological development of these terminals relies on new packaging and

interconnection technologies, as well as technological steps like SW-radio. The concept trends of mobile handheld terminals is likely to diverge from simple speech terminals towards a variety of different types, e.g., communicators, wearable phones, data terminals, etc. The dominant role of speech terminals will be challenged in the future by these new data- and multimedia-oriented terminals.

The UMTS user service identity module (USIM) shall contain sufficient information to identify the user and service provider. USIM is UMTS specific application residing on a IC card and is required for service provision. Authentication and ciphering functionality may be part of USIM or some other application on the same or different IC card. The UMTS IC card could also support applications other than UMTS USIM application in order to allow more versatile UMTS IC card functionality such as access to value-adding services.

The trend for IC Cards is similar to that for terminals. The next generation of IC Cards will be multi-application cards capable of supporting several applications simultaneously. Furthermore, applications could be downloaded to and removed from these cards, both at the time of issuing and during the card's lifetime The advent of these virtual machine cards, e.g. Java cards and Multos cards, will change the roles of the card issuers and application providers, and will enable IC cards to be much more flexible in the future.

5 Technology development

New radio-interface and system capabilities will enable higher quality multimedia services to be provided and therefore new terminal concepts to evolve. The variety of terminals in the UMTS environment will evidently be large. Terminal implementation technologies, such as digitalisation providing programmability and terminal configurability, VLSI, and display technologies, have developed a lot recently and will undergo further development in the future. Processing power, implementation architectures, IC and passive integration, and memory technologies are developing rapidly and will facilitate an increase in terminal functionality that will enable higher integration of terminals, as well as the integration of more functionality into smaller terminals.

It can be clearly seen that the technical development of IC card technology increases the available possibilities for IC cards in the UMTS context. Compared to current IC cards (e.g. GSM Phase 2 SIM cards), the amount of memory and processing power will increase significantly. These development trends will meet the requirements of UMTS and should be taken into account while defining the features and functions of UMTS IC card.

6 IC Card Functionality

6.1 Mandatory functionality for IC card containing a USIM

The mandatory requirements for IC Cards used for holding USIM application, are related to the need to have one USIM application on the IC card, as well as to the security issues. The following functionality is required from the IC card holding a USIM application:

- Physical characteristics same as used for GSM SIM
- The support of one USIM application
- The support of one or more user profile on the USIM
- Possibility to update USIM specific information over the air, (e.g. such information as service profile information, algorithms, etc.) in a secure and controlled manner.
- Security mechanisms to prevent USIM application specific information from unauthorised access or alteration. Verification of the access privilege shall be performed on the card itself and not delegated to another entity (for example the terminal).
- User authentication.

6.2 Desirable optional functionality for IC card containing a USIM

The standard should support the following additional functionality for the IC Cards in UMTS environment:

- The support for more than one simultaneous application (Multiple USIM, Ecash and/or some other applications).
- Possibility to have shared applications/files between multiple subscriptions, including ADNs, other user/SP controlled files and data, as well as for as yet undefined applications (including downloadable applications) required by future services. Related security issues have to be analysed.
- Possibility for some applications/files to be restricted to one or some of the subscriptions, under user/SP control, with all applications that are shared, being done so in a secure manner.
- Inclusion of a payment method (electronic money and/or prepaid and/or subscription details)
- An interface allowing highly secure downloading and configuration of new functionality, new algorithms and new applications into the IC card as well as updating the existing applications, algorithms and data.
- Support for storing and possibly executing encryption related information, such as keys and algorithms.
- In multi application cards a functionality to prevent the unauthorised access and alteration of USIM specific information by other applications residing on the card.
- The ability to accept popular value-adding IC card applications, such as digital signature applications, EMV credit/debit card, electronic purses such as Mondex and Visacash, etc. Dynamic addition and deletion of these applications during the lifetime of the card is envisaged.
- Possibility for one UMTS SP to block multiple subscription on the card the SP has issued.

Shared applications could include databases (e.g. telephone books), service profiles (e.g. controlling divert information), users preferences (e.g. short dialling codes) and SP-specific parameters inside a USIM application (e.g. call barring tables).

6.3 Presence of an UMTS USIM

6.3.1 Using removable card for using UMTS services

The implications of the requirement that the UMTS IC card with a USIM must be physically present in the terminal at all times are:

1) It is of limited use to put applications other than the USIM on the UMTS IC card.

2) Multi-user terminals have to be multi-slot terminals, which limits personal mobility in UMTS.

3) Users have to carry multiple IC cards, which is not user friendly.

Therefore if the use of “swipe” cards could be facilitated in a secure manner it would benefit actors of the UMTS role model. The security concerns of the use of swipe cards in UMTS should be validated.

Examples of services that can be used without the permanent physical presence of the UMTS card in the terminal are:

- Services that are free of charge or are charged according to a flat rate.

- Services where the calling user does not require authentication of the intended recipient (which is a user option).

- The service concerns incoming communication for which the calling party has accepted all call charges. Therefore a prior registration is made for the service. To make the registration the IC card has to be present in the terminal.

6.3.2 Alternative payment methods

In current systems, the user identity and authentication functionality is the basis for charging. However, more choices for the user are already appearing, with many operators launching pre-paid and re-chargeable GSM-cards during this year. In the future, the acquisition and use of UMTS services should be as easy as possible. Alternative solutions should be available for paying for UMTS services and value-added services.

A large number of cards in your wallet is the reality today. Based on market demands smart card manufacturers are developing cards able to contain multiple applications on the single card. In future consumers, in conjunction with the card provider, will be able to construct a smart card which is able to hold a number of different applications to suit their individual requirements or lifestyle. These new applications may provide payment possibilities such as pre-paid, debit- or credit-card based applications. Smart card is ideal support for payment over the Internet, whether in cash or as credit. Smart card provides safe and movable place for the needed secret keys and allows only the right user to use it.

Pre-paid smart cards are probably the first phase in the development. Other possibilities will exist like electronic cheques or perhaps a straight access to bank. Mobile commerce is a fast evolving market and it is difficult to forecast future developments. The success of electronic and mobile commerce depends critically on user acceptance. It is not easy to change users’ habits, new payment methods must be easy to use.

6.3.3 Separation of USIM and the payment method

Another considered way of organising the UMTS security and service related information and the payment method in UMTS could be the usage of separate modules. UMTS specific security algorithms and information, i.e. the USIM application, could be contained by a security card (an IC Card, microchip or another security module), which would resolve the possible problems of authenticating the UMTS users and ciphering the user information using UMTS specific algorithms if required. The role of the separate security module depends of the final configuration. In case of an IC card acting as a security module, also authentication information (user specific) could be present, because of easy movability between different terminals. In case of a smaller HW based solution (silicon), which would be considered unremovable for daily purposes, only the ciphering functionality could be contained (system specific). At the same time the payment method required to access the UMTS services could be contained in another IC Card (Figure 1). Additionally following benefits have been identified:

- Given the anticipated use of UMTS for financial transactions it allows particular banks etc. to provide their own customised security on the removable IC card (including end-to-end security). This will normally be of higher assurance than GSM can currently provide. With the separate security module, there is no need for the financial institution to reveal the detail of their security algorithms to, for example ETSI or an equipment manufacturer. Instead they can provide a sub-system with a defined interface.

- It would help UMTS to provide some PMR-like services where user groups (e.g. law enforcement agencies) often require specific security provision (especially for encryption). This would be facilitated by permitting the insertion of the removable IC card. The EP-TETRA model may offer some useful insight into this functional separation.

- Possibility to have small terminals where the size is not restricted by the size of the IC card.

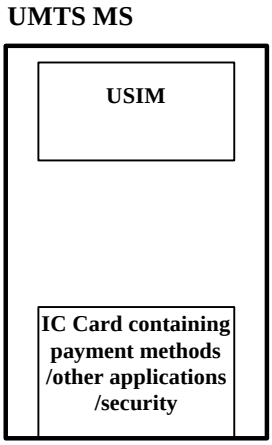

Figure 1: Separation of USIM and payment information

6.3.4 Separation of IC Card from the terminal equipment

In GSM terminology minimum configuration of a mobile station (MS) consists of a mobile equipment (ME) and a SIM card (Figure 2a). The introduction of mobiles with PCMCIA data functionality already makes this definition a little fuzzy (Figure 2b). In the context of UMTS, one could consider a possibility of UMTS terminals consisting of a laptop, radio PCMCIA card and a separate IC card reader (Figure 2c). The interface between the UMTS radio card and the IC card reader could be purely a software interface. This type of an MS configuration would raise following questions:

- Is this a valid configuration?

- Does the interface between UMTS radio card and a IC card reader have to be specified?

- Does the IC card have to be available for the whole time?

- Does the terminal know if the IC card has been removed from the reader?

- Would it be more viable in this configuration to use credit/debit/emoney card?

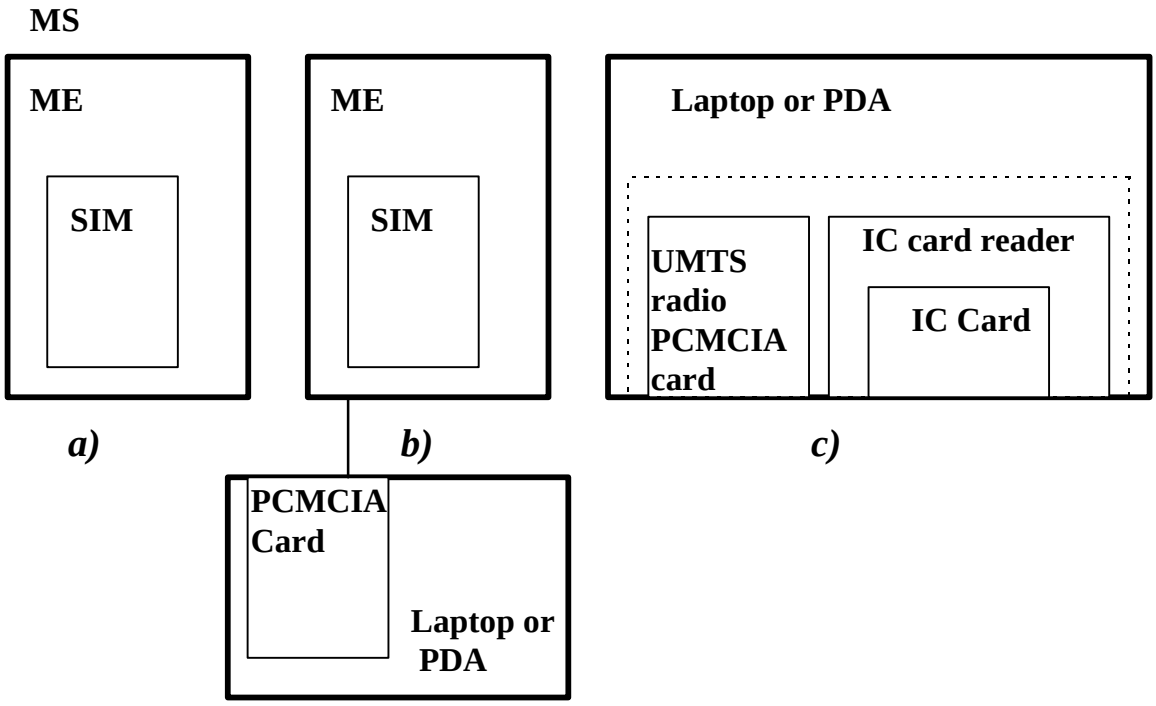

Figure 2: Examples of UMTS terminal configurations

6.4 Charging and accounting algorithms on the IC Card

For more information, please refer to ETSI UMTS 22.24.

7 Terminal Functionality

The UMTS standard does not restrict the functionality of the terminals in any way. The standard should allow terminal specific features and functions to exist. However, a minimum set of mandatory functions are required in order to ensure proper behaviour of the system.

7.1 Mandatory functions

The mandatory functionality of UMTS terminals is related mainly to the interaction between the terminal and the network. The following functions should be considered mandatory for all UMTS terminals:

- Terminal IC Card interface;
- SP and Network registration and deregistration;
- Location update;
- Originating or receiving a connection oriented or a connectionless service;
- An unalterable equipment identification;
- Basic identification of the terminal capabilities;
- Terminals capable for emergency calls should support emergency call without a USIM;
- Support for the execution of algorithms required for authentication and encryption;

7.2 Extra features

The Standard should support the following additional functionality for UMTS terminals:

- a mechanism to download service related information (parameters, scripts or even software), new protocols, other functions and even new APIs into the terminal;
- an API interface capability to allow information transfer through a well known interface;
- maintenance of the VHE using the same user interface and or another interface while roaming;
- optional insertion of several cards. An example scenario for this feature is a fax machine with a multiple IC card slots, where several users could insert their IC card and receive faxes.

7.3 External interfaces

Interfaces are needed for messages and information to be transferred between the terminal and an external device, e.g. a computer. Standardised interfaces and protocols shall be used as much as possible and UMTS specific enhancements will be specified for those. Additional physical specifications should not be specified by UMTS standards if possible.

External logical interfaces important for UMTS terminals can be, e.g. AT-command set, a SW API for PC environment.

7.4 Identification of Terminal capabilities

In the UMTS environment a large number of different terminal types are envisaged. All terminals will have to support mandatory functions identified for UMTS terminals (see subclause 7.1). One of the mandatory functions will be the identification of the terminal's capabilities. Information provided in the identification of terminal capabilities should contain the used selections in the case where alternatives are available (e.g. which speech codecs are supported) as well as the optional functions and features important from the used service point of view (e.g. certain data compression algorithm supported). Early identification of terminal capabilities will save network resources, e.g. in the case of an intended call between two incompatible terminals.

As UMTS is intended to be a future proof system evolving in the future, all capabilities of the UMTS terminals cannot be identified and classified in the first phase of standardisation. Therefore, a basic classification of terminal capabilities is needed. UMTS terminals should identify their basic capabilities when attaching to the network. Further negotiation of enhanced capabilities and features will have to be carried out between the calling parties and applications.

Basic capabilities identified by the terminals could be e.g.:

- Supported speech codec: GSM, GSM EFR, AMR, proprietary, none, etc.
- Supported display type: character, graphic, none, etc.
- Radio capabilities: capable of listening in several network simultaneously, transmitting in several networks simultaneously, etc.

8 IC Card/Terminal Interfaces

8.1 The IC Card interface

An interface between the terminal and the IC Card should be standardised from the physical and functional point of view. The following characteristics are identified for the physical interface:

- Physical interface should be based on ISO - 7816 [2, 3, 4, 5]

- Future terminal and IC card technology development should be considered for efficient implementation. Such aspects as supply voltage levels (3V and less), interface bit rates, virtual-machine APIs and even contactless interfaces.

- The IC card physical interface should support high bit rate transmission in order to support efficiently the applications on the IC card.

The IC card physical interface should support invocation and data manipulation of USIM application and other IC card applications.

8.2 Internal Application Execution Interface

Execution of service provider specific services and applications will be supported by UMTS terminals. An API will be standardised for the purpose of hiding terminal specific implementation issues and support for the execution of downloadable services. In order to support execution of external applications, a script or a description language will have to be identified. UMTS specific script languages should be avoided to maintain compatibility and therefore similar developments from other environments such as computer and PDA environments should be closely investigated. A detailed study of the application execution environment requirements have been done [6]. Following list describes the major requirements to be supported by UMTS application execution environment:

- Application development independent of the terminal platform;

- Wide variety of application tailored for certain categories of terminals, e.g. low end and high end terminals;

- Support for sophisticated user interface and wide variety of MMI concepts;

- The means to support SP and VASP specific services;

- The means to download new services/functions into the terminal and upgrade existing services/functions;

8.3 Physical dimensions

One of the principles of UMTS is to provide personal and terminal mobility. Therefore, a user should be able to roam either with a terminal or an IC Card upon which resides a USIM. The IC Card should therefore have physical dimensions which facilitate portability. For example, the IC Card could have the physical dimensions of a credit card.

It should not be obligatory for a terminal to fully envelop an IC Card, it may be enough that the terminal simply covers that part of the card that contains the chip *(USIM?).*

It should be possible to have smaller IC cards that remain embedded in terminals.

In light of the above requirements, UMTS shall adopt both of the card formats currently used by GSM, i.e. the full-size ID1 format [EN 27810-1:1989], and the ID000 “plug-in” format [ENV 1375-1: 1994].

9 Testing and Type approval issues

Testing and type approval of the UMTS terminals should concentrate on the UMTS specific issues of the terminals, i.e. radio, protocols and UMTS specific functionality. Type approval should be included in to the standardisation process in a manner that does not cause extra delays to the introduction of terminals. Specific requirements for testing and type approvals will be defined later.

10 Conclusions

This ETSI report has presented concepts related to UMTS terminal and IC card usage. Based on the these concepts UMTS requirements for terminals and IC cards are also presented. Some of the concepts presented in this documents are not fully investigated and therefore more requirements might come up, after further evaluating those concepts that will be found useful by the SMG and evaluated by the SMG STCs. Also it has to be considered that in certain

countries offering UMTS services, operators, regulators or legal authorities might restrict or recommend the usage of some of these concepts.

It is proposed that following UMTS IC card related standardisation activities will be carried out targeting to GSM/UMTS release 1999 (UMTS phase 1):

1) Mandatory functionality for the IC card containing a USIM application (see subclause 6.1).

2) Possibility to have also other applications on the IC card. Standardisation is needed to support the required functionality (see subclause 6.2 for relevant requirements).

3) Possibility to use alternative payment methods (see subclause 6.4.2).

4) Separation of USIM and the payment method (see subclause 6.3.3).

It is proposed that following UMTS terminal related standardisation activities will be carried out targeting to GSM/UMTS release 1999 (UMTS phase 1):

1) Mandatory functionality for the terminal (see subclause 7.1).

2) Mechanism to download service/function related information and SW (see subclause 7.2).

3) Application execution environment/interface (see subclause 8.2).

4) Mechanism to identify terminal capabilities related to services (see subclause 7.4).

It is proposed that following concepts will be part of UMTS phase 2 standardisation:

- Using removable card (e.g. swipe card) for using UMTS services (if security concerns can be resolved, see subclause 6.3.1).

- Multiple USIMs on single IC Card.

- Combination of concepts “Separation of USIM and the payment method (6.3.3)” and “Using removable card for using UMTS services (see subclause 6.3.1)”.

Separation of IC card reader from the terminal equipment (see subclause 6.3.4).

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Change history

Change history					
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SMG#27	98-0581	A001	Sections 4, 6, 10	3.1.1	Security aspects relative to USIM & Payment methods.

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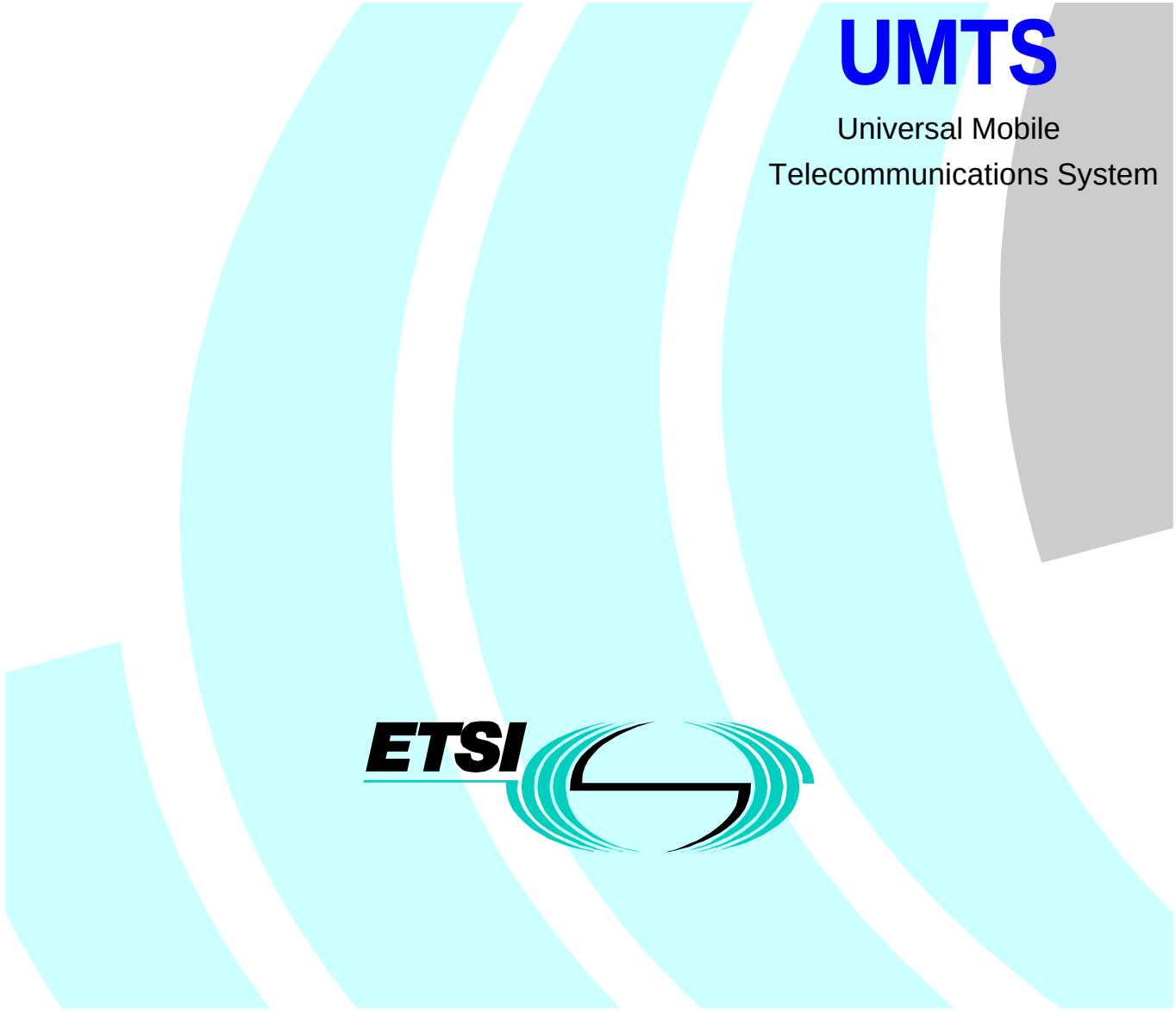

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Version 2.y.z

where:

- x the first digit:
  - 1 presented to SMG for information;
  - 2 presented to SMG for approval;
  - 3 Indicates SMG approved UMTS document.
- y the second digit is incremented for all other types of changes, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the specification;

1 Scope

This ETSI Technical Specification describes the Service Aspects of charging and billing of the Universal Mobile Telecommunications System (UMTS).

This standard is not intended to duplicate existing standards or standards being developed by other groups on these topics, and will reference these where appropriate. This standard will elaborate on the charging requirements described in the Charging Principles in UMTS 22.01 Service Principles. It will allow the generation of accurate charging information to be used in the commercial and contractual relationships between the parties concerned.

2 Normative 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] DTS/SMG-012201U, 1996: "Service Aspects; Service Principles (UMTS)";

3 Definitions and abbreviations

3.1 Definitions

For the purposes of this TS, the definitions in [1] are supplemented by the following definitions:

Accounting: The process of apportioning charges between the Home Environment, Serving Network and User.

Billing: A function whereby CDRs generated by the charging function are transformed into bills requiring payment.

Call Detail Record (CDR): A formatted collection of information about a chargeable event (e.g. time of call set-up, duration of the call, amount of data transferred, etc) for use in billing and accounting. For each party to be charged for parts of or all charges of a chargeable event a separate CDR shall be generated, i.e more than one CDR may be generated for a single chargeable event, e.g. because of its long duration, or because more than one charged party is to be charged.

Chargeable Event: An activity utilising telecommunications network infrastructure and related services for user to user communication (e.g. a single call, a data communication session or a short message), or for user to network communication (e.g. service profile administration), or for inter-network communication (e.g. transferring calls, signalling, or short messages), which the network operator wants to charge for. The cost of a chargeable event may cover the cost of sending, transporting, delivery and storage. The cost of call related signalling may also be included.

Charged Party: A user involved in a chargeable event who has to pay parts or the whole charges of the chargeable event, or a third party paying the charges caused by one or all users involved in the chargeable event, or a network operator.

Charging: A function whereby information related to a chargeable event is formatted and transferred in order to make it possible to determine usage for which the charged party may be billed.

Settlement: Payment of amounts resulting from the accounting process.

3.2 Abbreviations

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

CDR Call Detail Record

4 Requirements

The main new requirements for UMTS charging and accounting are:

- to provide a call detail record for all charges incurred and requiring settlement between the different commercial roles;
- to allow fraud control by the Home Environment and cost control by the User by providing CDRs to the Home Environment at short notice.
- to allow cost control based on a charge limit per user or per subscription.;
- to provide at the beginning of a chargeable event an indication to the charged party (if involved in the chargeable event) of the charges to be levied for this event;
- to allow itemised billing for all services charged to each subscription, including voice and data calls, and services offered by home environments.

These new requirements will allow users more freedom to obtain service when roaming, whilst providing effective cost and credit control for the Home Environment and User.

5 Generation of Call Detail Records

The standard shall support the creation and transfer of charging records in order to facilitate:

- interworking with pre-UMTS systems (e.g. GSM);
- fraud management procedures;
- detailed itemised billing.

5.1 Call Detail Record Requirements

Call Detail Records shall be generated in the Serving Network to record chargeable User or Mobile Station activity and inter-carrier connections. Some of the information is provided by the user, other information is only available in the network element of the serving network.

Depending on the type of chargeable event some of the information may not be available or might not be required.

5.1.1 Information provided by the user

The user incurring the charge shall provide the following information to the serving network:

- User identity used for authentication;
- Home environment identity;
- Terminal Identity and Terminal Class;
- Destination endpoint identifier for service requested (e.g. B number);
- Resource requested (e.g. bandwidth, connectionless);
- QoS parameters (e.g. maximum delay).

5.1.2 Information provided by the serving network

The serving network serving the user shall provide the following information to the home environment:

- All of the information listed in section above (Information provided by the user);
- Serving network identity;
- Recording network element identity;
- Universal Time (UT) at which the service request was initiated;
- Universal Time (UT) at which resources were provided for the service;
- Resource allocated to the user;
- Quantity of data transferred by the user;
- QoS provided to the user;
- Location of the user (definition of location is required) ;
- whether GSM Optimal Routing was applied;
- If IN or CAMEL services were applied, the service parameters and the actually used destination number and calling party number identification;
- Time duration covered by this call record to an accuracy of at least 1 second;
- Charge accumulated for this call in the currency of the serving network.
- Unique identity of the chargeable event which allows the billing system to correlate all records belonging to the same chargeable event;
- Unique CDR identity (unique per network element in a period of about 100 days).

5.1.3 Charged Party

For subscription related chargeable events the CDR shall indicate the charged party, i.e. normally the calling party. As alternative it should be possible to apply reverse charging or to charge the event to a party not involved in the event itself (e.g. a company as VPN subscriber). It should be possible for multiple leg calls (e.g. forwarded, conference or roamed) to be charged to each party as if each leg was separately initiated. However, in certain types of call, the originating party may wish/be obliged to pay for other legs (e.g. SMS MO may also pay for the MT leg.).
Provision shall be made for the chargeable party to be changed during the life of the call.
In case of inter-network chargeable events, the CDR usually does not contain the charged party, but it can be derived from network configuration information contained in the CDR.
For each party to be charged for a chargeable event or parts of it a separate CDR shall be generated.

5.2 Special Cases

5.2.1 Long calls

The advent of packet data calls, which can extend for very long periods of time (days, weeks etc), although at low cost because charges are based on data throughput, may mean that billing records are only output at the end of very long periods. This may require call records to be generated mid-call, either when some charge value is reached or some duration or both, to allow for both charging settlement and cost control.

5.2.2 Multimedia calls

During one call the user may invoke different services like speech, data transmission, video and audio, each leading to a separate CDR. The Unique identity of the chargeable event in each CDR shall allow the billing system to correlate these records and to indicate to the user on the bill that they belonged to one call.

6 Transfer of Charging Information

The efficient transfer of charging information between serving networks and from serving networks to home environments requires a standardised interface between these entities. Transfer of charging information between serving network and home environment shall be done at the following times:

- when a chargeable event occurs;
- when a chargeable event is initiated by the user;
- when a chargeable event terminates
- at regular intervals during a chargeable event.

The format of the charging information exchanged (see 5.1) shall be standardised. It shall be possible for the relevant parties to agree minimum and maximum age of call information tranfered between themselves.

6.1 Integrity, Secrecy and Validation of Content and Receipt of Charging Information

The transmission mechanism for charging information collected in 5.1 above shall ensure its integrity and secrecy.
A mechanism to validate the source and integrity of the information shall be provided so that:

- The home environment shall be able to validate the source and integrity of the charging information supplied by the serving network;
- The serving network shall be able to validate the source and integrity of the charging information supplied by the user;
- The serving network shall have proof that services were provided to a specified user.

7 Accounting and Settlement

The serving network shall collect and process the charging data generated in its network elements. The record of each individual transaction shall be reported to the home environment at short notice in order to provide itemised bills, and to deal with any disputes regarding charges both for users and for other UMTS networks and home environment.

7.1 Delegation of charging authority

The registration process allows the home environment to authenticate users before they incur any charges. Once authenticated, the home environment then delegates authority to the serving network operator with which he has a direct commercial relationship to incur charges for services supplied to that user. The direct commercial relationship may be with either the serving network operator if known directly by the home environment or a network operator

known to the home environment. This procedure uses each network as trusted third parties in a chain of delegation between entities, thus allowing commercial transactions between entities who have no direct commercial dealings. There shall be an authentication procedure between all entities in the UMTS system which have a commercial relationship.

7.2 Fraud Control and Cost Control

Mechanisms shall be provided which allow fraud control by the serving networks and the home environment, and shall allow cost control by the user.

7.2.1 Fraud Control by the Home Environment

Charging information shall be collected by the home environment in short time intervals from all serving networks which its users are allowed to use. The billing system in the home environment shall process the information in real time and provide the means to set charge thresholds per time interval upon which some actions may be started, such as informing the customer care centre or even barring the user in the HLR.

7.2.2 Fraud Control by the Serving Network

Charging information shall be collected from the network elements and processed in short time intervals. This will allow the serving network to always be aware of the exposure to visitors. A limit for the accumulated charges for all visitors from one home environment or a limit per visitor may be agreed between the home environment and the serving network.

7.2.3 Cost Control by the User

7.2.3.1 Charging Limit

The user shall be able to set in his home environment a limit for the accumulated charges per time interval. Upon exceeding this limit or prior to incurring a charge which would exceed the limit, certain actions may be desired by the user:

- notification to the user, requesting to extend the limit, or
- HLR barring allowing no further originating calls, or
- HLR barring cancelling the roaming permission.

7.2.3.2 Advice of Charge

A mechanism shall be standardised providing an indication to the chargeable party(if involved in the chargeable event) of the charges to be levied for a chargeable event. This mechanism shall be able to handle all possible charging scenarios, and all service and tariff variants that a home environment may offer to the user.

7.3 Inter-network Settlement

Mechanisms shall also be provided to allow inter-network settlement of charges on a bulk basis. The same mechanisms shall be used between home environments and serving networks. This will allow each of these parties to meter the total input and output of charges and thus determine the payments required on a periodic basis between each of the parties with which they directly interact. The mechanisms used shall allow each of the parties to meter charge flows independently, with the aim of matching the values recorded at both sides of the same interface. The imbalance in charge flow shall be accumulated in realtime, such that each entity can be informed when a threshold has been exceeded and determine whether to continue.

7.4 E-Commerce

The UMTS system may be used to trade soft goods (e.g. information, video, audio), or hard goods (e.g. books) of high or low value per item between the user and a merchant. It shall be possible for such merchants to charge users directly for services they provide. Electronic payment mechanisms are or shall be made available through other standards (micropayment, credit card payment, etc), and therefore are outside the scope of this specification UMTS shall not prohibit the use of these mechanisms, and, where possible, shall provide the basic communications transport to allow them to be used effectively.

However, if the serving network acts as merchant of soft goods, it may charge the user directly, creating a CDR as described above or using micropayment mechanisms.

8 Automatic Roaming Agreements

It is a requirement that UMTS users shall be able to obtain service and use chargeable services with networks with whom neither they nor their home environment have any direct commercial agreement. This shall be enabled by

interworking via trusted third parties. Each Home Environment shall interwork with one or more serving network operators, with whom they would negotiate a commercial roaming agreement and test the interworking. Any user wishing to use the services of a particular serving network would register with that serving network, who would either directly or indirectly interwork with the home environment. Real-time online billing mechanisms would be used to ensure that charges incurred for UMTS services do not exceed the credit limits set. This would be applied for the user and the other roles involved in commercial dealings. In practice, any serving network shall be capable of operating as a roaming broker.

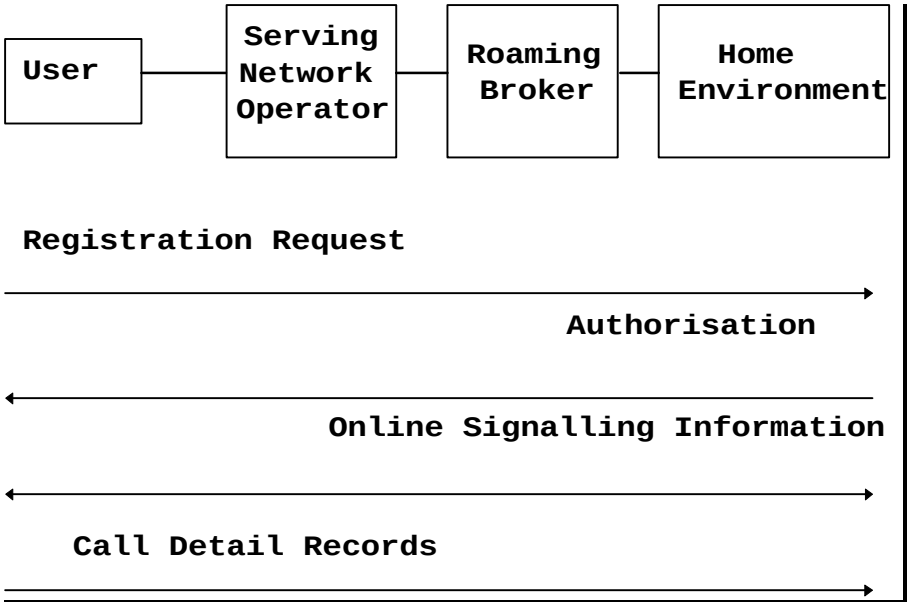

Figure 1: Registration and Roaming Process

There are two key aspects which are required to allow such a system to be deployed:

- How does the serving network operator know how to route the registration request?
- How does each party in the transaction charge for their services?

8.1 Routing the Registration Request

The same mechanisms used for routing calls and resolving addresses shall be used to route the subscription identity back to its Home Environment . Clearly, some form of routing identification will be required to allow a serving network, which does not maintain its own list of all known HE, to determine the appropriate route to reach a given HE. A number of alternative routes may be possible, and ideally the system should be capable of determining the lowest cost to the end user.

Typically, smaller networks will only have a limited number of external connections to other networks or clearing houses, but may not know which one to use for an unknown (new) HE. In this case, the serving network may make a number of inquiries for each route to determine the lowest cost route to handle the call.

8.2 Settlement of charges

Settlement of charges incurred by a user shall be on a wholesale basis between the different parties involved in the registration link. By authorising a user to register, or a roaming broker to pass that on, each party is in turn authorising charges up to a maximum credit limit with the adjacent party. Any charges levied can then be paid to the adjacent party on a wholesale basis at the end of a mutually agreed accounting period. Funds are thus passed between each party for the services supplied by the network operator in a serial fashion.

Annex A (informative): Change history

Change history					
SMG No.	**TDoc. No.**	**CR. No.**	**Section affected**	**New version**	**Subject/Comments**
SMG#28				Version 3.0.0	Approved

History

Document history		
Date	**Status**	**Comment**
27 August 1996	Version 0.0.1	SMG 1 WPC output draft for editing purposes only
3 February 1997	Version 0.0.3	Presented to SMG1 WPC meeting, London Incorporated changes agreed at Dec 96 Meeting including charging model and charge enquiry
20 April 1997	Version 0.0.4	Presented to SMG1 WPC meeting in Sophia Antipolis Incorporated text submitted at Feb 97 meeting
4 June 1997	Version 1.0.0	Proposed Version 1 incorporating changes discussed at SMG1 WPC meeting in Antwerps, June 97
23 June 1997	Version 1.0.2	Incorporated remaining changes discussed at SMG1 WPC meeting in Antwerps, June 97
27 Nov 1997	Version 1.1.0	Preparation for SMG1 UMTS Helsinki meeting, incorporating text from reports 22.24 and 22.71
4 Dec 1997	Version 1.2.0	Incorporated comments from 22.24, 22.71 developed at SMG1 UMTS Meeting in Helsinki

8 Dec 1997	Version 1.2.2	Format and editorial changes by ETSI Sec for SMG#24
5 November 1998	Version 1.3.0	Incorporate changes discussed at SMG1 Rome, including reflecting changes to 22.01 role model.
12 January 1999	Version 1.3.1	Accept Changes and send to editing SMG1 Rome Tdoc 98-0859 Agreed by correspondence. Reviewed by Rapporteur Jan 13, 1999
27 January 1999	Version 2.0.0	To be presented at SMG#28 for Approval
February 1999	Version 3.0.0	Approved at SMG#28

TR 22.24 V3.1.0 (1999-03)

Technical Report

Universal Mobile Telecommunications System (UMTS); Charging and Accounting Mechanisms (UMTS 22.24 version 3.1.0)

UMTS

Universal Mobile Telecommunications System

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Contents

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Foreword

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

1 Scope

This document outlines the requirements and proposed new mechanisms to be used for billing and charging in UMTS. This document is a basis for discussion during the standardisation work within ETSI SMG for UMTS.

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

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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] ETS 22.01: "Universal Mobile Telecommunications System (UMTS); UMTS Service Principles".

3 Definitions

Charging: A function whereby call information is formatted and transferred in order to make it possible to determine usage for which the subscriber may be billed.

Call Detail Record(CDR): formatted collection of information about a single call or datacommunication session, (e.g. time of call set-up, duration of the call, amount of data transferred, etc) for use in billing and accounting.

Billing: A function whereby CDRs generated by the charging function are transformed into bills requiring payment.

Accounting: The process of apportioning charges between the roles in the UMTS role model.

Settlement: Payment of amounts resulting from the accounting process.

4 Introduction

One of the major differentiators between GSM and UMTS will be the mechanisms used for charging and accounting for services. This report outlines why these mechanisms are required, and how they could work.

5 Background

GSM was designed using many of the principles and systems design from existing fixed networks. This included itemised billing for voice calls, which is implemented by logging one or more CDRs (Call Detail Records) for each individual call made or received. Offline billing systems can then process these records to produce an itemised bill for each customer, applying one of a wide range of specific tariffs. CDRs have been enhanced to contain additional information about the call, such as the location (cell id) of the originator and destination of the call. Ancilliary platforms performing value-added services can also output CDR’s, which can be processed or matched with ordinary CDR’s to charge for value-added services. Immediate post-processing of CDR’s is used to provide near real-time

charging information for services such as subscriptionless pre-paid SIM cards. Offline processing can also be used for fraud analysis and data-mining for churn reduction activities.

The major limitation of this method is that charges are calculated offline, sometimes many days after being incurred. This has led to some concerns about fraud, especially when roaming where the home network has no visibility of the charges being accumulated in the foreign network until some days later. The provision of additional services which can be charged in real-time up to a known credit-limit, or the use of the GSM network to pay for non-communications services, is not yet feasible.

The introduction of packet-based services into GSM, in the form of GPRS, has led to a requirement to bill for factors such as duration of an SVC “Switched Virtual Call”, quantity of data actually transferred, and quality of service actually obtained. The billing for these factors is being added to the standard CDR records, but the potential for very long virtual calls will require some additional safeguards.

6 Requirements

The main new requirements for UMTS charging and accounting mechanisms are:

- to allow on-line control of charges between the Home Environment and Serving Network
- to provide an accounting record for all charges incurred and requiring settlement between the above roles;
- to allow itemised billing for all services invoked.

7 Proposed solution

7.1 Overview

Two independent mechanisms are proposed to fulfil the identified requirements:

- an online cost control mechanism to limit charges incurred for each user;
- an offline accounting mechanism which acts as the basis for inter-role settlement.

It is not proposed to standardise cost control mechanisms between the Home Environment and Serving Network, This is because the Home Environment can deduce from its commercial agreement with the Serving Network what charges will be due to the Serving Network. The Serving Network is free to make whatever interconnections and commercial agreements it chooses with other networks. If intermediate networks are used during a call, it is transparent to the Home Environment which only makes accounting with the Serving Network. Accounting with other networks is done by the Serving Network.

7.2 Online Cost Control Mechanism

Two options are proposed below for the Home Environment to control the charges incurred by the user.

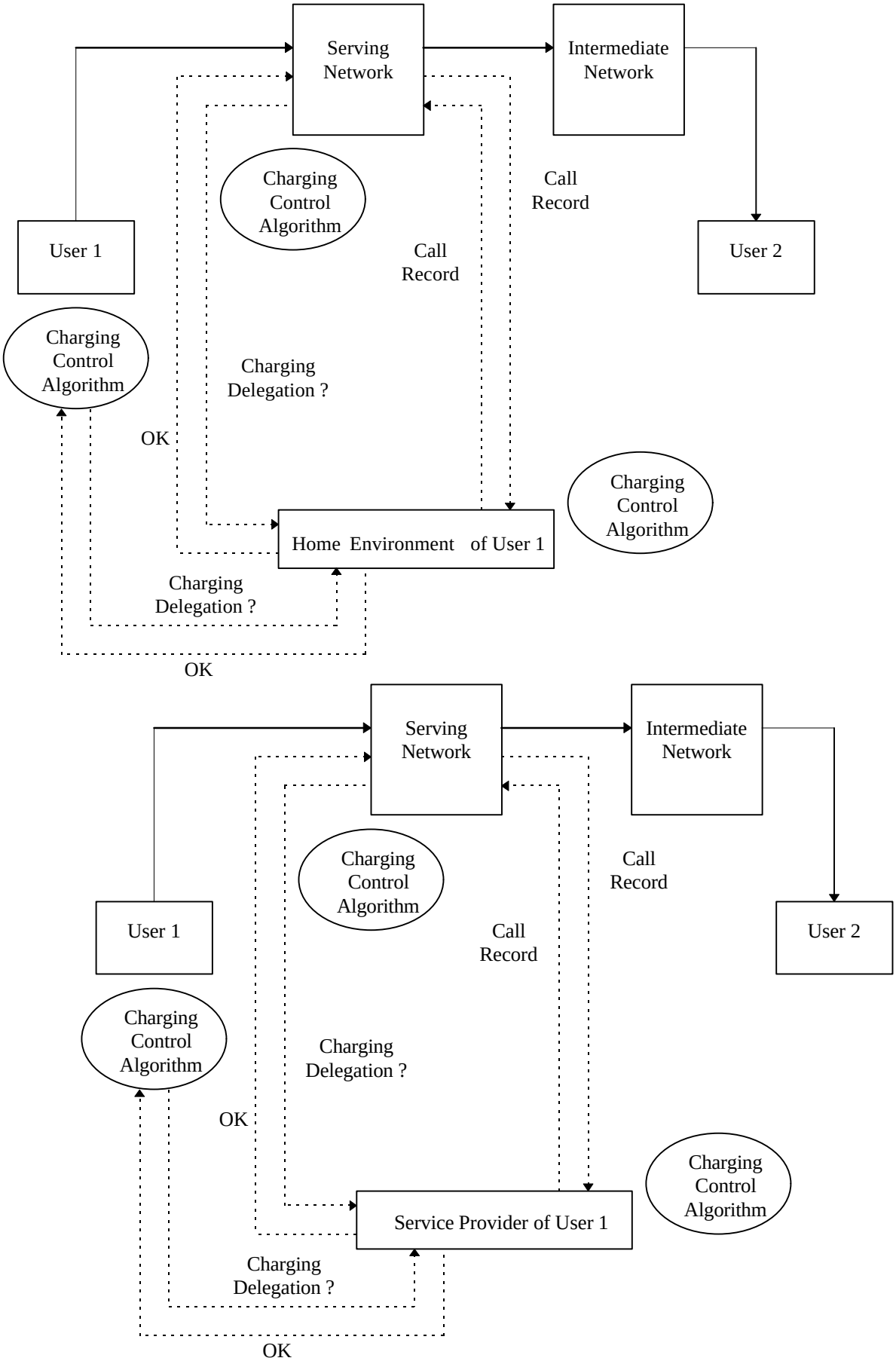


Figure 1: Charging Control Flow for Outgoing Calls

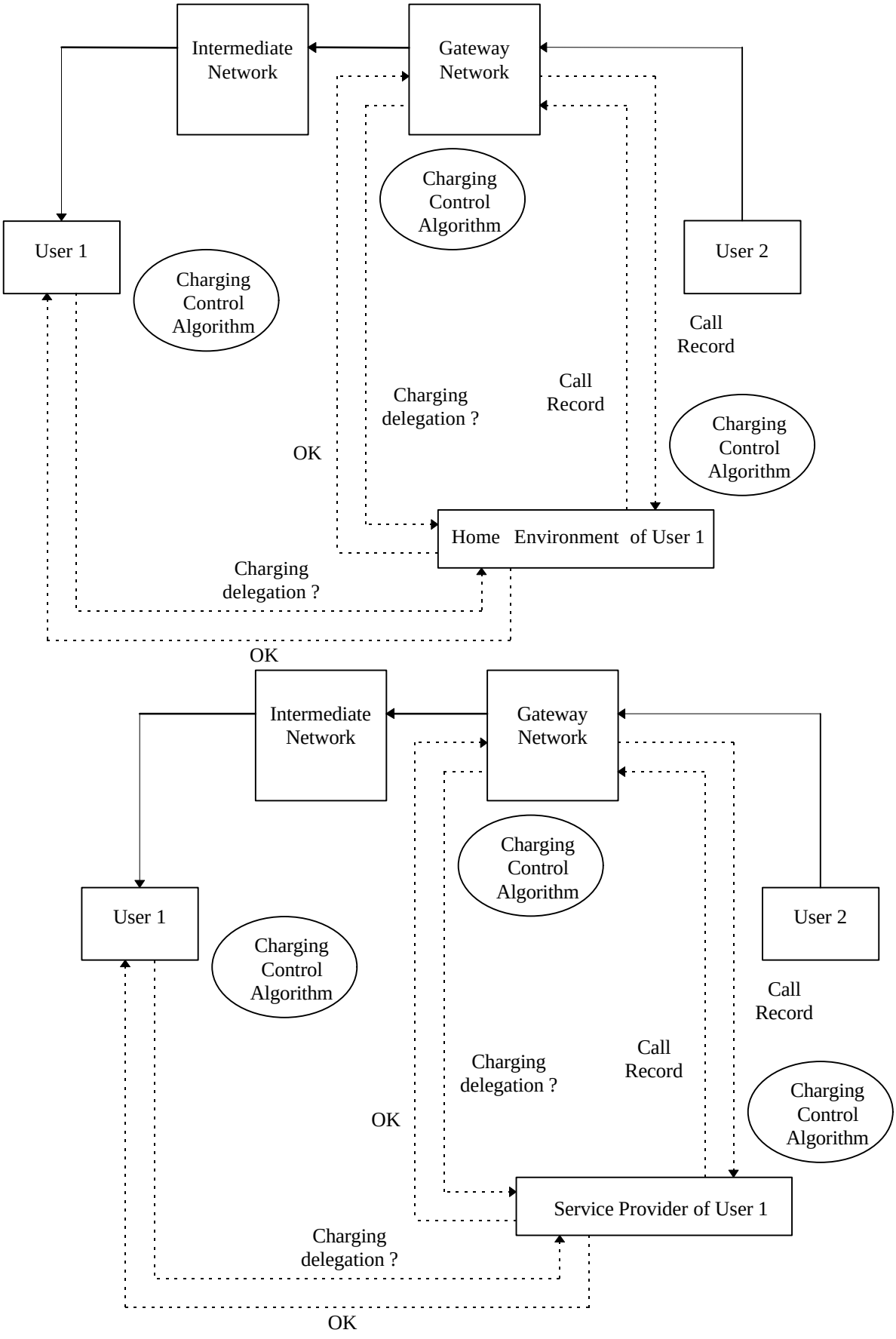


Figure 2: Charging Control Flow for Incoming Calls

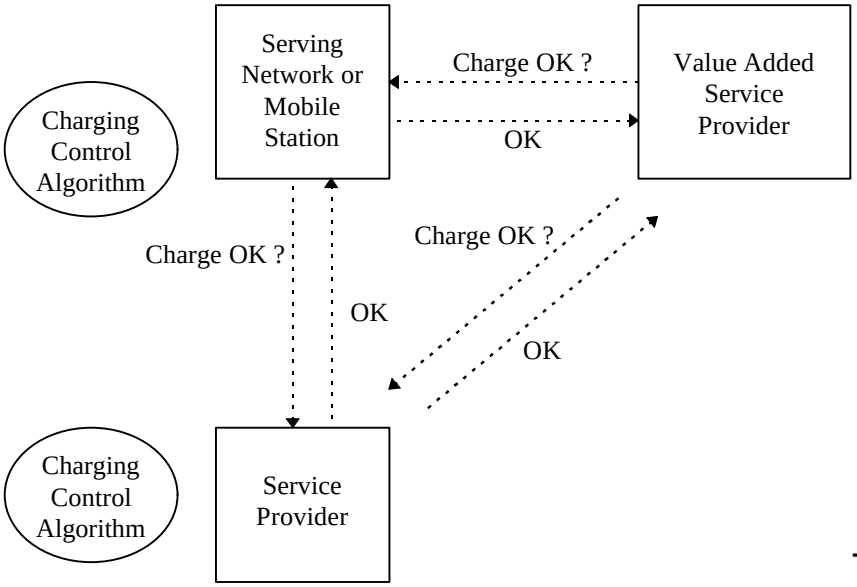
7.2.1 Charging Delegation

The serving network (MO call) or the incoming gateway network (MT call) or the mobile station (both MO and MT) have the necessary capabilities to download a charging control algorithm from the Home Environment. This algorithm is used during the calls to control the user's charges. The Home Environment delegates authority to the serving network/ gateway network/ mobile station to incur charges up to a limit. The period up to the charge limit is called a charging session. Once a charging session is finished, the Home Environment has to authorise a new charging delegation for the next charging session. The system should be designed such that authorisation for new charges is obtained before the expiry of the previous charge limit.

The generation of call records is independent from the duration or cost of charging sessions.

7.2.2 On-line forwarding of call records

The charging algorithm runs in the Home Environment premises. Call records are regularly forwarded on-line to the Home Environment so that call continuation is authorised or not. This could be used by the Home Environment as the fallback mechanism when the charging algorithm cannot be downloaded



7.3 Offline Settlement

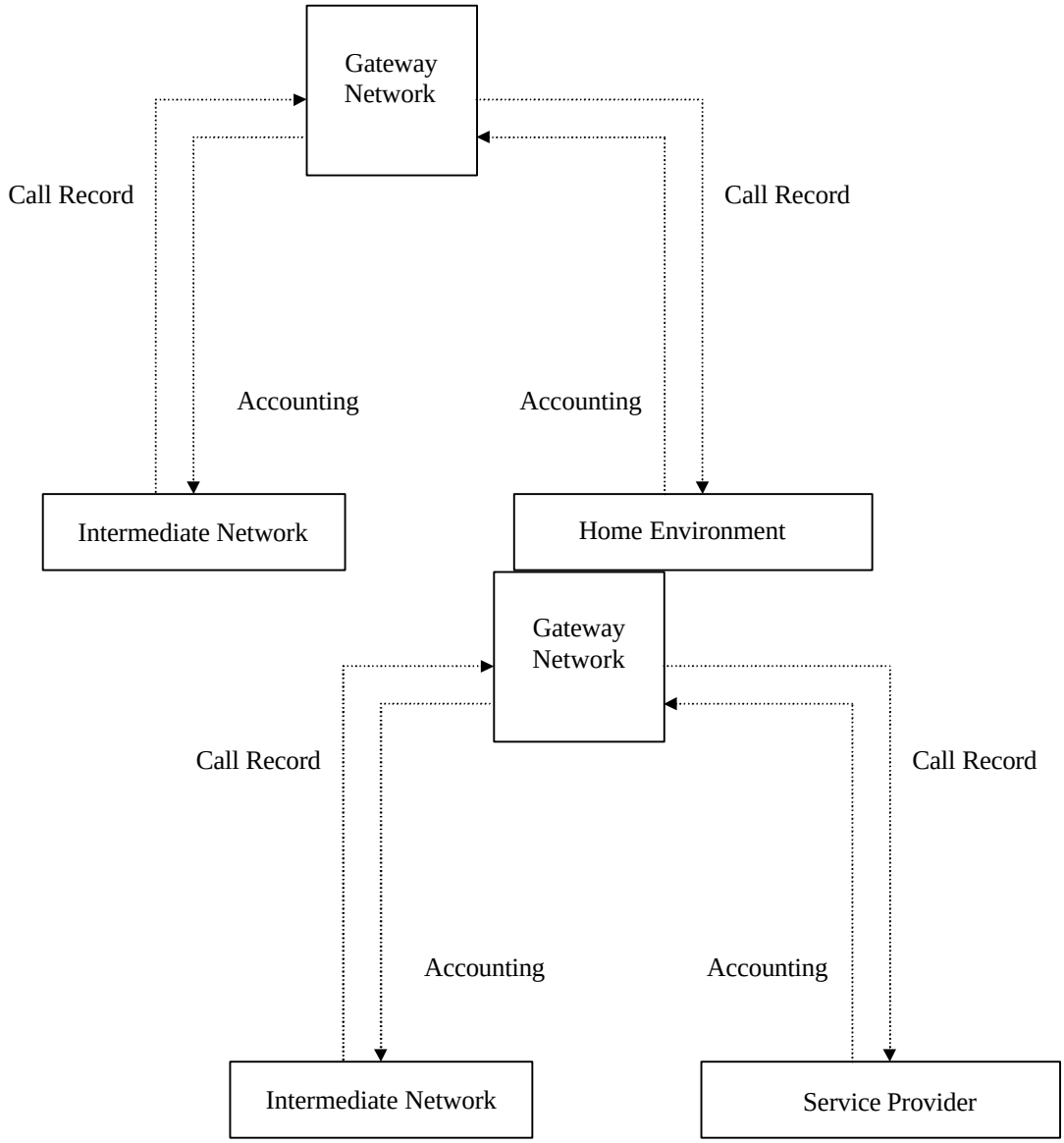


Figure 4: Accounting Data Flow

Off-line, the charging records are sent by the serving/gateway network to the Home Environment. These records must itemise every chargeable event incurred. They are used to calculate the users's bill and provide itemised billing to the user. They also act as the basis for settlement between the Home Environment and Serving Network.

Although this mechanism operates offline, ideally records would be sent electronically within a few minutes of their creation. It is likely that charging records will be processed within a few hours. This would allow the method of cost control using forwarded billing records to be applied.

7.4 Views from perspective of each role

The following subclause reviews the proposed methods of billing and charging from each of roles.

7.4.1 Home Environment

When a user registers on a network, the Home Environment will delegate authority to incur charges up to a set limit on that network. The Home Environmentwill have great flexbility in the method of calculating charges, because its own charging algorithm is used, whether running the the Mobile Station (SIM or ME), serving network or gateway. The serving network will then offer services to the user until that limit is reached, when a request for additional authorisation will be made to the Home Environment to authorise further charges. This allows the Home Environment

to exert control of limits to each user and/or serving network as appropriate, much in the same way as credit card authorisation at point of sale terminals operates today.

Charges which the Home Environment will pay the Serving Network will be based on commercial agreements between the these two roles, and there will not be a standardised procedure for calculating these online.

The Home Environment will receive billing records, usually online, and typically very shortly after they have been generated. These are used to calculate the settlement charges between the Home Environment and Serving Network. They may be passed via a third party (clearing house), which could provide currency conversion and credit control between the Home Environment and different Serving Networks. However, these latter functions are outside the scope of standardisation.

The standardised features of UMTS Charging and Billing will therefore allow the Home Environmentto limit itscredit risk for each individual user , whilst retaining detailed accounting records for inter-role settlement and itemised billing. The latter could be based on an evolution of the current TAP2 format billing records used in GSM today.

7.4.2 Serving Network

The serving network needs to ensure that the users of its network services are authorised to do so, and that it will be paid for the services obtained through it. The concern is therefore primarily between the Home Environment and Serving Network, which is a commercial agreement outside the scope of standardisation. A separate report deals with how the Home Environment and Serving Network can interwork when they have no prior knowledge of each other or commercial agreement in place (see ETSI report "Automatic Negotiaion of Roaming Agreements").

The Serving Network must therefore validate users of his network, and receive authorisation from the Home Environment to incur charges for that user. This may involve downloading a charging algorithm which calculates subscriber charges, and causes a revalidation when the charge limit has been reached.

The Serving Network is responsible for generating on-line charging records and forwarding them to the Home Environment for settlement.

The tariffing method which a Serving Network uses, and the commercial basis on which charges for the services used are levied to the Home Environment are outside the scope of the standard.

7.4.3 User

It is envisaged that the user shall be able to limit the charges (say on a monthly basis), such that specific additional authorisation from the useris required to exceed the limit. The user should be aware that the granularity of the cost control mechanisms proposed for UMTS shall not allow precise real-time status of current charges, but will provide a maximum charge exposure (the sum total of all outstanding charge delegation authorities plus all received charge records) together with a detailed and accurate itemised billing status based on all received charging records to date.

8 Issues

8.1 Long calls

The advent of packet data calls, which can extend for very long periods of time (days, weeks etc), although at low cost because charges are based on data throughput, may mean that billing records are only output at the end of very long periods. This may require call records to be generated mid-call, either when some charge value is reached or some duration or both, to allow for both charging settlement and cost control.

8.2 Multimedia calls

Where calls use bandwidth-on-demand to vary the quality and quantity of data sent during a call, the parameters used to calculate charges become considerable. The downloading of a charging algorithm which can access the relevent

parameters may be implemented. The variable bandwidth etc. makes it difficult to calculate cost, and may result in very large numbers of billing records.

8.3 Low-cost Chargeable Events

Some services offered by networks may be at such a low cost per invocation that they become more expensive to charge and bill for than to provide the service itself. Three solutions are possible:

offer the service for free (or included in the basic subscription). This can lead to significant additional traffic which requires additional infrastructure to support it. Example of this case are SMS in GSM, and Public Internet access through ISPs.

Charge for the service anyway. The high profit margins on the service are seen to justify the limited use. This could be seen as the current market positioning of SMS in some GSM networks today.

Use of a concept of "Postage Stamps", where a pack of electronic low-value units is purchased and used when such services are invoked. This could be done by attaching an electronic stamp to the message when invoking the service, or possibly using an electronic purse in the subscriber's USIM to pay directly at the time of invocation.

9 Conclusion

The proposed control mechanisms allow charging control in all situations (even when the terminal is not involved in the call). Only UMTS equipment shall require the deployment of the new charging mechanisms. Other equipment do not need any upgrade. Intermediate networks have a classical technical and commercial relationship with UMTS network operators.

10 Impact on Standardisation

The following items have been identified as requiring standardisation work to implement the schemes proposed in this report:

A charge control mechanism whereby a standardised form of service logic can be downloaded from the Home Environment to serving network, terminal equipment/USIM. The service logic execution environment (e.g. MExE) shall be standardised to allow the same charge control logic to operate identically in different networks. The charge control logic shall have access to all relevent parameters to allow it to determine charges in real time, including time of day, number dialled, bearer(s) used, data transferred and Quality of Service achieved. A procedure for online authorisation of charges is also required. This feature effectively supercedes the GSM Advice of Charge service, and would apply to both circuit switched and packet data traffic. The GSM Phase 2+ system shall be enhanced to provide support for this charging mechanism.

Accounting records shall be used as the basis of inter-role accounting and offline billing, The GSM billing record format (TAP3 format) shall be enhanced to accommodate charging parameters required for the more flexible data and multimedia traffic. A standardised procedure for transferring call records online between the serving network and the Service Provider is required.

It is therefore proposed that a new work item be started for GSM Phase 2+: "Online Charge Control Mechanism", to handle both GSM and GPRS traffic with a view to meeting the UMTS requirements.

Annex A (informative): Change history

Change history					
SMG No.	**TDoc. No.**	**CR. No.**	**Section affected**	**New version**	**Subject/Comments**
SMG#25				3.0.0	Approved at SMG#25 Version 3.0.0
pre-SMG#28	SMG1 Tdoc 98-0808	A001	Misc	3.1.0	Updated to reflect changes in UMTS Role Model terminology in 22.01
SMG#28				3.1.0	Approved

TR 22.25 V3.1.0 (1998-03)

Technical Report

Universal Mobile Telecommunication System (UMTS); Quality of Service and Network Performance (UMTS 22.25 version 3.1.0)

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Universal Mobile
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ETSI

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Foreword

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

Introduction

The Quality of Service of the Universal Mobile Telecommunications System UMTS is an important factor when introducing the system to the customers. When UMTS is ready to be launched to the mass market, several other mobile telecommunication services exist as an alternative for the general public. A high quality experienced by the user of UMTS is essential in order to promote the idea of UMTS as a global all-purpose communication tool for millions of people with mass produced low price terminal equipment.

A possibility to use multi media services via UMTS in a practical and reliable manner is even more important in the near future than today. There is also a tendency that a larger amount of traffic is taking place between mobile terminals, i.e. traffic within UMTS and between UMTS and other networks. This gives more importance to transcoding and delay quality requirements.

1 Scope

This ETSI TR identifies the parameters and parameter values which are to be used as targets when producing UMTS standards and which are to serve as guidelines to operators and service providers for network design and service provision.

2 Normative 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] ITU-T Recommendation I.350

[2] ITU-T Recommendation E.800

[3] ITU-T Recommendation G.711

[4] ITU-T Recommendation G.721

[5] ITU-T Recommendation T.30

[6] ETSI TS UMTS 22.05: "Universal Mobile Telecommunications System (UMTS); Services and Service Capabilities"

[7] ETSI TR UMTS 22.60: "Universal Mobile Telecommunications System (UMTS); Service aspects; Mobile multimedia services including mobile Intranet and Internet services".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following definitions from the ITU-T Recommendation E.800 apply:

Network performance: The ability of a network or network portion to provide the functions related to communications between users.

Quality of service: The collective effect of service performance which determine the degree of satisfaction of a user of the service.

3.2 Abbreviations

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

BER	Bit error ratio
EFS	Error free seconds
NP	Network Performance
MOS	Mean Opinion Score
PSTN	Public Switched Telephone Network
PDNs	Public Data Networks
QoS	Quality of Service

4 General

Quality of service

Quality of service is defined in ITU-T Recommendation E.800 as the collective effect of service performances which determines the satisfaction of a user of a service. It is characterised by the combined aspects of performance factors applicable to all services, such as:

- service support performance;
- service operability performance;
- service accessibility performance;
- service retainability performance;
- service integrity performance;
- service security performance;

Within this report the aspects of Quality of Service that are covererd are restricted to the identification of parameters that can directly observed and measured at the point at which the service is accessed by the user. Other types of QoS parameters which are subjective in nature, i.e depend upon user actions or subjective opinions are not subject of this report.

Network performance

Network performance is defined in ITU-T Recommendation E.800 as the ability of a network or network portion to provide the functions related to communications between users; it contributes to service accessibility, service retainability and service integrity. Network performance parameter values are usually derived from quality of service parameter values (c.f. for example ITU-T Recommendation I.350).

The QoS and NP parameters identified within this report should be used as targets when producing UMTS standards and should serve as a guideline to service provider and network providers for service provision and network design. Therefore the mentioned parameters reflect the main aspects of the UMTS systems, especially those which distinguish UMTS from other e.g. 2 generation systems. The prameters are only valid for UMTS systems not when roaming in 2 generation systems.

The identified QoS parameters focus on user perceivable effects and therefore give the framework for the network design. The NP parameters describe the performance of a particular connection element, hence they determine the QoS.

4.1 Basic Requirement

From the user perspective UMTS is characterized by the following main aspects;

- Services will be provided by multiple service provider and multiple network provider with different levels of QoS.

- The individual service profile will be agreed between the user and the service provider
- The user has the same service environment idependent from the serving network by support of VHE.
- Service continuity is required on handover when roaming at various geographical areas (UMTS and 2nd generation areas), i.e. the user should be unaware of roaming and/or handover.

These UMTS aspects lead to some general requirements for QoS and NP **parameters**.

- The user should have the possibility to choose the service quality package best suitable for his needs (e.g. lowest bit error rate, highest transmission speed, ...).
- The QoS parameters should be set within the VHE of the customer, when obtaining a service from the service provider. Thus the customer is given choice with regard to service quality and the service provider is able to provide the network operators with the predicted volumes of the different service packages enabling the network operator to dimension his network.
- Negotiating the service quality between the terminal and the network before invoking a service shall be possible. The service quality packages are obtainable from the service provider and are supported through the VHE. E.g., if the customer wishes to pay less for a lower service quality package or more for higher service quality package, this should be possible by selecting such a package from the service provider
- Information of the user about the offered service quality before service execution. If a quality as perceived by the user is expected to degrade e.g. due to the use of an additional service in a multimedia envoronment, the user shall also be informed.

The basic requirement for quality of service parameter **values** over UMTS is that they should be closely comparable to the corresponding values achieved when using the contemporary fixed networks (e.g. PSTN/ISDN/B-ISDN and PDNs) alone.

4.1.1 QoS Parameters

Following parameters describe to above mentioned requirements are: (speed, accuracy, dependability)

time for network access,(time to attach)
The time between the user action in oder to access the network and the positive acknowledgement received by the user. This time period includes all neccessry procedures performed

time to invoke service (Service access, get alerting, ringing indication),

time to change service profile

seamless service retainability when roaming

Time to receive service quality information

4.1.2 NP Parameters

Answer/connect time- when called party accepts the call

Release time

Interruption of services

4.2 Support of Speech Services

A standardised speech codec will be adopted for UMTS. It shall be possible for proprietary speech codecs standardised elsewhere to be deployed as well as the codec standardised for UMTS (Quality at least as good as that provided by fixed networks as defined in G.711). This ETR specifies requirements related to the speech codec to be standardised for UMTS.

4.2.1 QoS Parameters

- subjective quality (Noting age, sex, language, etc..);
- speaker recognition;
- natural speech quality;
- ease of conversation;
- perception of echo;
- interruption of service;

4.2.2 NP Parameters

- loss of interactivity due to delay:
  - two party conversations;
  - delay in the two-way speech path, dual talk;
  - multi-party and multi-speaker;
  - background noise.

4.3 Support of Data Tranmission Services

Some QoS values that the user experiences are dependent on the application used.

The quality of a service the user perceives is influenced by the network as well as by the terminal equipment. As the intelligence and complexity of an application used in UMTS increases, application performance becomes an important factor in determining the quality perceived by the user. Within this report, the identified parameters for data transmission do not include the influence by the terminal equipment and used application.

4.3.1 QoS Parameters

- delay (round trip);
- duration (of data transfer);
- throughput;
- percentage of transmision errors.

4.3.2 NP Parameters

- bit error ratio (BER),
- information transfer rate,
- trnsfer delay,
- dekay variation
- probability of loss

4.4 Support of Messaging Services

A standardised way of supporting messaging services will be defined for UMTS. It is assumed that messaging services can be provided via a store and forward implementation and therefore units which constitute a message can be subject to delays and dealay variations during transmission. Any service center providing store and forward services is considered outside the scope of this report. Quality of Service parameters apply to overall messages. Network performance parameters apply to the underlying transmission.

4.4.1 QoS Parameters

- delivery delay;
- probability of error in the message;
- probability of delivery to a wrong address;
- throughput;
- probability of loss of message.

4.4.2 NP Parameters

- delivery accuracy;

see data transmission service for other parameters

4.5 Support of Facsimile Services

A standardised way of supporting facsimile service will be defined for UMTS e.g. via a store and forward service or via support of ITU-T T.30.

4.5.1 QoS Parameters

- transmission delay;
- throughput;
- resolution.

4.5.2 NP Parameters

- bit error rate;
- lines in error;
- delay variation;
- transmission delay.

4.6 Support of Multimedia Services

4.6.1 QoS Parameters

- synchronisation (skew) between media components (see TR 22.60)

4.6.2 NP Parameters

- see data transmission performance

5 Quality of Service and Network Performance Parameter Values

The parameters and values in the following sections are necessary for the support of UMTS.

Furthermore, for mobile communication systems, network performance parameter values also depend on dependability factors (essentially, availability factors) expressed in terms of time availability (% of the time) and radio coverage availability (% of the radio coverage)

Service-specific quality of service parameters may include, for the telephony service as an example, speech quality, level of background noise, level of echo, delay, etc.. Section 5 provides indicative values calibrating the parameters using the following arguments:

- 95% probability;
- mean;
- target value;
- least acceptable value (LAV).

This forms the basis of candidate material for standardisation, and must be aligned with the work of the ITU-T.

5.1 General

(Applicable to all services)

5.1.1 QoS Parameters Values

Table 1: QoS Parameters Values

User Perspective	**Mean**	**95%**
Time for network access	5 s5 s2 s	10 s10 s
- automatic	5 s	2 s
- manual	2 s	5 s
Time to invoke service		5 s
Time to change Service Profile	100 %	
Time to receive service quality information		
Seamless service retainability when roaming		

5.1.2 NP Parameters Values

Table 2: NP Parameters Values

Answer/connect time - when called party accepts the call	< 100 ms, see Note 1	< 200 ms, see Note 1
Release time	< 100 ms, see Note 1	< 200 ms, see Note 1
Interruption of services	0	0

Probability of	**Probability value**	**Note**
Premature disconnection	0.005	No disconnection desired even if temporary loss of network coverage
NOTE 1: < 0.5 seconds is the target in the satellite environment		

For bearer services in general, issues related to extra delay and loss of data due to handover need to be considered as well as maintaining synchronisation (e.g. between video and speech) in case of multiple simultaneous bearers.

5.2 Support of Speech Services

5.2.1 QoS Parameters Values

Subjective criteria for assessing quality:

- subjective quality (Noting age, sex, language, etc..),

  as in G.711 (objective) and at least as good as G.721

- speaker recognition, as in G.711 (objective) and at least as good as G.721
- natural speech quality, as in G.711 (objective) and at least as good as G.721
- ease of conversation. as in G.711 (objective) and at least as good as G.721
- perception of echo,

5.2.2 NP Parameters Values

This is for the default speech codec to be standardised for UMTS.As a guideline for speech, the break should be less than [40 ms]. Interruption of service (e.g. due to handover) 40 ms (this also applies to GSM/UMTS handover).

Delay (one way end-to-end) 40 ms <to be checked>

Mean Opinion Score as in G.711 (objective) and at least as good as G.721

5.3 Support of Data Tranmission Services

5.3.1 QoS Parameters Values

- delay (round trip) for interactive services < 2 s
- duration (of data transfer), negotiatable
- throughput, negotiatable
- percentage of transmision errors: error free transmission

5.3.2 NP Parameters Values

See TS 22.05 for values of parameters:

- bit error ratio (BER),
- information transfer rate,
- trnsfer delay,
- dekay variation
- probability of loss

5.4 Support of Messaging Services

5.4.1 QoS Parameters Values

- delay negotiatable: 1 s to 12 h (possibly higher)
- probability of error in the message 0
- probability of delivery to a wrong address 10E-6
- probability of loss of message 0

5.4.2 NP Parameters Values

- accuracy of delivery to the right address - > 1 - 10E-6
- throughput, see 22.05

see data transmission service for other parameters

5.5 Support of Facsimile Services

5.5.1 QoS Parameters Values

- transmission delay < 1 minute/page
- resolution negotiatable as defined in ITU-T T.4/T.30
- lines in error < 5%

5.5.2 NP Parameters Values

- delay variation derived from ITU-T T.4/T.30
- transmission delay drived fron ITU-T T.4/T.30

See data transmission network performance for other parameters.

5.6 Support of Multimedia Services

5.6.1 QoS Parameters Values

- synchronisation (skew) of media components < 10 ms

5.6.2 NP Parameters Values

See data transmission performance

Annex A:
General Quality Considerations

Music:

The sound quality of music shall be acceptable and not annoying.

The system shall be capable of performing seamless handover not detectable via the audio path by the user.

Echo: not perceptable

Multiple speakers:

The codec should be able to handle multiple simultaneous speakers in cases like:

- several users at a single terminal
- multiparty call

Background noise:

It is desirable eliminate background noise so that the discontinuous nature of speech can be fully exploited.

Tandeming:

The quality achieved when the UMTS codec is interworking with any other standardised codec (n other UMTS codec, GSM codec or fixed network codec etc.) should be no worse than the quality of the worst of the two codecs.

The codec shall facilitate speaker recognition of different sexes, and not discriminate between languages, ages or ethnic groups.

Graceful degradation in deteriorating radio conditions:

For the UMTS speech codec it is required that it can adapt to provide good quality speech even when radio conditions deteriorate. The codec should adapt to good quality speech even if there is a temporary deterioration of the radio environment. Graceful speech quality quality degradation is required if speech quality degradation is not unavoidable. If the detorioration of the radio environment is more permanent any degradation in speech quality should not be annoying to the user.

Annex B (informative): Change history

Change history					
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SMG#25 Sophia Antipolis	98-067	A001	3.1, 4, 4.1, 4.1.1, 4.3, 5, 5.1.1	3.1.0	Improving readability and adding QoS Parameters

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Universal Mobile Telecommunications System (UMTS); Service aspects; Mobile multimedia services including mobile Intranet and Internet services (UMTS 22.60 version 3.0.0)

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Foreword

This Technical Specification (TS) has been produced by ETSI Special Mobile Group (SMG).

1 Scope

This document discusses the issues related to mobile multimedia in UMTS environment. Specifically the foreseen mobile multimedia applications and their special requirements are referred briefly. The major technical challenges faced in the provision of multimedia services and Internet and Intranet access are discussed and highlighted in order to give guidance for UMTS system standardisation.

This document contains various views into these future topics and cannot be regarded as complete.

2 Definitions and abbreviations

2.1 Definitions

Call : a logical association between several users (this could be connection oriented or connection less).

Connection : is a communication channel between two or more end-points (e.g. terminal, server etc.).

Bearer service: is a type of telecommunication service that provides the capability of transmission of signals between access points.

Multimedia service: Multimedia services are services that handle several types of media. For some services, synchronisation between the media is necessary (e.g. synchronised audio and video). A multimedia service may involve multiple parties, multiple connections, and the addition or deletion of resources and users within a single call.

2.2 Abbreviations

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

GSM	Global System for Mobile Communications
HPS	Handover Path Switching
HRR	Handover Resource Reservation
ISDN	Integrated Services Digital Network
IP	Internet Protocol
ITU	International Telecommunication Union
MHEG	Multimedia and Hypermedia Information Coding Expert Group
MPEG	Moving Pictures Experts Group
QoS	Quality of Service
PSTN	Public Switched Telephone Network
RSVP	Resource ReserVation Protocol
WWW	World Wide Web

3 General

Two major trends that have been seen during the last years are the increased use of both mobile phones and data communications. GSM and other second generation systems have expanded widely and penetration figures have climbed in certain countries up to 30%. Data communications, and specially the use of Internet (since the introduction of world wide web), has attracted a large number of users. Multimedia is a new area of communications and has been growing fast in the computer environments. It is also seen that multimedia will be an important area of telecommunications in the future.

UMTS is a third generation system that tries to merge these two trends, i.e. allow for mobile mass market as well as for optimised mobile data communications. Another additional important objective for UMTS is to provide capabilities for mobile multimedia.

4 Multimedia

Mobile multimedia services are seen to be important when UMTS is introduced and therefore UMTS should enable efficient support for such services. A multimedia service is a service that combines two or more media components within a call. The components can for instance be voice, audio, video, data or pictures. A multimedia service may involve several parties and connections and therefore flexibility is required in order to add and delete components, resources and parties during a call.

In addition to multimedia services UMTS shall also support the simultaneous use of multiple services associated with separate calls. This requires that different calls (these might be multimedia calls with several connections) can be added and dropped independently of each other.

4.1 Applications

Multimedia applications and services can be classified in two categories: interactive services which can be conversational, messaging or retrieval, and distributional services which can be with or without user control.

Most of the future applications containing multimedia information are basically the same as applications available already today. The visual richness of these service is increased by using multimedia instead of single media. The perceived end user quality of these applications will of course be better due to increase in system capacity, as well as developments in source coding and implementation technologies. However, technological development will enable also new types of services to be introduced. Such new components as virtual reality and 3 dimensional (3D) graphics, for example, enable totally new type of applications, e.g., electronic shopping, education, and entertainment. Also research, development and standardisation work is being done in areas of WWW, MPEG-4, ITU-T/SG16 and MHEG based interactive multimedia information retrieval. Passive multimedia application examples of information retrieval are video-on-demand, pay-TV, and audio-on-demand, all being important future applications. Interactive multimedia applications, as for example multimedia conferencing including audio, video and data applications, are also seen to be important.

4.2 Technical challenges

Introduction of mobile multimedia services will set stringent technical challenges for the underlying systems. This chapter reviews the most important of those new challenges; sensitivity of coded video stream, synchronisation of media components and interworking aspects between different networks.

4.2.1 Sensitivity of coded video stream

Compression of information is typically optimised in terms of compression efficiency, coding complexity and quality. As is the case with the highly optimised video coding algorithms targeted for multimedia applications. From the transmission point of view, the most critical side effect is that the error resilience is often sacrificed. As a rule of thumb, it can be said that when the coding algorithm compression ratio increases, the sensitivity for transmission errors increases, i.e., bits inside the compressed multimedia bit stream are very significant and therefore highly sensitive for errors. Transmission errors in video stream can cause loss of synchronisation of hierarchical picture format or false symbol decoding.

Extra difficulty for video transmission is introduced by the picture update schemes used by video codecs. A transmission error in coded video stream is potentially present for long time, due to the idea of sending only the changes in the consecutive pictures (Figure 1). An intra picture is coded independently from previous pictures. Predicted picture, on the other hand, consists of motion vectors and prediction error, therefore representing the changed information of the picture. Potential intra picture update in the video stream removes the artefacts caused by transmission errors. Intra updates on the other hand produce higher amount of information to be transmitted causing refresh rate to slow down momentarily.

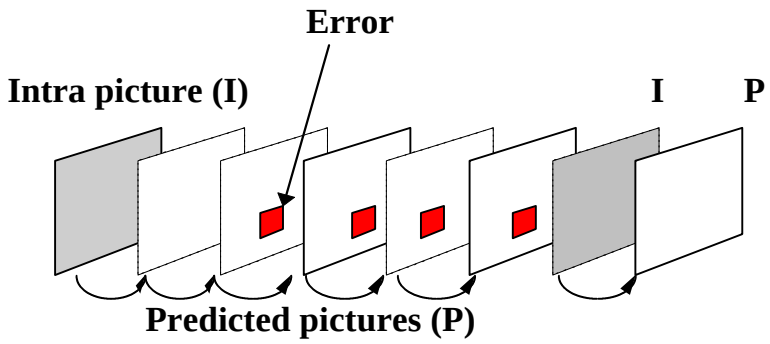

Figure 1: Effect of an transmission error for coded video stream

4.2.2 Synchronisation

In a multimedia system, different media streams have to be synchronised in order to guarantee proper presentation of the information. Synchronisation of media streams means maintaining the temporal relations of involved media. For time-dependent media components, such as speech and video, intramedia synchronisation is essential. Intermedia synchronisation is needed to guarantee the temporal relations between time-dependent and time-independent media components.

Intramedia synchronisation refers to a technique of maintaining the constant delay between consecutive samples of source video or audio from the time of generation to the time of presentation. The timing difference between consecutive data components inside a single media component is called jitter. The involved transmission systems in delivering the information might cause cumulatively jitter to the stream. Jitter is relevant only for time-dependent components, because in time-independent components jitter ceases to exist in buffering phase before presentation. In circuit switched transmission the transmission dependent jitter can be easily managed by having synchronised transmission modes in use. However, in packet switched transmission jitter exist more easily due to the possible packet transmission delay and possible non constant packet switching delay.

Intermedia synchronisation refers to the maintaining of the relative time dependencies between several continuous media streams from the time of generation to the time of presentation. This important multimedia QoS related parameter is the temporal dependence between separate media components, e.g., maintaining the so called lip-synchronisation between a video and an associated audio component is crucial for the quality. A parameter, often called skew, represents the timing difference of the different media components (Figure 2). Basically, the same reasons presented for jitter can also cause skew. Additionally, skew might be a result of different transmission characteristics of the used parallel channels. Straightforward ways to manage skew and to resynchronise media components are by catching up, e.g., by skipping, a delayed component or delaying a fast component. Both of these techniques reduce the resulting QoS.

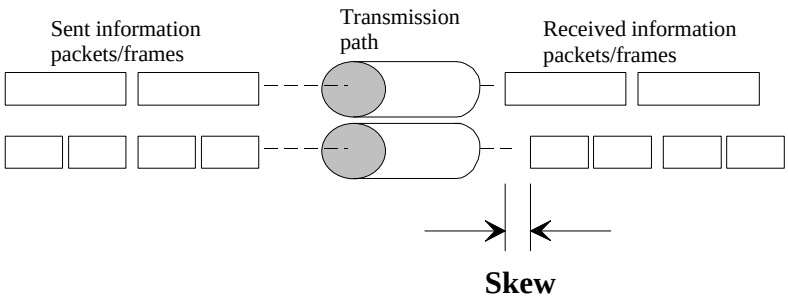

Figure 2: Transmission skew between two media components

Several different synchronisation techniques have been developed for ensuring the proper time alignment between different components. These techniques can be roughly divided into two categories, namely production level and presentation level synchronisation.

- Production level synchronisation is a technique where skew is minimised already on the point of time when the actual information is produced. Interleaving and multiplexing of different media components are possible production level synchronisation schemes. A multiplexed multimedia stream can be transmitted using a single

traffic channel, i.e., there is no need to synchronise separate traffic channels. E.g. ITU H.320/H.324 and MPEG-based techniques use multiplexing synchronisation method.

- Presentation level synchronisation guarantees the minimal skew while presenting the information. For example by recording the generated time difference between transferred components during the transmission phase, the skew can be controlled in the presentation of the information. Alternatively synchronisation can be managed in different phases of transmission and presentation, e.g., by time stamping the streams. This method requires more synchronisation functionality from the underlying system, i.e., to synchronise separate traffic channels used for multimedia components.

4.2.3 Interworking aspects of mobile multimedia

In order to achieve seamless interoperation and communication between different systems, such as mobile systems, Public Switched Telephone Network (PSTN), Integrated Services Digital Network (ISDN), etc., functionality for interworking is needed. In principle, interworking means the conversion from the protocols and formats used in system A to the protocols and formats supported by the system B. Possible interworking functionality causes additional delay to the transmission and drop of QoS provided.

The importance of efficient interworking is highlighted by the fact that multimedia is driven by the development in fixed networks and therefore seamless interworking between wireless and fixed systems is a necessity. Minimised interworking functionality needed is an obvious goal, i.e., wireless multimedia should be supported seamlessly by the future wireless systems. The fact that UMTS and wireless broadband services are not standardised, i.e., provided services are unknown, makes the implementation of interworking more difficult, even impossible in some cases, and therefore telecommunication services provided should be transparent from the interworking point of view.

4.2.4 UMTS Relation to Multimedia source coding

Multimedia services are very diverse and will include very many different codecs and applications. Some services are interactive and require low-delay channels while some others are retrieval services where delay is not critical. Moreover, some multimedia services also usually include a system layer for multiplexing different media types and for controlling the applications. Many multimedia applications emerge from the computer, telecom and Internet industry and it is necessary that the system is able to support such services as efficiently as possible.

In UMTS the multimedia services will use generic bearer services with the required QoS parameter values. This assumes that the system is able to offer bearer services with a wide range of different QoS values (BER, delay). Optimally, the system should provide a way to have multiple QoS values with one bearer service (”QoS on demand”). For the purposes of UMTS there will not be any UMTS specific video/still image codecs specified, moreover the work done by ITU-T SG 16 (H.32x) and ISO/IEC (MPEG) will be closely followed.

5 Internet and Intranet

It is clear that access to Internet is one of the most important usage of UMTS data services. Therefore the UMTS relation to Internet is discussed here. Intranet is considered similar to Internet from the applications and technology point of view, however restricted for a certain group of users.

5.1 Applications

Applications mainly used in Internet are e-mail, WWW-browsing and file transfer. These applications are also important in the future. However it is seen that information in Internet will also be more and more multimedia oriented and new types of application will emerge (interactive, virtual reality, etc.).

Already today multimedia applications are used in Internet. For example Microsoft Netmeeting is a conversational multimedia application that can include voice, text messages (often called chat), shared documents (that can be edited by several parties at the same time) and also video components. Other examples of interactive services in Internet are games as Quake where players from different places in real-time can compete in a 3D-world, and applications like Realplayer by which distributed video and audio from for example TV and radio stations can be viewed and listened to. There are also different real-time conversational services in Internet as telephony and text message/chat applications. Electronic shopping is also becoming popular in Internet. All these applications can be important for UMTS as users

might expect to get the same possibilities wireless as in wired environments. The evolution of Internet and applications will probably be of great importance for which services and applications that will be offered to UMTS users.

Many companies today are using Intranets for spreading of information. The Intranet can comprise all sorts of applications that are available in Internet (e.g. multimedia conferencing, e.-mail, www etc.). One important category of UMTS users are business men. These users will require capabilities comparable to the ones they have in their offices. Therefore it is important that UMTS enables the development of mobile office environments that have the same capabilities as the wired office computer will offer.

The applications provided and used in Internet and Intranet environments will be implemented in servers and service platforms which are separate from the transporting network.

5.2 Technical development foreseen

Internet transmission and presentation technologies, such as TCP/IP and HTTP protocols and Java, have a significant role in transporting multimedia services and applications. The development of Internet protocols to support delivery guarantees and QoS by introduction of Resource Reservation Protocol (RSVP), Real Time Protocol (RTP) and IPv6 will drive real time multimedia applications also to Internet. An important enabling technology area for Internet multimedia will also be packet transmission specific low bit rate video coding and related protocols. It is important that above used protocols can be efficiently supported in UMTS.

Techniques to enable electronic commerce in Internet have also been developed, and will play a significant role as a driver for applications and multimedia content in Internet. Internet security can be treated as end-to-end security and appropriate for many types of usage, e.g., electronic commerce and electronic banking. An example of security in Internet is the SET-technique which can be implemented on IC-cards and is used for end-to-end security. It is expected that SET or some other technique will become widely used in Internet for electronic commerce. Proper interoperation of Internet and UMTS security schemes should be guaranteed.

Mobile Agents are pieces of software that can exchange information with their environment. Some important capabilities of mobile agents are: independence and flexibility (the agent can independently react to changes in the environment), communication (the agent can communicate with users other agents and the environment) mobility (the agent can transport itself between different environments), self activation (the agent can activate itself when changes in the environment occurs), personalisation (the agent can react in different situations according to its state and characteristics). A common way of using agents are for information search. The agent can then compile the information in an intelligent way (e.g. according to the users preferences). Agents are designed to be able to move around in different environments and therefore they can be used in order to make a system less centralised. E.g. instead of downloading a whole lot of files in order to search them through an agent can search them through in their original environment. One problem with agents is security, as agents can be used as computer viruses. In UMTS agents can e.g. be used for decentralised service management (i.e. personalising services and execute the management procedures in terminals).

The computer world currently has many platforms, among them Microsoft Windows, Macintosh, OS/2 and UNIX; some software (e.g. C++) can be compiled by different platform dependent compilers to various multiple platform dependent machine codes. The advantage is that developed software can be reused must not be rewritten for on various platforms but , the drawback is that it must be recompiled (you need to know the destination platform in order to choose the correct compiler)..

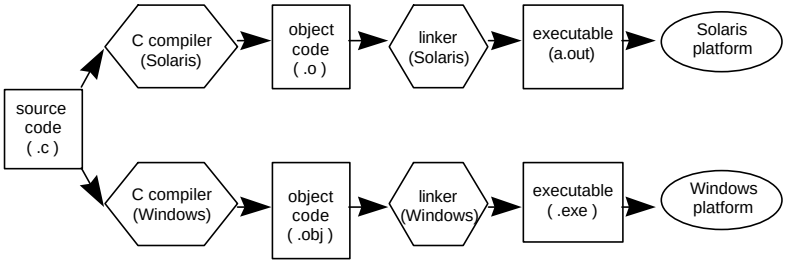

Figure 3:

The benefit of Java is that it can be compiled by different platform dependent compilers to one bytecode, which is platform independent. This intermediate code can be interpreted and executed on every operating system which has an abstract computing machine, called the Java Virtual Machine.

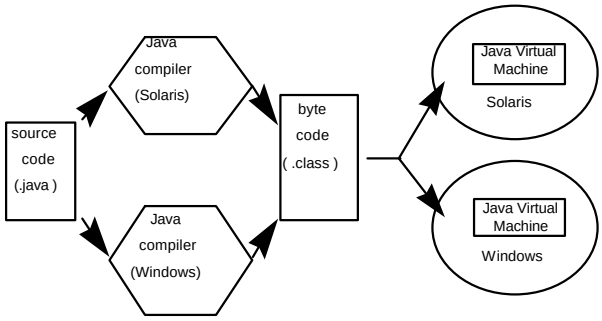

Figure 4:

More than 20 operating systems already support the Java Virtual Machine. Because the programmer (or service provider) doesn't have to worry about the operating system of the customer making, the Java Platform is the ideal platform for delivering and running highly interactive, dynamic, and secure software (called applets) on network devices. In UMTS it should be possible to download software, e.g. JAVA applets to JAVA platforms in terminals. Parameters for the JAVA Virtual Machine need to be standarised.

6 Requirements set for the UMTS

Internet, Intranet and multimedia services will be of great importance for UMTS. Internet services are becoming more and more multimedia influenced. However, Internet services are using packet transmission without guarantee for QoS and the performance of real time services in Internet today varies a lot. For multimedia services it is important that QoS can be guaranteed, and therefore resource reservation and QoS guarantee is important in Internet for high quality multimedia applications. Despite that current standards allow videoconferences in Internet but they are without guaranteed QoS (e.g. the H.323 standard).

6.1 Transport of multimedia

There are different options for how multimedia calls can be transported as is described above in section 4.2.2. Some multimedia applications (e.g. MPEG4, H.320, H.324) multiplex all media components onto a single bearer. However, there are ideas (e.g. in B-ISDN standardisation) for using different bearers for different media components. This has the benefit of using different QoS or bearer service attributes for the different components, which may optimise the use of radio resources.

6.2 A UMTS Service Platform

New multimedia, Internet and Intranet applications and services will be implemented in servers, terminals and service platforms, and will require transparent bittransport in between the terminal and another terminal or a server or a service platform (see figure 5). In order to enable easy and fast creation and adoption of such new services and applications in UMTS an application programmers interface, a service platform, might have to be specified (see I/f figure 5). This interface shall enable the possibilities for control and management of the transparent transportation of services to UMTS terminals and users via UMTS bearer services.

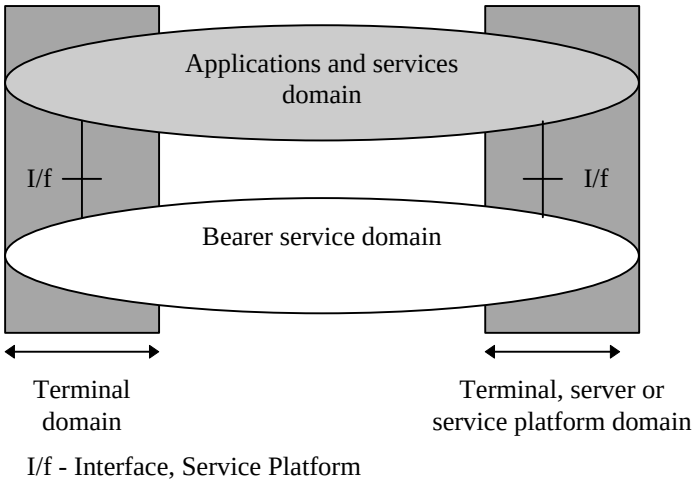

Figure 5. The separation applications and services from the bearer services

The service platform shown in figure 5 shall enable flexible negotiations of bearer services. The negotiation capabilities shall include changes in QoS and Information attributes, adding and dropping of parties involved in a call, adding and dropping of connections (media components) in a multimedia call and possibilities to have multiple calls simultaneously.

When setting up calls for multimedia in UMTS a negotiation about QoS for the call phase has to take place. Requirements and capabilities from applications, codecs, terminals, access networks and other networks for both originating and terminating side has to be considered (compare for retrieval and distributional services). A user may want to establish a communication with certain QoS. If some part cannot fulfil the requirements then the connection may not be established, or a degradation of QoS will occur.

Renegotiations of QoS for calls shall be possible. This can be used to add media components or to set up new calls (i.e. multiple service usage) during a call.

Since the services that will be provided to UMTS users can not be predicted it is of most importance that the UMTS bearer services are specified in a generic fashion. This will make UMTS future proof and will not limit the areas of use for UMTS.

6.3 Download of software

Download of software to terminals in UMTS is important for enabling easy and fast delivery of new services. A lot of possibilities for downloading software exists via Internet. If the existing Internet solutions for software download are considered standardisation work can be minimised. Also download of software or service logic to network components is desirable.

6.5 Internet access

An optimized access to Internet is of importance for UMTS. The most important benefits achieved by the definition of Internet Access would be:

- Optimized transmission of IP traffic over the UMTS radio interface to minimize the amount of information transmitted
- Optimized usage of encryption protocols/algorithms over the UMTS radio interface
- Interoperation of QoS mechanisms used in both, UMTS and in Internet
- Provision of IP addresses for the UMTS users using Internet applications and accessing Internet

For the purposes of optimized access to Internet one or more of the generic UMTS bearers will be used. On top of the bearer a UMTS protocol profile can be defined. This profile could be based on the work done by IETF or other relevant fora, and will consist of a recommended set of protocols and parameters to be used in UMTS. In the case of Internet

traffic it would be possible for the user to select the encryption to be used (e.g. no encryption, end-to-end encryption, encryption over UMTS radio, etc.). The QoS mechanisms defined for UMTS packet access mode shall be harmonized with those defined for Internet (e.g. RSVP, RTP). UMTS users should have IP addresses enabling the usage of IP applications.

6.5 Handover

Handover is the function that hands over the communication path. It comprises two different functions: handover resource reservation (HRR) and handover path switching (HPS). The HRR reserves and activates the new radio and wireline resources that are required for handover. After this is done the HPS will perform the switching from the old to the new communication path, including the intermediate path combinations required.

For multimedia services in UMTS handover might raise additional requirements compared to handover for speech in for example GSM. Different multimedia services raises different requirements for bitrate, bit error rate, delay etc. on the bearer services they use. Therefore the HRR has to consider the specific communication path it is going to handover and reserve resources according to the requirements on it. A user may allow degradation of QoS to a certain degree when handover is executed if resources are not available in the new cell. E.g. a multimedia call including audio, data and video components might after handover only consist of audio- and data components due to scarce resources in the new cell, or a 500 kbps call might be reduced to a 200 kbps connection after handover (there are a lot of similar scenarios that can occur for handover of multimedia services). Some kind of call admission control function for allowing new connections in a cell is might be useful. One possibility is to consider resource conditions in neighbouring cells and probabilities for handovers between cells when allowing call set-ups.

For the case when multimedia services are handed over from UMTS to GSM QoS will most probably drop.

Changes in QoS during calls require adaptable applications and codecs in terminals and bridges.

It is also important to consider different scenarios for buffering for packet based services (e.g. Internet) in order not to lose packets. Packets may be buffered and redirected when handover occurs. Another solution may be that packets are sent to both the new and the old address during handover. The protocol Mobile IP forwards packets from the old address to the new address after handover and the mobile terminal updates the originators with the new address. The originators then sends the packets directly to the new address.

7 Impact on standardisation

This chapter describes the impact of multimedia, Internet and intranet services have on standardisation.

7.1 Control of bearer services and calls

The following has to be supported in UMTS standardisation:

Generic bearer services for transport of multimedia, Internet and intranet applications.

Set-up and release of calls.

Negotiation of bearer service attributes (QoS) both at call set-up and renegotiations during calls.

Resource reservations and guarantee of QoS.

Adding and dropping of parties during a call.

Multiple calls with different QoS.

[Not agreed if ”Set-up and release of bearer services within a call” shall be supported or not.]

7.2 Download of software

Support of download of software and service logic to terminals and networks. Existing techniques might be used, e.g. from Internet.

7.3 Handover

Handover of multimedia, Internet and intranet applications shall be supported, though they may result in change of QoS.

7.4 Service platform

A UMTS service platform should enable the use of multimedia, Internet and intranet applications. Parameters for the JAVA Virtual Machine shall be standarised.

7.5 Internet protocols

For optimized Internet access following should be provided in UMTS standards:

- Optimized transmission of IP traffic over the UMTS radio interface to minimize the amount of information transmitted.
- Ability to turn off encryption schemes over the UMTS radio interface.
- Interoperation of QoS mechanisms used in both, UMTS and in Internet.
- Provision of IP addresses for the UMTS users using Internet applications and accessing Internet.

7.6 Charging

UMTS charging for multimedia, Internet and intranet usage should include charging based on amount of traffic, time of usage, type of service etc.

Annex A (informative): Change history

Change history					
SMG No.	**TDoc. No.**	**CR. No.**	**Section affected**	**New version**	**Subject/Comments**

History

Document history		
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0.0.2	July 7th, 1997	New version presented at SMG1 WPC#12, Malmesbury
0.0.3	Sept. 9th, 1997	Presented at SMG1 UMTS, London
0.0.4	Oct. 16th, 1997	New version presented at SMG1 UMTS, Sophia Antipolis
0.1.0	Dec. 2nd, 1997	New version presented at SMG1 UMTS, Helsinki
0.2.0	Dec. 4th, 1997	Changes agreed during Helsinki meeting.
1.0.0	Dec. 9th, 1997	Format and editorial changes by ETSI sec. SMG#24 for information
1.1.0	Feb. 4th, 1998	Changes made as agreed in drafing group during SMG1 UMTS Vienna meeting.
1.2.0	Feb. 5th, 1998	Changes agreed at SMG1 UMTS Vienna meeting.

TR 22.70 V3.0.0 (1998-03)

Technical Report

Universal Mobile Telecommunications System (UMTS); Service aspects; Virtual Home Environment (VHE) (UMTS 22.70 version 3.0.0)

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Universal Mobile Telecommunications System

ETSI

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Contents

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Foreword

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

1 Scope

This document describes the Virtual Home Environment (VHE) concept and its constituent parts. It aims to identify how VHE will be realised.

A concept called Service Environment is introduced to describe how VHE services will be made available on demand to a user travelling with her terminal in any location.

The concept of Virtual Terminal is discussed to describe how VHE can be made available in any terminal.

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] UMTS 22.71: ”Universal Mobile Telecommunications System (UMTS); Automatic Establishment of Roaming Relationships".

[2] UMTS 22.07: "Universal Mobile Telecommunications System (UMTS); UMTS Terminal and Smart Card Concepts".

[3] UMTS 22.05: “Universal Mobile Telecommunications System (UMTS); Services and Service Capabilities.

3 Definitions and abbreviations

3.1 Definitions.

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

Service Profile: (check 22.20, what is user profile)

Service Provider:

Value Added Service Provider: (Check 22.01)

3.2 Abbreviations.

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

VHE Virtual Home Environment

4 Virtual Home Environment concepts and requirements

4.1 The Virtual Home Environment concept.

Virtual Home Environment (VHE) is defined as a system concept for personalised service portability across network boundaries and between terminals.

The concept of the VHE is such that UMTS users are consistently presented with the same personalised features, User Interface capabilities and services in whatever network and whatever terminal, where ever the user may be located. The exact configuration available to the user at any instant will be dependent upon the capabilities of the USIM, Terminal Equipment and Network currently being used or on the subscription restriction (user roaming being restricted). A user with her USIM in another terminal, should receive maximum capability provided depending on the limitation of the terminal. For example if the terminal currently in use does not support a specific service then this will not be available to the user, however the user should be made aware of this in a straightforward manner.

VHE will be created by a combination of capabilities located in the service provider, network operators and terminal equipment. In effect the VHE can be considered as a distributed user profile. The profile outline will be owned by the service provider, at any instant it may be distributed between the Terminal Equipment, USIM, Network Operator and Service Provider. It should not be necessary for any network operator to permanently store any information relating to a Users VHE.

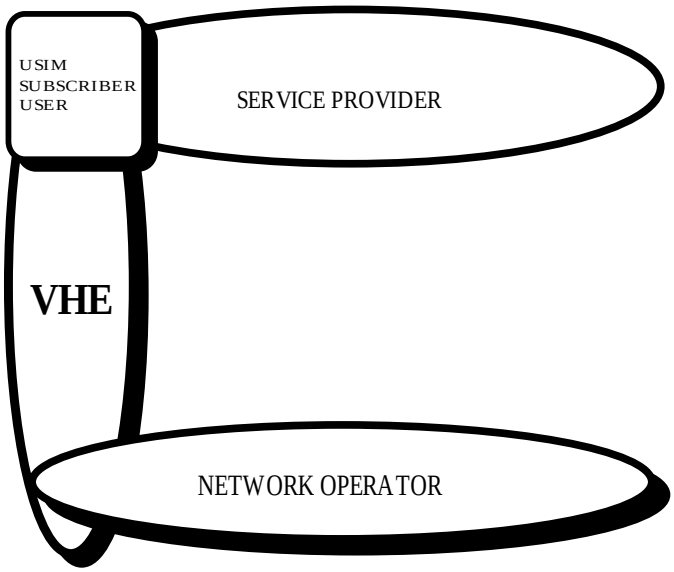

Figure 1: VHE MODEL

Figure 1 shows the Virtual Home Environment model and its components. The roles and component involved in realisation of VHE consist of the following:

- One Service Provider;
- One or more Value Added Service Provider;
- One USIM;

- One IC Card;
- One Subscriber;
- One Subscription;
- One User;
- One or more Terminal (simultaneous activation of terminal providing the same service is not allowed);
- One or more Network Operator.

A UMTS user is associated with one service provider. The Service Provider provide VHE according to the subscription. The Service Provider can utilise a plethora of network operators and terminals to support VHE for the User.

4.2 Multiple VHE

In the situation where there are multiple subscriptions in a terminal, for each active subscription its associated VHE is also active. This requires the standard to support the use of multiple active VHEs on the same terminal.

4.2.1 Terminal view of VHE

The terminal indicates the service profile in VHE mode. It presents the same degree of look and feel depending on the limitation of the serving network and the capabilities of the terminal in use. The VHE terminal representation, either visual or audio, should be intuitive. Any limitations in the terminal for example the class of the terminal will be indicated to the user when terminals change. For instance if a user changes terminal of a different class, for example, from a mobile phone to a PDA terminal, the display (if that is the presentation mode chosen by the user) will be consistent in the use of icons, given the limitation of the terminals screen size. Services that are available/unavailable will be displayed in a way that is familiar to the user no matter what class of terminal is used.

4.2.2 User view of VHE

Individual Users can have a VHE which is based on a subset of the total service. For instance the look and feel may be entirely down to the User. However whilst the User may have a set of services he would expect to be offered these will only be offered if permitted by the Subscriber and Service Provider for example language comparability check.

From the users point of view the use of the network is hidden, however the service behaves in a similar manner irrespective of the serving network (the user is made aware of any limitation).

The user is made aware of the following using the personalised presentation mode chosen (e.g User Interface) and agreed by the network at the time of operation:

- addition and cancellation of service subscription;
- modification of user/subscriber data;
- presentation of error messages and session progress signals in the same language and format;
- presentation of various choices which can be selected in case of quality reduction;
- presentation of the service depending on the destination;
- presentation of charging credit control and security checks;
- modification of environment to use local resource available;
- access to list of services offered by service providers attached to the serving network;
- support of comfort services for disabled people.

4.2.3 Subscriber View of VHE

This could equate to a set of restriction/permissions on the Users of the service (e.g Credit Limits or Call Forwarding Limits). It may also include the method used to provide billing etc.

4.2.4 Network view of VHE

The network should not need to be aware of the VHE. The user/service provider may request transport capabilities in line with the VHE and may (if offered) request services of the network in line with the VHE. It may have to be aware of restrictions placed on the User, for example, call forward limits etc.

The Network Operator need to know:

- how to find the appropriate service provider to bill;
- whom to bill and how, for traffic and signalling;
- how to interpret the QoS negotiation;
- how to interpret the addressing;
- how to interpret the service logic of services demanded;
- how to account for services delivered;
- how to route incoming signals;
- how interpret the User Interface received from the user/subscriber's terminal into session control information or service provider dialogues;
- how to maintain transient data in sync with data held by the service provider;
- translation function to support disabled people e.g text to speech conversion or speech to braille conversion.

The originating network particularly needs to know:

- how to charge for traffic transiting his network;
- how to interwork between networks;
- how to charge for signalling;
- how to route sessions;
- how to route signals;
- how to maintain transient data if necessary.

4.2.5 Service Provider view of the VHE

To the service provider the VHE will appear as a list of capabilities, preferences and settings appropriate to the User and Subscriber. Some of this data must be held by the Service Provider since it is related to subscription capabilities and ultimately charges to the Subscriber. Some of this data could be held by the USIM or terminal.;

A service provider needs to know the following about a user who is located in a network.

- the location of the user and routing of incoming sessions;
- authentication of the user and services in the network;
- how addition, cancellation of service subscription is to be managed;
- how modification of user / subscriber profile is to be managed;

- how accounting for signalling traffic is to be managed;
- how to account for traffic;
- how distribution of user interface logic for new services is to be managed;
- how distribution of service logic for new services is to be managed;
- how remote interpretation of addressing in case of need is to be managed;
- how to allow access to services;
- how to cease subscription to a service when the subscriber departs;
- how service quality packages are negotiated such as throughput and signal level.

4.2.6 Value Added Service Provider view point on VHE.

The value added service provider are typically content provider examples of such services are:

- Video on Demand;
- Language translation;
- Speech to text Translation;
- Text to Braille translation;
- Entertainment information provider.

4.3 Service Profile Hierarchy

The Service Provider is the core of the VHE and provides a set of features/services, some of which can only be changed by the Service Provider. The Subscriber, as the next level is allowed to change her service depending on the limitations of the Service Provider. The User, is limited to the features/services offered by the Subscriber and is therefore not allowed to change any services not permitted by the Subscriber or Service Provider. The level of changes permitted by the User may be limited to the things like "look and feel" of the working environment and personal address book .

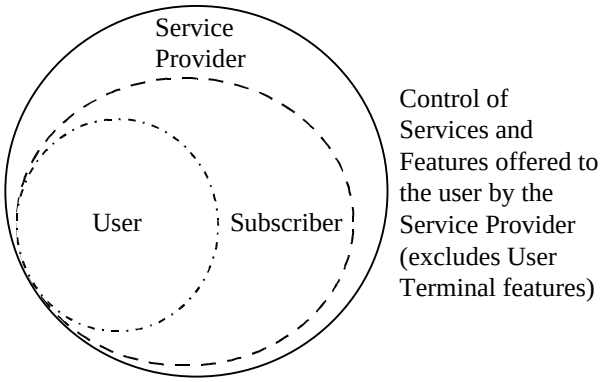

Figure 2: VHE RELATIONSHIPS

Figure 2.shows the hierarchy of service profile management. The Service provider has control over ALL the services on offer. The Subscriber has control over a subset of these services, while the User has the most restricted level of control over services. The types of service the User has control over include such things as the look and feel of the terminal and personal data. It should be noted that the set of services controlled by the Subscriber and User could be coincident.

4.4 Roaming Relationships in VHE.

VHE is primary of importance when user is roaming. UMTS roaming relationship for full service (including VHE) is covered in UMTS 22.71. Commercial relationships will be required between Service Provider and Network Operator either directly or indirectly.

When roaming, a user has the capability of accepting the local environment, this is part of VHE services, provided that this option is part of the service profile agreed with the Service Provider. VHE can be modified but can not be changed without the permission of the Service Provider.

In a situation where for some reason commercial roaming is not established between the Service Providers and a Network Operator full service (including VHE) will not be offered but mandatory basic services i.e. emergency calls will be provided. The user will be notified in an appropriate manner.

4.5 Service Environment.

The service environment describes the scenario where the user is allowed to use all the services he is accustomed to given limitations of the network and terminal.

It will be possible for a user to optionally view and obtain new services that are available in the serving network, these may be services beyond those normally available to the user. The ability to download and use the new service depends on the type of subscription with the Service Provider.

The service capabilities (specified in UMTS 22.05) are the basic building blocks which can be used to build service provider specific supplementary services which are VHE services. These services, are used to complement and personalise the basic telecommunication services (bearer services and teleservices).

The following service capabilities may be required (this list is not exhaustive):

- address translation;
- call origination;
- call control;
- answering calls;
- call termination;
- user to user information.

4.6 Virtual Terminal Environment

The concept of Virtual Terminal describes how VHE is made available in any terminal irrespective of the terminal that was registered as the users terminal.

UMTS terminal does not restrict the functionality of terminals in anyway [see UMTS 22.07]. The standards shall allow terminal specific features and functions to exist. The terminal shall contain mandatory function specified in UMTS 22.07 such as terminal IC card interface, SP and network registration and extra features as specified in UMTS 22.07.

The IC card will interpret the interactions from the User Interface and translates them into the required set of commands to the network operator or service provider. The IC card will also interpret messages and indications from the network as required.

4.6.1 Terminal Classes

A set of terminal classes will be defined according to the types of service capability they support. VHE will allow

a familiar set of services depending of the class of terminal, higher, lower or identical class. Early identification of terminal capabilities is necessary as this will save the network resources in case of incompatible terminals. The user terminal shall identify basic capabilities when attached to the network. Further negotiation of enhanced capabilities and features has to be done according to VHE services (basic capabilities has been identified in UMTS 22.07). Any limitations will be made known to the user in a straight forward manner.

4.6.2 IC Card Functionality

A USIM application on an IC card in combination with other components such as SP, NO etc (see UMTS 22.07) provides a Virtual Home Environment. It is possible to have more than one USIM application on an IC card hence more than one VHE, on an IC card. IC card functionality is covered in UMTS 22.07.

- Terminal should be able to interrogate USIM to determine which VHE is active.
- Terminal should be able to support activation and deactivation of VHE with appropriate security.

4.7 Service Aspects and Requirements

Services and Service Access are supplied to the user on bearers supplied by the Serving Network Operator. Basic bearer or teleservices are supplied by the Network Operator, with the service provider or providers being responsible for authentication and charging during session establishment..

Routing and addressing of sessions is made using a subset of the complete world-wide addressing space. The type of address used may belong to a number of address domains (e.g E.164, E.191 or IP Address)

Value added services are made available by selected value added service providers on the basis of known or predictable costs.

A process of negotiation of QoS will take place between the network and the user regarding the service capabilities necessary for service and the capabilities available in the network. This process of negotiation may need to be standardised in all networks.

If implemented in this way a separation of Service Logic and Invocation Logic may take place in the terminal with the connection being made by encrypted logic on the USIM.

5 Recommendations for realisation of VHE Concept.

The following clause outlines different mechanisms that could be adapted for the realisation of Virtual Home Environment.

5.1 Service Emulation

Service Emulation:- for the support of VHE, can be realised by the transfer of service related data/software or the necessary parameters from the Service Provider to the serving network and/or the terminal/USIM. This maybe be achieved by downloading of service logic, Java Applets, Agents, usage of an evolved SIM Toolkit, usage of an evolved MEXE approach etc. This are useful for audio/video codec download, UI/MMI upgrade/adoption.

Requirements:

- Secure and standardised mechanism for transport of software parameters.
- Secure and standardised execution environment for USIM, Terminal and Network.
- Standardised API for service execution environment.
- Certification of software.
- Unique identification of services/software.

5.2 Remote Service Execution

Remote Service Execution gives the user the possibility to use VHE services although the serving network might not be able to support the desired service or the storage and execution of the appropriate software/data. Possible solutions are evolved CAMEL approach, and Client-Server approach.

The serving network may or may not execute the Service Provider's comment.

Requirements:

- Standardised API in the network.
- Transparent Signalling to the Service Provider.

6.0 Standardisation

The following standards are needed to realise VHE:

- Standardised execution environment for terminal, IC card and Network
- Standardised APIs.
- Network Architecture. The following interfaces are required for standardisation, for downloading VHE profile:
  - Service Provider/Network Operator for service emulation.
  - Service Provider/Network Operator for remote service execution.
  - Network/Mobile Terminal Interface.
  - Service Provider/Mobile Terminal Interface.
  - Service Provider/USIM Interface.
  - Mobile Terminal/USIM interface.

Annex A (informative): Change history

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UMTS 22.71 V3.1.0 (1999-03)

Technical Report

Universal Mobile Telecommunications System (UMTS); Service aspects; Automatic Establishment of Roaming Relationships Version Approved by SMG#28 (UMTS 22.71 version 3.1.0)

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Foreword

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Version 3.x.y

where:

3 UMTS SMG approved

y the third digit is incremented when editorial only changes have been incorporated in the specification;

x the second digit is incremented for all other types of changes, i.e. technical enhancements, corrections, updates, etc.

Introduction

The global success of GSM has resulted in a multitude of cellular networks which can interwork. One of the problems of this success is that the mechanisms used to setup and manage the interworking arrangements cannot handle this success in a cost-effective manner. This report discusses the limitations of the current methods, and outlines a proposed solution to meet these needs in UMTS, where many more parties are required to interwork on a commercial basis.

1 Scope

This document outlines a proposed framework for commercial and technical interworking between UMTS Home Environments and Serving Networks who have no direct prior commercial agreements with each other.
This document is applicable to UMTS standardisation within ETSI, and is produced with the intent to clarify the concepts involved, and identify those areas which require standardisation.

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

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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] TS 22.01 (V2.0 onwards): “Universal Mobile Telecommunications System (UMTS); UMTS Service Principles”.

3 Automatic Establishment of Roaming Agreements

3.1 Current GSM Interworking

When two GSM networks wish to interwork, they setup a roaming agreement which is based on the standard GSM MoU agreement. This involves opening a signalling connection for C7 MAP messages between the networks, and a commercial settlement procedure to exchange billing records and net charges within set timeframes. A standard set of tests has been written by MoU committees SERG and TADIG to check the functions of basic operation and billing record formats.
Typically this procedure takes 2-4 weeks to setup, test and put online. Additional technical problems for some networks include:

- access to a C7 SCCP signalling link - where these are unavailable, X.25 links have been used;
- conversion between ANSI SS7 and ITU-T C7 message formats - a conversion box is required for these links;
- handling billing records in many different currencies and formats - a small number of clearing houses are able to process and pass on billing records between networks, settling net charges in one currency.

When GSM MoU was first setup, it was envisaged that all networks would interwork with each other, much as fixed network PTT’s do at present. However, large networks are finding that with coverage provided by competing networks in many countries there is little additional to be gained by setting up further roaming agreements in those countries. There is also concern at possible commercial exposure when interworking with these smaller, newer operators. On the other hand, smaller networks have much to gain by interworking with larger operators, but don’t have the resource to fund setting up many agreements.

3.2 New GSM Developments

Recently, an International Roaming Platform has been developed which solves many of these problems. The platform is connected to networks for both online signalling and offline billing processing. Signalling messages are routed

transparently to the appropriate network without modification, whilst billing records are processed and reformatted offline. Networks wishing to setup roaming agreements, need only setup and test a single link to be able to interwork with most of the other networks. This functions in a similar manner to credit card transactions and clearing through VISA or MasterCard, where any bank in any country can automatically deal with any other through a central system.

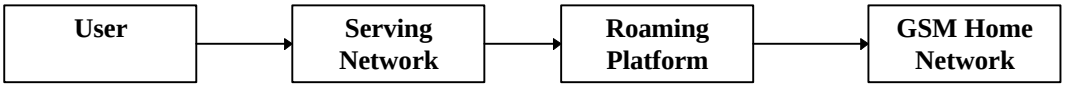
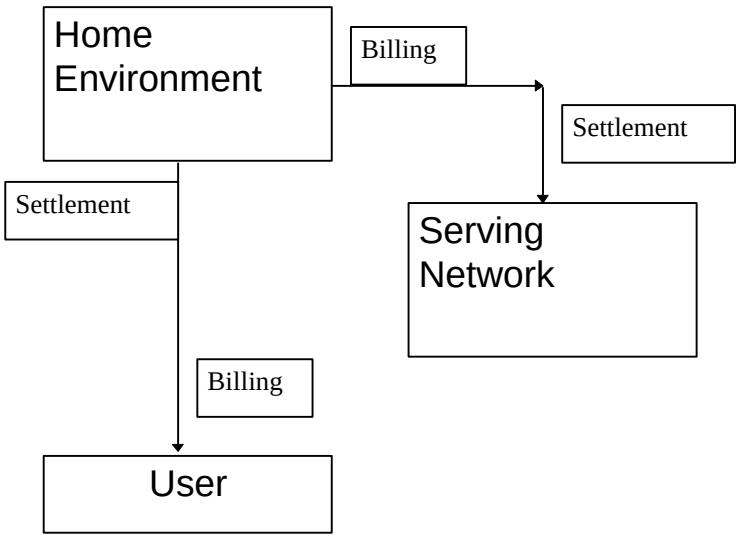


Figure 1 - Registration/Signalling Flow through Roaming Platform

Limitations of the scheme remaining include offline processing of billing records, which do not allow online credit control of charges being raised by any network. Currently, billing records which are not forwarded within a set timeframe do not require to be honoured by the recipient network, however this rarely occurs. It is therefore not possible to limit the charges incurred by any network in a real-time method.

3.3 UMTS Requirements

The basic requirements for commercial interv[illegible]billing[illegible]UMTS framework are best described in the context of the Role Model in 22.01 (UMTS Service Principles).



- Each of the roles in the role model must be able to setup a commercial agreement with any other party and obtain chargeable services up to the limit of his credit. This includes not only relationships between different roles such as user and home environment, but also between role peers such as between different serving network. Such agreements should be capable of being setup online, between parties which have not interworked before.

- There must not be any substantial overhead for any role to commercially interwork with any new role.

- There must be real-time credit control for the net charges incurred by any role.

- There must be good security to allow each role to authenticate each other prior to incurring charges.
- Serving Networks and Home Environments shall have the capability to block or veto particular roaming agreements.

3.4 Proposed System Solution For UMTS Interworking

The proposed scheme to meet the desired UMTS interworking requirements between these roles is an extension of the principles used in the Interworking Roaming Platform. Each Home Environment would interwork with one or more serving networks, with whom they would negotiate a commercial roaming agreement and test the interworking. Any user wishing to use the services of a particular network would register with that network, who would either directly or indirectly interwork with the Home Environment. Real-time online billing mechanisms would be used to ensure that charges incurred for UMTS services do not exceed the credit limits set.

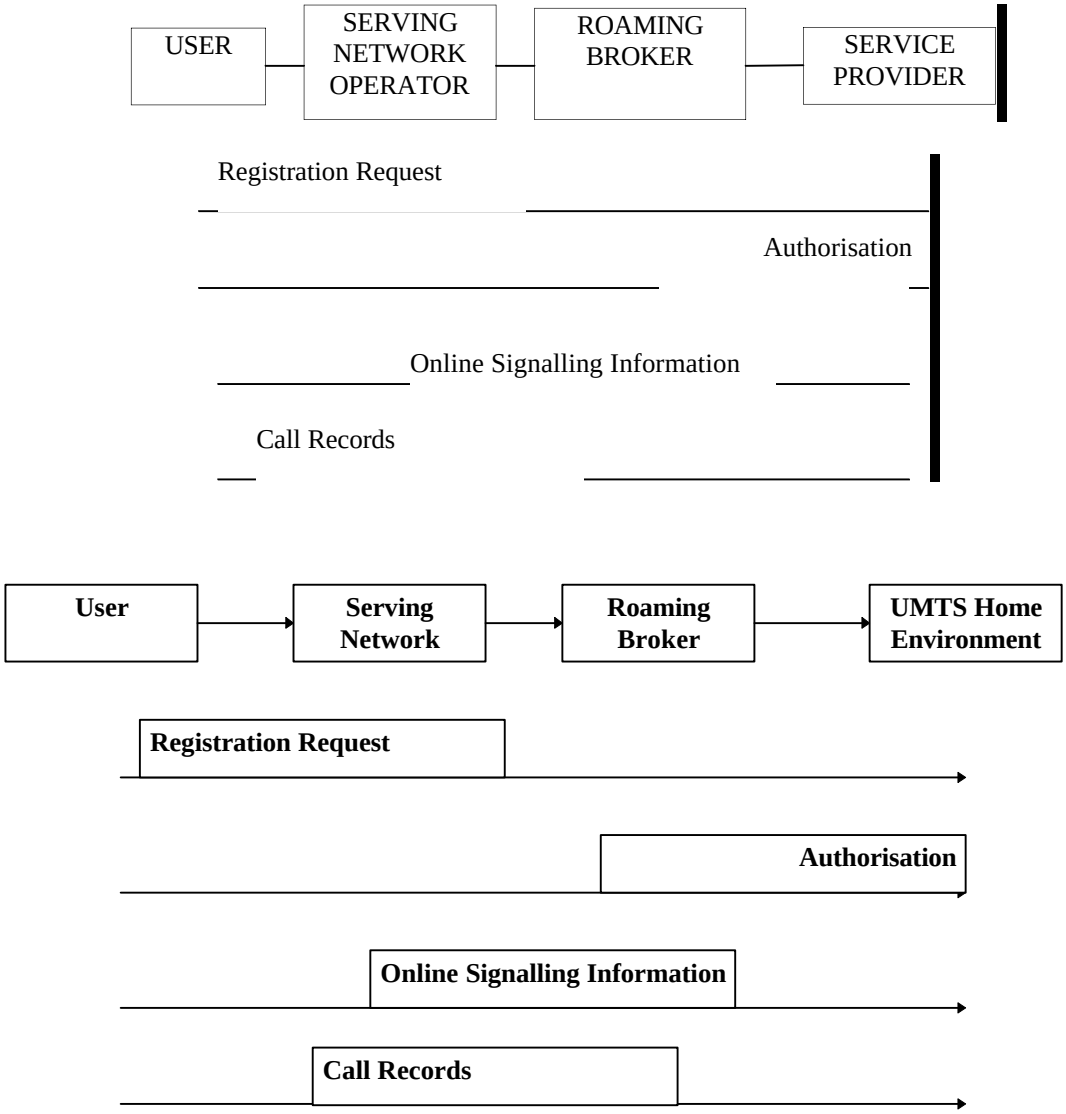


Figure 2 : Registration and Roaming Process

It is possible in some cases a chain of Roaming Brokers is involved in this process.
There are two key aspects which need to be dealt with to allow such a system to be deployed:

- How does the serving network know how to route the registration request?
- How does each party in the transaction charge for their services?

3.4.1 Routing the Registration Request

Clearly, some form of routing identification will be required to allow a serving network, which does not maintain its own list of all known Home Environments, to determine the appropriate route to reach a Home Environment. A number of alternative routes may be possible, and ideally the system should be capable of determining the lowest cost to the end user.
This will be an extension of the addressing scheme discussed in a separate report. The requirement is to allow each entity to determine an efficient route back to the Home Environment, probably based on the USIM number, through a C7 STP global title lookup or Internet DNS addressing request. Typically, smaller networks will only have a limited number of external connections to other networks or clearing houses, but may not know which one to use for an unknown (new) Home Environment. In this case, the serving network may make a number of inquiries for each route to determine the lowest cost route to handle the call.

3.4.2 Billing, Charging and Accounting

Billing, Charging and Accounting mechanisms used when roaming are discussed in an associated report 22.24.

4 Summary

"Automatic Negotiation of Roaming Agreements" as required by the GSM MoU can be achieved by routing the interworking traffic through trusted third parties. These can either be dedicated Interworking Roaming Platforms, such as are being developed for GSM today, or through existing network operators who are acting as clearing houses. Online (real-time) charging and billing will allow credit control between each of the parties involved in any transaction, replacing the need to process and handle billing records themselves. Settlement would occur in a wholesale basis between adjacent parties, at the end of agreed periods.

5 Impact on Standardisation

As discussed in this report, automatic establishment of roaming relations is already a reality. There are three components:

- a contractual relationship;
- a signalling interworking (for authentication, incoming call handling etc);
- an accounting and settlement procedure.

These components have been implemented as an International Roaming Platform, so that any network which interworks with the central roaming platform, also interworks with any other network also connected to it. No additional standardisation was required to make this a reality. Similarly, any of today's network operators could provide this functionality without any new standardisation effort.

5.1 Contractual Relationship

This is dealt with outside ETSI standardisation effort (either via GSM MoU or directly between network operators) and is outside the scope of standardsiation work.

5.2 Signalling Interworking

This uses standard GSM MAP signalling messages, and does not require any further additions to facilitate automatic roaming relationships.

5.3 Accounting and Settlement Procedure

This uses the current GSM accounting and settlement procedures, which are standardised by the GSM MoU. No additional/special changes to the standard billing record format (TAP format) is anticipated.

5.4 Conclusion

No special standardisation work is required to facilitate Automatic Establishment of Roaming Relationships because these can be implemented with current standards and procedures as discussed in this report.

Annex A (informative): Change history

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SMG No.	**TDoc. No.**	**CR. No.**	**Section affected**	**New version**	**Subject/Comments**
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SMG#27				3.0.1	Editorial correction. Change word specification to report and IPR clause and Foreword update
Pre-SMG#28	SMG1 Tdoc 98-0809	A001	Misc	3.1.0	Updated to reflect changes to 22.01 role model
SMG#28					Approved

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Foreword

This Technical Report has been produced by the Special Mobile Group (SMG) of the European Telecommunications Standards Institute (ETSI).

This report defines the requirements for numbering and addressing for UMTS.

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where:

- x the first digit:
  - 1 presented to SMG for information;
  - 2 presented to SMG for approval;
  - 3 Indicates UMTS;
- y the third digit is incremented when editorial only changes have been incorporated in the specification;
- z the second digit is incremented for all other types of changes, i.e. technical enhancements, corrections, updates, etc.

Introduction

UMTS is a telecommunications system which allows person to person and machine to machine interactions. Addressing schemes allow users (people or machines) to indicate to the system the target of a particular communications session. Traditionally, this has involved a user dialling a telephone number to indicate the destination of a telephone call.

This report describes the desirable features of the UMTS advanced addressing scheme requirements for numbering and addressing for UMTS , and example directory, application and translation mechanisms which could be used to enhance the service to the customer.

A key requirement is the need for UMTS users to be able to interwork with users on legacy schemes. These would encompass telephony, data and multimedia.

The requirements developed in this report are to be used within ETSI NA2 to develop a proposal for numbering and addressing applying existing schemes or developing new ones. Other ETSI groups will be involved in the development of addressing of applications and network elements.

1 Scope

This document defines the requirements for numbering and addressing for UMTS. This technical report is aimed at generating discussion and should agreed with ETSI WG NA2. The responsibility for developing of Numbering and Addressing schemes for all networks being in ETSI NA2.

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

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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 E.164 (1997): "The International Public Telecommunications Numbering Plan".

[2] ITU-T E.168 (1993): "Application of E.164 Numbering Plan for UPT".

[3] ITU-T E.212 (1993): "Identification Plan for Land Mobile Stations".

[4] ITU-T X.121 (1993): "International numbering plan for public data network".

[5] ITU-T X.400 (1993): "Message handling system and service overview".

[6] ETSI UMTS 22.01 (1997): "Universal Mobile Telecommunications System (UMTS);UMTS Service Principles".

[7] ITU-T E.191 (1996): "B-ISDN Numbering and Addressing".

3 Definitions and Abbreviations

3.1 Definitions

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

Address: A string or combination of decimal digits, symbols, and additional information which identifies the specific termination point(s) of a connection in a public network(s) or, where applicable, in interconnected private network(s).

Addressable: The ability to direct a call towards a user based on this name or number

Domains: (t. b. d.)

IC-Card: A card holding an Integrated Circuit containing subscriber, end user, authentication and/or application data for one or more applications.

Identity: (t. b. d.)

International Mobile User Identifier: The IMUI uniquely identifies a logical user. The IMUI is stored in the USIM and the home environment. Although only one IMUI is associated with a particular (logical) user, a person or entity may have more than one user identity associated with it.

International USIM Identifier: The IUI uniquely identifies a USIM.

Label: A number or name as defined below.

Name: A name is an alpha numeric label used for identification of end users and may be portable.

Network Termination Point: A network termination point is a logical concept which may refer to a person, a persona (e.g. work, home etc.), a piece of equipment (e.g. NTE, phone etc.), an application, or a location. (ITU definition)

Number: A string of decimal digits that uniquely indicates the public network termination point. The number contains the information necessary to route the call to this termination point.

A number can be in a format determined nationally or in an international format. The international format is known as the International Public Telecommunication Number which includes the country code and subsequent digits, but not the international prefix.

USIM: User Service Identity Module is an application residing on the IC-Card used for accessing UMTS services with appropriate security.

NOTE 1: These definitions should be discussed with ETSI NA2

3.2 Abbreviations

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

ASEA	ATM End System Addressing
CC	Country Code
DDI	Direct Dial In
DN	Destination Network
DNS	Directory Name Service
IMSI	International Mobile Station Identifier
IMUI	International Mobile User Identifier
IMUN	International Mobile User Number
IUI	International USIM Identifier
MCC	Mobile Country Code
MGT	Mobile Global Title
MNC	Mobile Network Code
MSIN	Mobile Station Identification Number
NDC	National Destination Code
NMSI	National Mobile Station Identifier
NUI	National User / USIM Identifier
NSAP	Network Service Access Point
PSTN	Public Switched Telephone Network
SN	Subscriber Number
TC	Trunk Code
UMTS	Universal Mobile Telecommunication System
UPT	Universal Personal Telecommunication
USIM	User Service Identity Module
VHE	Virtual Home Environment

4 Background

In any discussion on numbering and addressing there first needs to be a clear understanding of the terminology. It should be noted that assumptions have been made in this report which should be agreed with ETSI NA2. For this report the following understanding is used. The name or number are used to uniquely label the users and addresses are used for routing. The user perspective will be that the number will be the way to reach another user but from the network point of view the number may not be directly used to reach the called user.

Traditionally, parties have been called by means of an E.164 telephone number, by a short number (on a PABX), by an X.121 number on packet data networks or by an X.400 or Internet name for electronic mail. UMTS is intended to be universal, so although it may support all these existing mechanisms, it should also support a more integrated approach, where calls can be set up without having to use all these mechanisms together.

5 Requirements

The following subclauses describes different requirements for UMTS numbering schemes, addressing schemes, and identification schemes:

- The user shall be able to initiate communications with another party using a label to identify that party. This might be a logical label referring to a job function, and advertising response line etc. and would be resolved into a real terminal address by the UMTS system transparently to the user. Labels shall be capable of being stored in an address book which shall be accessible from any terminal that the user is registered on.

- Users also have requirements with regard to addressing for receipt of communications. The user shall be able to have a number of different persona (e.g. business and personal), each of which can be managed independently.

- When receiving communications, the recipient shall perceive the caller's label in the appropriate role. For example, when making a call as chairman of an ETSI committee, then that persona will be presented as the caller ID. When making a personal call, then the underlying persona would be presented.

- Some labelling schemes should be fully independent of the supporting serving network and the home environment, allowing users to transfer this label to another home environment.

- Serving networks need to be able to communicate with, authenticate and commercially deal with the home environment associated with any USIM being registered on their network. This shall require a USIM identity scheme which uniquely identifies each USIM, and a mapping scheme which allows the USIM identity to be used as a identifier with the "owning" home environment.

- Serving networks also require to be able to route efficiently any communication to and from USIMs (or rather the devices on which they are registered). An address scheme is therefore required for operators to access and map any outgoing or incoming communication to USIMs and thus devices on their networks.

- Operators will also require mapping functions at locations where interworking with legacy networks is provided.

- The home environment shall be able to Resolve the ownership of any USIM to his own, or another environment.

- The home environment shall be able to map a range of labels to any of his USIM. This shall include one or more labels of the same type, and one or more labels of different types.

- Name labels shall allow extended character sets.

- Labels may be used to identify groups as well as individual terminals or people.

- Support E.164 Number Portability, either directly or indirectly, in accommodation with fixed network number portability schemes is required.

- The UMTS system shall allow a end to end transparent application addressing of a large variety of different applications and services on a terminal.
- 3rd party services should be reached by a label. Based on the selected charging policy for this services the calling party or/and the home environment of the calling party needs to be uniquely identified.
- The possibility to address a terminal (rather than a subscriber) may be required for some applications and shall be supported.
- Although a called party may be addressable via different means, he should be reachable independent of the medium. This would require a new functionality which can map name (alpha numeric string) / number (digits) for call routing purposes. Networks might only support basic functionality while advanced databases might be offered by 3rd parties.
- Sequential label translation shall be supported.
- In order to permit interworking with legacy networks, address interworking with common legacy network addressing shall be supported. In principle, this shall include interworking with any networking addressing scheme, but the following schemes listed below shall specifically be supported:
  - E.164,
  - E.168,
  - E.212,
  - X.121
  - ASEA
  - Internet

6 Discussion

It is likely that subscriber's telephone numbers will be associated with a subscriber and home environment rather than a network. The subscriber may have the flexibility to keep his name or address when changing the home environment. The possibility to address a terminal (rather than a subscriber) may be required for some applications and should not be excluded.

A called party is typically reachable by several, today incompatible, naming, numbering, and addressing mechanisms, yet a user is a single entity with a single identity. Thus, it should be possible to telephone a user with an e-mail address if the user's telephone number is not known, or to e-mail the user to his telephone number, if the user's e-mail address is unknown. This would appear to require access to a database holding the desired information. It may be possible to map the name or number (Internet name, telephone number, NSAP number) to the called party address the user is at.

Thus although a called party may be addressable via different means, he should be reachable independent of the medium. It is recognised that this would require a new network functionality which can map the address, name (alpha string) / number (digits) and service type for routing purposes. This would add significant complexity which is seen as optional in a network, but which should not be excluded. It is also noted that alpha addressing is popular in some countries (especially in US and Australia for advertising), where the association between the alpha characters and numbers on the standard keypad is exploited. Maybe this should be further evolved.

However, this should not prevent the customer having different roles for different environments - e.g. a personal domestic number and a different business number. At home, the different occupants may have separate numbers, although these may be associated together. Thus a caller might call, indicating the desired individual at that house, while also allowing another to respond to the call if the first is not available. This might be achieved by a mixture of Multiple Subscriber Profile and sub-address (as today) or by a new mechanism.

It is clear that the naming mechanism shall not be restricted to numeric format (as today with * and #), but also it shall support alpha-numeric naming, of adequate maximum length. It would seem desirable to be able to provide a user friendly access so that e.g. the " . @ . " format used for the Internet might be prompted in a user friendly format. This might be used as an alternative to traditional numbers for a variety of naming and numbering applications.

More advanced requirement could logically be extended to cover calls to a car, based on the vehicle registration number (either to the person in that car or to the car management system e.g. to avoid breakdown or to arrange a repair), to a house - based on e.g. post code and house number - (i.e. to call or e-mail that house rather than to use the traditional postal service).

6.1 Interworking with Legacy Schemes

In order to permit interworking with legacy networks, address interworking with common legacy network addressing shall be supported. In principle, this shall include interworking with any networking addressing scheme, but the following schemes listed below shall specifically be supported:

- E.164
- E.168
- E.212
- X.121
- Internet
- ASEA

6.2 Unique Internal Identity of all USIMs

Many of today's networks operate an internal numbering scheme which is invisible to the user. For example, GSM allocates IMSI identity to every SIM card and uses these numbers internally for routing of calls and service requests. [3]

Each UMTS USIM shall be allocated a unique identity which may be used for internal call routing and addressing. An administrative procedure shall ensure that duplicate USIM identities cannot be issued.

6.3 Support of Label Portability

The use of label mapping schemes implicitly allows for label portability (i.e. names or numbers can point to different subscriptions on demand). However, additionally there is a requirement to support the E.164 number portability schemes being developed for both fixed and mobile networks. Therefore, label portability within the geographic domains, restricted to the labelling scheme used, shall be supported as stated in UMTS 22.01 [6].

E.164 Number Portability shall be supported within 3rd generation systems and from a 2nd generation system to a 3rd generation system.

7 Suggestions

This clause lists the standardisation requirements based on the advanced addressing schemes discussed in this report.

7.1 UMTS Numbering Scheme

The E.168 [2] scheme describes different possibilities that shall be used in future UPT environments. It is closely related to the E.164 numbering scheme. A similar approach in terms of numbering principles shall be used for UMTS. Numbers shall be assigned to different domains:

- a home environment domain / serving network domain;
- a local area domain (home related scheme);
- a country or geographical domain (national scheme);
- the international domain (international global scheme).

It shall be possible to support all domains in parallel, i.e. that a country can assign numbers e.g. for national services, local services and networks. Number portability shall be restricted to the assigned domain, i.e. numbers assigned to a local area are portable between home environments in this domain.

7.2 UMTS Identity Scheme

The purpose of an identity scheme is to allow identification of users/subscriptions independent of the numbering or labelling scheme used by the users. The IMUI shall allow the identification of the services provider and shall be used for signalling and routing purposes ,e.g. using a MGT to reach a HLR like database, and need not to be visible for the user/subscriber. A scheme similar to that described in the ITU-T Recommendation E.212 [3] might be suitable for USIM identification.

8. Examples

In the following sections examples of UMTS numbering scenarios and realisations were given.

8.1 Application and Service Addressing

Besides standardised telecommunication services a lot of different specialised applications will be developed which may use non standardised application protocols (e.g. a special unique database application of a company, a application for accessing a voicemail system). To easily support those non standardised applications offered by the Home Environment and Value Added Services (see figure 1), the UMTS system shall allow a end to end transparent application addressing of a large variety of different applications and services on a terminal. Similar mechanisms like the ISDN subaddress or a wide non restricted range of teleservice identifiers might be sufficient.

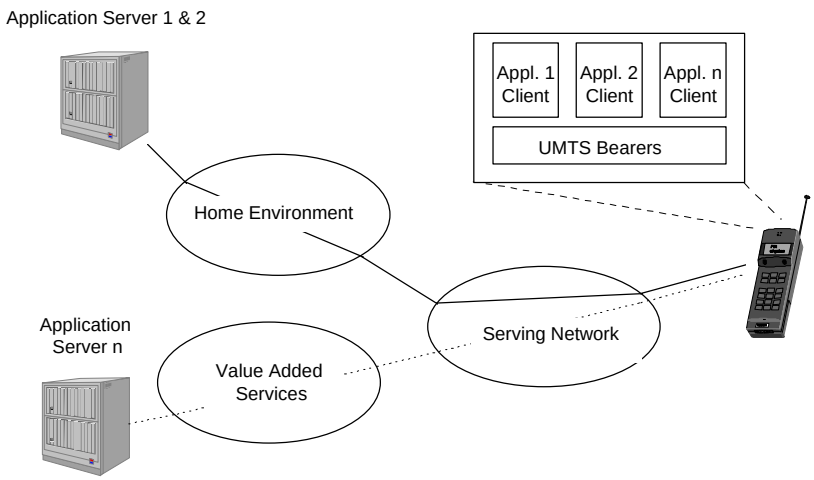


Figure 1: Application and Service Addressing

8.2 Label Translation

User labelling by means of e.g. car registration number, e-mail address or any other future addressing scheme could be offered e.g. by a special address book service / application that will be part of the VHE offered by the home environment and may not need to be standardised. In the following a possible solution is described (see figure 2).

If the user enters a label of a called party or a party he wants to send a message to, a label translation application in the terminal analyses the label and looks for an UMTS routing address that may be stored in the USIM module. This address might be a routing address (e.g. MGT (mobile global title)) toward an HLR like function for UMTS or GSM subscribers or a RN (routing number) for fixed ISDN terminals. This addresses are used inside the terminal / USIM and are not shown to the user. Assuming there is an entry, the terminal initiates a call setup procedure. This implies e.g. sending the HLR address towards the network to start a direct routing number request or sending a direct connect message with a routing number.

If an address is not available, the application contacts a linked label translation service to find the corresponding address via a defined UMTS data channel. The result is transferred to the terminal and it may be stored for future use.

Special databases might be part of 3rd party commercial offerings. Only the basic addressing schemes and mechanisms to store routing numbers or addresses on the USIM have to be standardised.

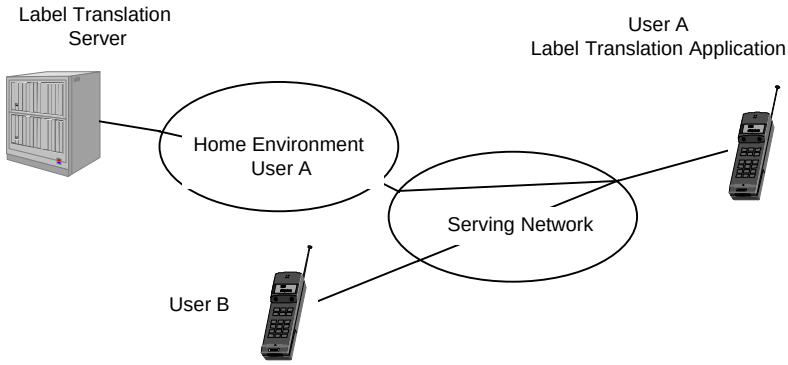


Figure 2: Label Translation Service

With this label translation capabilities, any future possible labelling scheme can be offered to the user and it is up to the home environment to offer it. The service can be speech based, or based on any future labelling scheme. For the final destination addressing a unique UMTS addressing scheme is necessary. This scheme need not to be visible to the user.

Using this kind of addressing even the problems of number portability may be overcome. If the network detects that the address has changed, the label translation application will automatically search for the new UMTS address and add it to the user's personal address book.

8.3 Principle of a Label Translation Database

To fulfil the different requirements a label translation database is required, which can be used for flexible addressing. The following queries to a label translation database shall be possible:

- user initiated (based on an application triggered by the user)
- Network initiated (every time the network faces an unknown label or number for which no further routing can take place)

Furthermore a UMTS user shall have the possibility to access the database for entering label updates for his own identification. The access to the database shall only be possible in secure manner, i.e. the necessary security mechanisms need to be defined to prevent fraudulent use of the access.

Since it is not possible to have just one logical database (even if physically this is possible) which is used for every kind of address translation, the possibility shall exist, that one database can access and address several other databases.

For an example see figure 3.

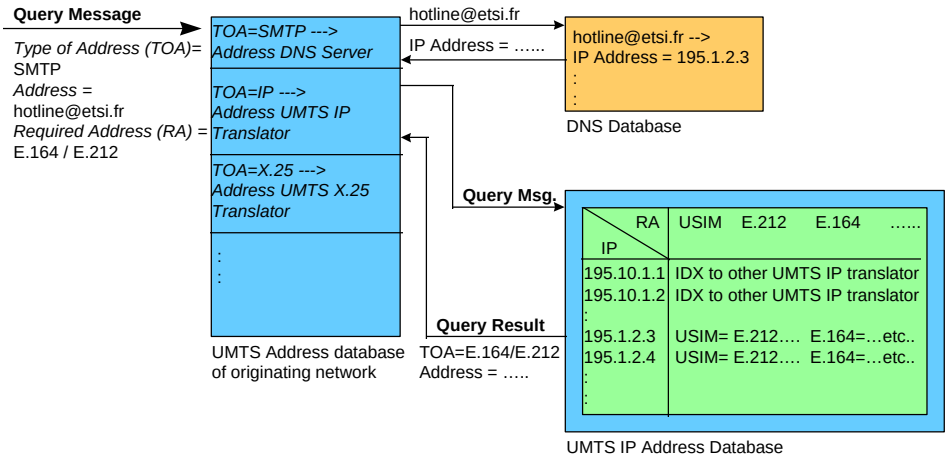


Figure 3: Label Translation Database

To avoid overload of certain label translation servers and to ease maintenance, two different query procedures shall be provided, a recursive procedure and an iteration procedure (see figure 4).

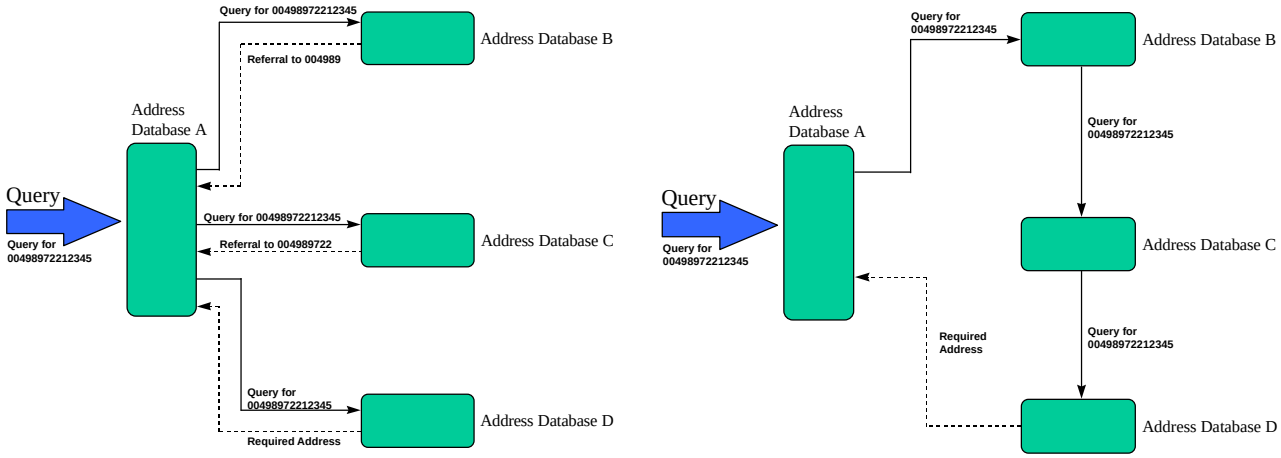


Figure 4: Address Resolution

In the recursion example (left) the label / number database D doesn't respond to the label database the query was coming from but sends the response directly to the database which was initiating the query.

If the database would respond to the database the query was coming from the 'interactive' solution wouldn't avoid signalling traffic but would just distribute it over the whole network.

In the iteration example (right) the query initiating database has to send a temporary ID to database B which forwards it to database C and so on. Database D has to send the temporary ID back to database A. If the ID is known by database A, the response message is accepted.

To speed up label translation caching of already translated addresses in the UMTS CN and/or the USIM/terminal shall be possible. Furthermore the label servers shall have caching capabilities as well. Of course cached data should be refreshed after a certain time of period.

8.4 Interfaces of Label Translation Database

For advanced addressing capabilities a UMTS label translation database is needed. This database shall support queries via the following protocols:

- TCP / UDP (for interface to INTERNET DNS).
- INAP / CAP (for compatibility with PSTN / ISDN / PLMN Number Portability for circuit switched calls).
- SCCP (for compatibility with PSTN / ISDN / PLMN Number Portability for circuit switched and non circuit switched calls).
- Any UMTS specific interface especially designed for the purpose of home environment specific advanced labelling schemes.

8.5 Sequential Address Translation Schemes

The advanced addressing schemes of UMTS shall allow users to originate communications (voice calls, multimedia calls, datagrams etc) by indicating the desired target of the communication with a series of relevant factors. An address resolution process shall map this to a physical address for internal routing purposes. The physical address may not be known to the originator (or the recipient) of the communication, and be used only internally within the UMTS routing architecture. More than one translation function may be used when resolving the final address.

For example:

A user want to call the chairman of an ETSI standards committee. In today's system, this might involve

- determining the telephone number for ETSI secretariat;
- calling the ETSI secretariat and asking who the chair of the committee is;
- asking what his telephone number is;
- calling this telephone number.

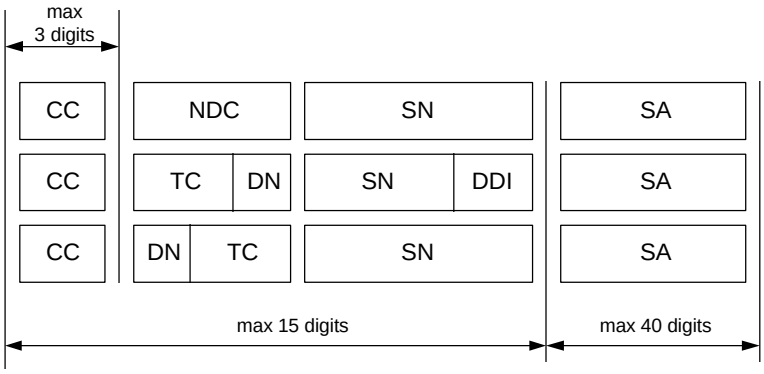
In order to ensure that the current chairman is always called, this process must be repeated in entirety. It may also be difficult to cope with holidays etc, where calls to this person may be diverted to different people depending on the original target/purpose of the enquiry. For example, telephoning a person in his capacity as chairman of ETSI might be diverted to the deputy chairman of the committee, whilst calling him as co-ordinator of a research project might divert to the deputy project manager.

Annex A:
Addressing Schemes

Traditionally users have been called by means of an E.164 telephone number, by short address (on a PABX), by an X.121 address on packet data networks or by an X.400 or Internet address for electronic mail. UMTS is intended to be universal so although it should support all these existing mechanisms, it should support a more integrated approach, were multimedia calls can be set-up without having to use all these mechanisms together.

A.1 E.164 Scheme

The E.164 [1]scheme is the most common one used for numbering and addressing fixed and mobile subscribers and different network elements like a GSM Home Location Register (HLR) in today's telecommunication environment. The number consists of a Country Code (CC), a Network Destination Code (NDC), a Subscriber Number (SN), and optionally a Sub Address (SA). The NDC optionally can be divided in a Trunk Code (TC) and a Destination Network (DN). The total number length shall not exceed 15 digits for the international ISDN number including optional Direct Dial In (DDI) numbers for a PABX (see figure **5**).

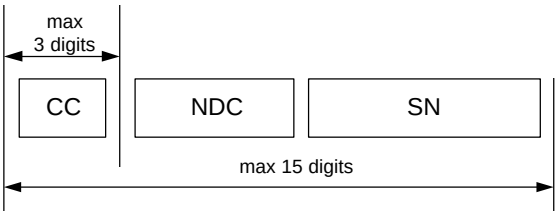


CC Country Code
DDI Direct Dial In
DN Destination Network
NDC National Destination Code
SN Subscriber Number
TC Trunk Code

Figure 5: International ISDN Number (E.164)

A.2 E.168 Scheme

The E.168 [2] scheme describes different possibilities that shall be used in future UPT environments. It is closely related to the E.164 numbering scheme. ITU-T distinguishes between three different schemes that can coexist and are based on the structure shown in figure **6**.



CC Country Code
NDC National Destination Code
SN Subscriber Number

Figure 6: UPT number Structure (E.168)

A.2.1 Home-Related Scheme

In this scheme the address does not contain any indication of the UPT service addressed by this number. The service profile, which contains all information related to the subscriber, is stored in the home domain of the subscriber. A caller could not distinguish if she calls a UPT number, a PSTN number, or an ISDN number.

A.2.2 National Scheme

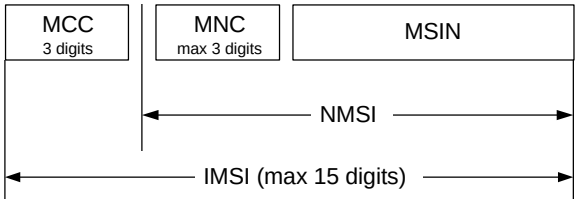
In this scheme, the National Destination Code (NDC) contains a UPT indicator and optionally a home environment indicator followed by the Subscriber Number (SN). A calling party of the same country and the network can recognize the number as a UPT number. This scheme is used in the personal number services with the recommended NDC „700“.

A.2.3 International Global Scheme

In this scheme, a Country Code (CC = „878“) is assigned to UPT numbers as a UPT indicator. With this indicator one gets globally recognisable UPT numbers. The NDC element may contain a CC, in which case there is a national number administration. With no CC in the NDC, the administration of numbers is a global matter.

A.3 E.212 Scheme

The purpose of the Recommendation E.212 [3] is to uniquely identify mobile stations with International Mobile Station Identities (IMSI). This identity is only used for identification and not for routing purposes. It includes a 3 digit Mobile Country Code, a Mobile Network Code (MNC) with 3 digits maximum, and a Mobile Station Identification Number. The complete number shall not exceed 15 digits (see figure **7**).



MCC Mobile Country Code
MNC Mobile Network Code
MSIN Mobile Station Identification Number
NMSI National Mobile Station Identifier
IMSI International Mobile Station Identifier

Figure 7: IMSI Number Format (E.212)

History

Document history		
<Version>	<Date>	<Milestone>
0.0.1	2. June 1997	First Draft
0.1.1	17. October 1997	2nd Draft
0.2.0	3. December 1997	3rd Draft by SMG1 UMTS
1.0.0	9. December 1997	Editorials and format changes for information at SMG#24
2.0.0	6. February 1998	Version for approval at SMG#25
2.1.0	15. May 1998	1st draft revised version after discussion on SMG1 meeting
2.2.0	10. July 1998	2nd draft version
2.3.0	22. September 1998	3rd draft version to be approved by SMG
3.0.0	15.October 1998	*****