Technical Specification Group Services and System Aspects ***TSGS#6(99)508***
Meeting #6, Nice, France, 15-17 December 1999

ETSI Project UMTS http://www.etsi.org/UMTS
4th EP UMTS Meeting
Yarnfield, Staffs., UK
23-26 November 1999

Document **EP UMTS(99)158**

LIAISON STATEMENT

From: **EP UMTS**

To: **3GPP SA1**

Cc: **SA**

Subject: **Response to request for information on Virtual Home Environment (VHE) work on fixed network access**

EP UMTS thanks 3GPP SA1 for providing information on the progress on R99 VHE stage 1 and that you are now looking towards R00 VHE.

ETSI SPAN6 has prepared deliverables on architectures for evolved fixed networks (SPAN-061309) and the support of VHE. In particular, work has been completed on a range of UMTS wired and wireless access for public and private access networks.

ETSI Work Item NA-061309 addresses "***Strategies for the evolution of fixed networks to UMTS"***. The main result is that the original concept of evolution of an ISDN based fixed network to support UMTS will not be progressed any further in the SPAN6 UMTS Task Force. The scenario, which is now envisaged, is to use a high-speed access technology such as xDSL to provide an "always on" high bandwidth access to a packet based (i.e. IP) core network. Mobility may be provided by new IP based functionality, which should support not only IP but also satisfy QoS, charging and mobility functions.

ETSI Work Item SPAN-061305 addresses the "***Virtual Home Environment support in an ISDN evolved UMTS core network"***. The deliverable contains some requirements for the support of VHE in an evolved ISDN core network. Some generic VHE service components are listed and how these map onto VHE architectures is described. Some information flows have been presented based on the direct Home Command scenario in ITU-T IMT-2000 since this approach is aiming at Global VHE.

Enclosures:

1. Draft ETSI EG 201 721 V1.1.1 (1999-11): "UMTS Strategies" – on ETSI Membership Approval Procedure MV 200004: 1999-11-30 to 2000-01-28.

2. ETSI EG 201 717 V1.4.2 (1999-11): "UMTS; Virtual Home Environment (VHE) in the Integrated Services Digital Network (ISDN); Evolved UMTS core network" – published in November 1999.

Draft ETSI EG 201 721 V1.1.1 (1999-11)

ETSI Guide

Universal Mobile Telecommunication Systems (UMTS); Strategies

Reference

DEG/SPAN-061309 (fxo00icq.PDF)

Keywords

ATM, IN, ISDN, PSTN, UMTS

ETSI

Postal address

F-06921 Sophia Antipolis Cedex - FRANCE

Office address

650 Route des Lucioles - Sophia Antipolis
Valbonne - FRANCE
Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16
Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Internet

secretariat@etsi.fr
Individual copies of this ETSI deliverable
can be downloaded from
http://www.etsi.org
If you find errors in the present document, send your
comment to: editor@etsi.fr

Contents

Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (http://www.etsi.org/ipr).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Foreword

This ETSI Guide (EG) has been produced by ETSI Technical Committee Services and Protocols for Advanced Networks (SPAN), and is now submitted for the ETSI standards Membership Approval Procedure.

Introduction

Broadband multimedia services, which can be accessed from fixed and mobile terminals, have considerable market potential. International standards are being developed to provide for such services and several technologies will soon be available. IMT-2 000 and UMTS requirements are the basis of a target network that will enable operators to offer such multimedia services. UMTS, which will be operational in 2002, gives a time frame within which the evolution of fixed networks could occur.

These developments offer opportunities and present challenges for fixed network operators. Systems capable of supporting mobile multimedia services require very large investments. Customers will only invest in expensive terminals if these offer attractive new services of the highest quality and at an acceptable price. Fixed network operators will have to develop and evolve their core and access networks to meet these demands.

The present document provides scenarios for the evolution of fixed networks to UMTS. Several starting points based on PSTN, N-ISDN and B-ISDN networks are being considered to support the different access options available for UMTS. Recognizing the importance of the Internet Protocol (IP) in today's networks, this technology has been included in the evolution strategies outlined in this document.

1 Scope

The scope of the present document is to describe possible strategies for the evolution of fixed networks towards UMTS. The following issues are covered by this document:

- Identification of access scenarios to UMTS.
- Definition of networks/network components that need to be upgraded with UMTS capabilities.
- Interworking with legacy networks / network components.
- Introduction of wireless access networks as specified by 3GPP RAN and EP BRAN and interconnection to the fixed network (e.g. ISDN, PSTN, IP, ATM) evolved to UMTS.
- Introduction of mobility-supporting capabilities in fixed networks to facilitate global roaming within the IMT-2 000 family of third generation systems.

2 References

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

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

[1] EN 301 061-1: "Integrated Services Digital Network (ISDN); Digital Subscriber Signalling System No. one (DSS1) protocol; Generic functional protocol for the support of supplementary services at the "b" service entry point for Virtual Private Network (VPN) applications; Part 1: Protocol specification".

[2] ITU-T Recommendation H.323: "Packet based multimedia communications systems".

[3] ITU-T Recommendation T.120: "Data protocols for multimedia conferencing".

[4] EN 301 005-1: "V interfaces at the digital Service Node (SN); Interfaces at the VB5.1 reference point for the support of broadband or combined narrowband and broadband Access Networks (ANs); Part 1: Interface specification".

[5] EN 301 217-1: "V interfaces at the digital Service Node (SN); Interfaces at the VB5.2 reference point for the support of broadband or combined narrowband and broadband Access Networks (ANs); Part 1: Interface specification".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the following definition applies:

fixed network: network that does not deploy the infrastructure (equipment and protocols) that is required for mobility management. However, a fixed network may provide fixed wireless access to terminals or private networks. A fixed network does not provide support for continuous mobility (i.e. handover)

3.2 Abbreviations

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

3GPP	Third Generation Partership Project
3GPP RAN	Third Generation Partership Project - Radio Access Network
AAL2	ATM Adaptation Layer 2
ABR	Available Bit Rate
ATM	Abstract Test Method
B-ISDN	Broadband-ISDN
BRAN	Broadband Radio Access Networks
BS	Base Station
BSS	Base Station System
CBR	Constant Bit Rate
CN	Core Network
CT2	Cordless Telephone 2nd generation
DECT	Digital Enhanced Cordless Telecommunications
DSS1	Digital Signalling System number one
DSS2	Digital Signalling System number two
FT	Fixed Terminal
GK	Gatekeeper
GSM	Global System for Mobile communications
GW	Gateway
HLR	Home Location Register
VLR	Visitor Location Register
IMT-2 000	International Mobile Telecommunications for year 2000
IN	Intelligent Network
INAP	IN Application Protocol
IP	Internet Protocol
ISDN	Integrated Services Digital Network
ISP	Internet Service Provider
ISUP	ISDN User Part
IWU	InterWorking Unit
LAN	Local Area Network
MT	Mobile Terminal
N-ISDN	Narrowband Integrated Services Digital Network
NNI	Network Node Interface
PDN	Plesiochronous Digital Network
PHS	Portable HandSet
PIG	PSTN/Internet Gateway
POTS	Plain Old Telephone Service
PSTN	Public Switched Telephone Network
Q-SIG	Q Interface SignallinG protocol (ECMA standard)
QoS	Quality of Service
RNC	Radio Network Controller
SCF	Selective Call Forwarding
SDF	Service Data Function
TDD	Time Division Duplex
TIPHON	Telecommunications and Internet ProtocolHarmonization over Network
TUP	Telephone User Part
UBR	Unspecified Bit Rate
UMTS	Universal Mobile Telecommunications System
USIM	UMTS Subscriber Identity Module
VBR	Variable Bit Rate
WATM	Wireless ATM
WWW	World-Wide Web
xDSL	generic Digital Subscriber Line technology

4 Generic requirements

The target system must provide a user access to broadband multimedia services from different access points and while on the move. From these general user requirements, target network requirements can be derived.

The target system resulting from the fixed network evolution shall satisfy the requirements in the following subclauses.

4.1 General requirements for support of mobile multimedia services

This subclause covers requirements related to Internet access and radio & network bearer capabilities. Fixed-evolved UMTS will be required to:

- be compatible with the Internet Protocol;
- provide routeing capability based on IP version 4 and/or IP vervion 6;
- support a wide variety of services, including "push", "pull" and multicast-type services;
- provide packet mode bearers up to 2 Mbps;
- support of global mobility;
- support of terminal mobility, personal mobility and service portability;
- support roaming between UMTS and GSM;
- support global Roaming:
  - UMTS aims to be compatible with IMT-2 000 systems, to provide global terminal mobility (e.g. to provide access to the subscribers of various IMT-2 000 member networks), and to transparently provide all subscribed home services to roaming IMT-2 000 users;
  - UMTS aims to be inter-operable with all IMT-2 000 Family members in order to offer the global roaming capability to its users roaming in other IMT-2 000 networks. Therefore, UMTS standards need to be common to the maximum extent possible with the standards of other IMT-2 000 Family members;
  - the UMTS inter-operability with other IMT-2 000 networks is to be implemented via an inter-working function in the short term leading towards the development of a common NNI in the long-term.

4.2 Intelligent network capabilities

- Support of rapid service creation and introduction;
- Support of Virtual Home Environment (VHE) i.e. operator specific services.

4.3 Quality of Service requirements

- Speech quality comparable to fixed network;
- High quality audio, data, image, and video;
- Selection of QoS classes / parameters required by users' applications;
- QoS indication/negotiation (CBR, VBR, ABR, UBR).

4.4 Features related to security and privacy:

- Protection from impersonation (authentication);
- Protection of user and service profile from malicious attacks;
- Privacy of communications (encryption of user data);
- Location privacy.

4.5 Cost-effective network

- Support of a multivendor environment based on open (standard) interfaces;
- Effective use of transmission facility:
    - ATM technology as one possible candidate:
        - ATM switching system;
        - AAL2 for efficient use of resources for low bandwidth applications;
        - circuit and packet switching capabilities on the same ATM platform.
- Support of a broad range of applications;
- Cellular, Wireless IP, WATM, …;
- IP technology as a further possible candidate.

4.6 Requirements for packet networks

Packet based networks as part of the fixed network evolved UMTS should provide the following capabilities:

- Wide area and large scale;
- Efficient use of radio and network resources;
- Mobile multimedia capabilities:
    - High Speed;
    - Support of point to point, point to multipoint, broadcast connections;
    - Support of QoS.
- To provide IP based applications (e.g. e-mail, WWW, …)
  Support of fixed and / or dynamic IP addresses.

5 Access scenarios to UMTS

Fixed network operators will have a variety of options at their disposal for providing customers access to UMTS services. These options are identified as access scenarios in this clause, and may have different implications on the protocol requirements at the user-network interface.

The basis for the description of these access scenarios is figure 1, which identifies different system / network domains in UMTS.

These scenarios are:

- fixed Terminal Access;
- fixed Access Roaming in Private Networks;
- radio Access Roaming in Private Networks;
- support of Private Access Systems;
- public Cellular Access to the Fixed Network.

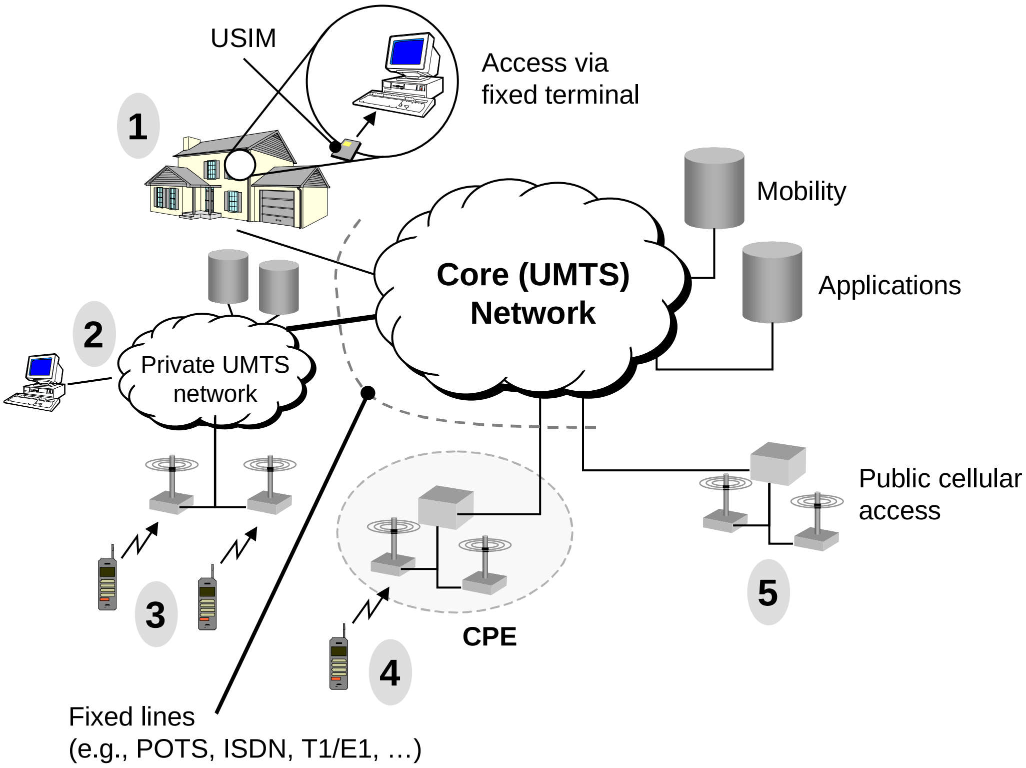


Figure 1: Implementation of the different access scenarios

5.1 Scenario 1 - fixed terminal access

In this scenario, USIM roaming is assumed, i.e. the only type of mobility supported is personal mobility. This scenario can be accomplished by providing a wired terminal with a USIM . This arrangement would be beneficial when the user:

- is out of range of public UMTS radio coverage;
- only requires terminal transportability, thus releasing UMTS radio capacity for other users;
- needs higher data rates than supported by UMTS radio access.

The support of UMTS capabilities on fixed terminals (including support of discrete mobility between UMTS-capable fixed terminals) offers opportunities both in the business and residential user environment.

In a residential environment, this scenario allows a UMTS user (more specifically the USIM) to roam between wired terminals giving the user same support of his service profile on these terminals. This scenario takes advantage of the network operator's significant investment in the access network.

In a business user environment, this scenario allows a corporate UMTS user (the USIM) to roam between wired terminals located in a business or residential environment. This scenario gives the user the same support of his service profile on each terminal. It takes advantage of the business's investment in the access and switching infrastructure. The expedient solution for UMTS phase 1 (circa 2002) may be based on private network standards (e.g. evolution of Q-SIG).

5.2 Scenarios 2 & 3 - roaming in private UMTS networks

These scenarios involve customers owning and operating their own UMTS core networks. These self-contained systems will interwork with other private and public UMTS core networks, and typically will operate in licence exempt spectrum. These systems should provide a home network capability for internal users across multiple, possibly isolated, sites to enable users to access the same services when roaming within the private network. Such networks will typically be used by organizations with large industrial sites or office complexes.

Private Networks involve the implementation of UMTS Core Network (CN) functionality. This allows customers to own and operate their own UMTS core and radio access network within their own premises.

Private Networks require an extension of the SMG UMTS Model to include an additional interface between the private network and the access network of the public network . This is included in the SPAN UMTS Task Force extension of the SMG UMTS Model as another use of the Wu Interface, this time between the Access Network Domain and the Private Network Domain (see figure 4). However, the use of this interface is quite different from that of the Private Access System.

In order to understand the standards implications of the private networks, it is necessary to consider the next level of detail of the Private Network Domain. This is illustrated in Figure 2 which shows how a Private Network is made up of a number of BSs which serve the Uu interface and are connected to and controlled by an RNC. The RNCs are connected to the CN which provides the connection to the Access Network via the Wu Interface. The simplest private network may include the functionality of the BS, RNC and CN within a single physical entity. It is not clear whether or not interfaces within the private network (i.e. between the BS and RNC and between the RNC and CN) should be specified.

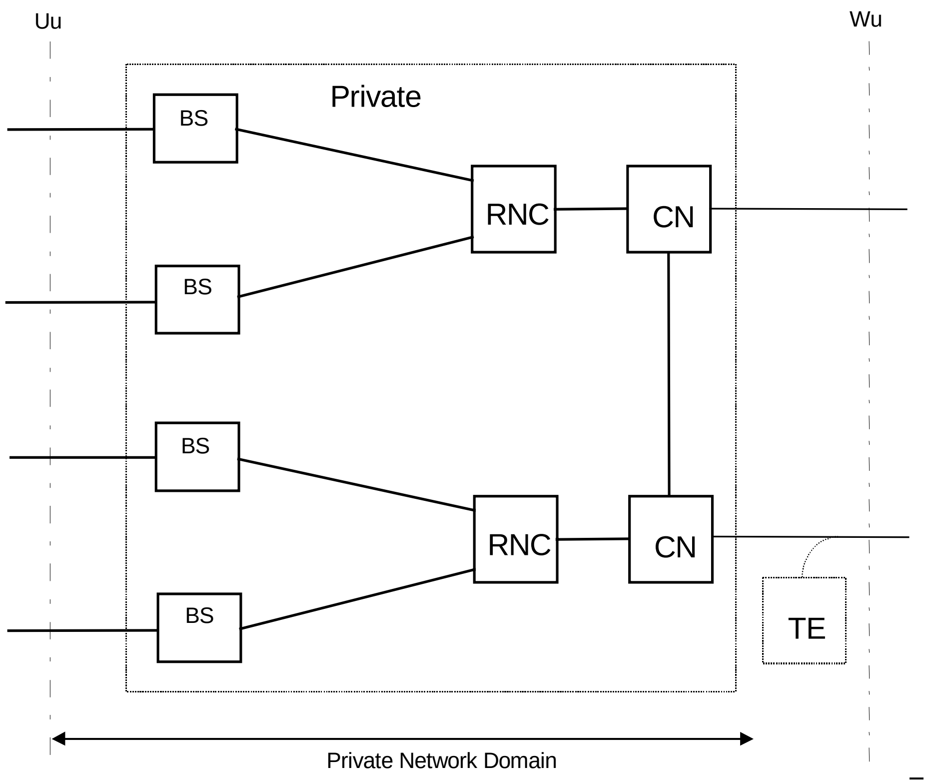


Figure 2: The private network domain

As with private access systems, it is not known whether there is any specification work being pursued on the network aspects of UMTS Private Networks. However, much of what has been done for wireless/cordless terminal mobility in private networks (CT2, DECT and PHS) in ETSI, ECMA TC32, and ISO/IEC JTC1 may apply.

In general, private networks will have their own service provision capability for their internal users. Private networks may also provide access for visiting users from other private or public networks. Private network registered users could also roam into other private or public networks. Therefore, the interworking over the Wu Interface between the Core Network Domain and the Private Network Domain will be similar to that between different UMTS public CNs.

To interconnect with public networks, private networks may need to share the same public network termination point with other terminal equipment / services (the TE in Figure 2). This will be particularly important for small business installations where a single connection to the public network may need to be shared with other non-UMTS services.

5.3 Scenario 4 - support of private access systems

This scenario involves customers owning and operating their own UMTS radio access network within their premises. These systems will operate in licence exempt spectrum and will be connected to a public UMTS core network. This arrangement would be beneficial when the user:

- is out of range of public UMTS radio coverage;
- requires access to UMTS services in the residential environment.

Functions of the core network include authentication, support of service profiles, network interconnect and traffic routeing. Applications will range from residential use to private organizations such as universities and conference centres.

The implementation of this scenario requires an extension of the SMG UMTS Model to include an additional interface between the access network of the public network and the private access system. This is included in the current NA6 WG SPAN6 UMTS Task Force extension of the SMG UMTS model as the Wu interface between the Access Network Domain and the Private Access Domain, see figure 4. In order to understand the standards implications of private access systems, it is necessary to consider the next level of detail of the Private Access Domain, see Figure 4. This figure shows how the Private Access System is made up of a number of BSs which serve the Uu interface and are connected to and controlled by an RNC which provides the connection to the access network via the Wu interface. (Note that the RNC here may not need the full functionality required in public access systems).

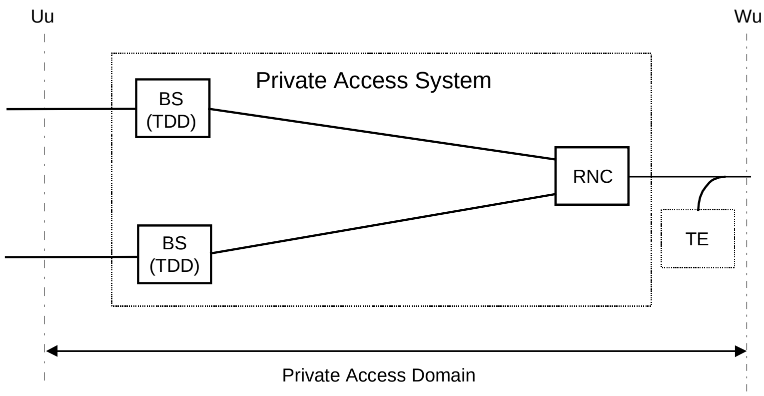


Figure 3: The private access domain

Note that, in order to interconnect with public networks, private access systems may need to share the same public network termination point with other terminal equipment / services (the TE in Figure 3). This will be particularly important for residential and small business installations where a single connection to the public network may need to be shared with other non-UMTS services. The simplest private access system will include the functionality of the BS and RNC within a single physical entity (which could be applicable to the residential user scenario).

5.4 Scenario 5 - public cellular access to the fixed network

Only one service scenario is considered. A PNO with an existing fixed network has obtained a licence for UMTS spectrum and wishes to introduce a public wide-area UMTS cellular network.

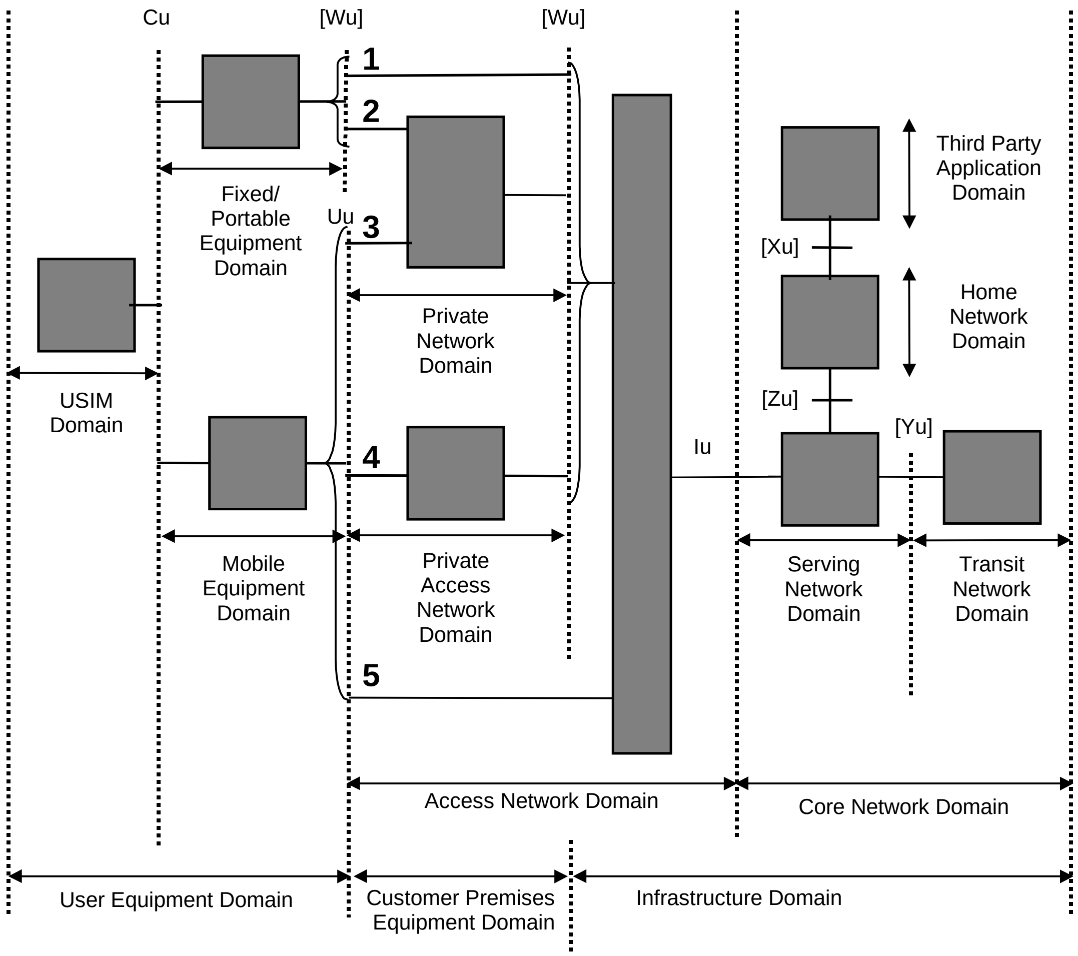
In this scenario, special considerations in the access network domain are not required. The addition of UMTS mobility management capabilities in the fixed network needs to be considered.

Interfaces between individual domains, as identified in figure 4 shall be open and thus require standardization. The identification of further interfaces between sub-components within individual domains is out of the scope of this document.

The interface between the access network domain and the core network domain is the Iu interface being specified by 3GPP. The interface between the mobile equipment domain and the access network domain is the Uu interface being specified by 3GPP.

Figure 1 introduces a new reference point Wu, which takes into account the possibility that only a subset of the features specified by the Iu interface might be required.

The physical implementation of the different access scenarios is illustrated in Figure 1.



NOTE : The domains identified in the figure will generally result from an evolution of existing network infrastructures. The core network domain may result from evolutions of existing network infrastructures, e.g. a GSM infrastructure, an N-ISDN infrastructure, a B-ISDN infrastructure or a PDN infrastructure. The evolution of these infrastructures may be performed via the use of IWUs, hidden within the domains shown in the figure.

Figure 4: Additional reference points for fixed and cordless access to public and private networks

6 Evolution Scenarios

6.1 Starting Points

Three different types of fixed networks have been selected as starting points for the network evolution scenarios towards a target core network supporting broadband services and mobility. The selected starting points are considered to represent the most common public fixed network types.

6.2 Starting point 1 - PSTN / POTS

The first starting point is POTS terminals connected to the PSTN as shown in Figure 5. The following assumptions have been made:

- the Fixed Terminal (FT) is a POTS terminal;
- the core network uses N-ISDN for transport and switching;
- the core network has not implemented any intelligence.

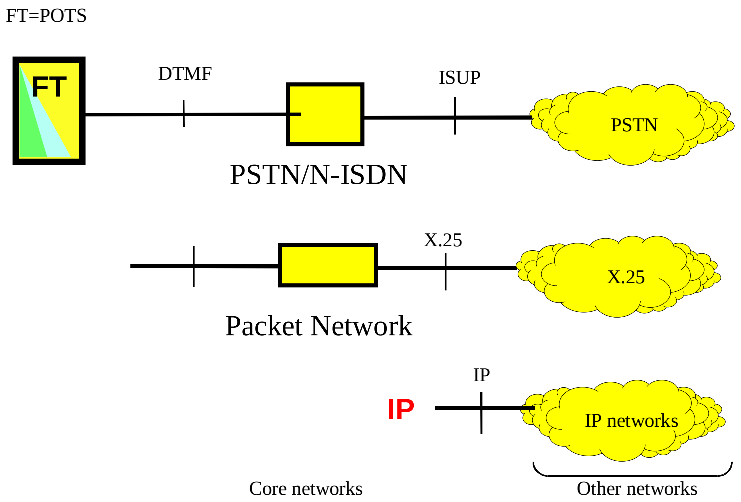


Figure 5: Scenario 1: PSTN / POTS starting point

6.3 Evolution scenario for starting point 1

A first step in the evolution of a PSTN core network that satisfies some of the requirements of a target system is illustrated in Figure 6. The evolution is based on installation of a UMTS Base Station Sub-systems (BSS) and introduction of a mobility server in the core network to provide support for terminal and personal mobility. The mobility server is a generic concept that describes storage of user location information. Interactions between network elements and the mobility server may be based on enhancements to IN, or in IP networks on mobile IP, with appropriate extensions to meet the requirements of public network operators. Handover is unlikely to be supported in this scenario.

An InterWorking Unit (IWU) is introduced in the access point Iu, to separate circuit switched and packet data traffic in the core network. From the UMTS BSS over the Iu interface xDSL modem technology may be used over the copper local loop. The use of xDSL will offer a bandwidth of more than 300 kbit/s.

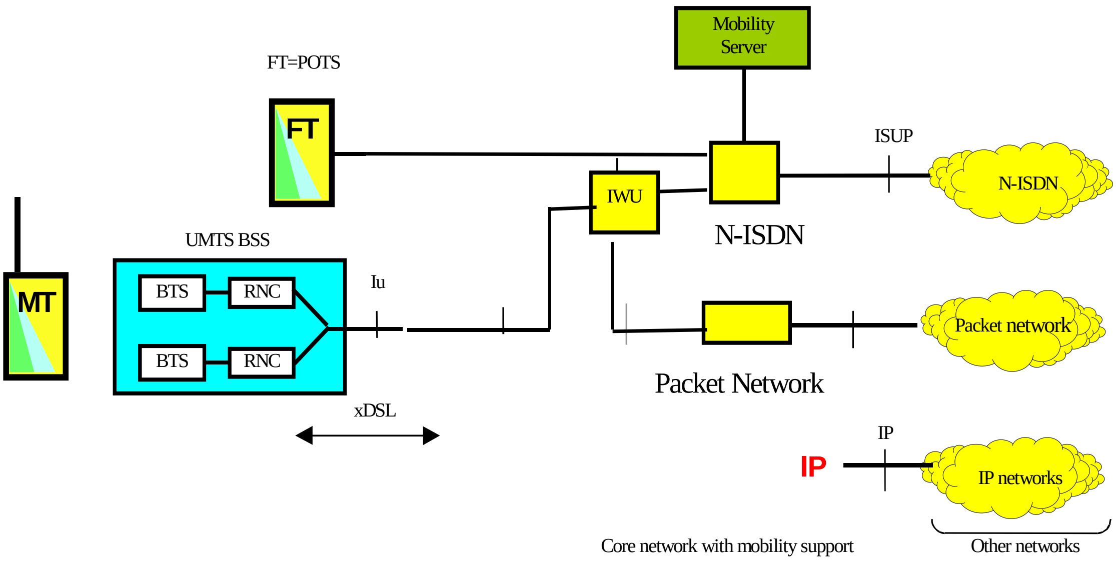


Figure 6: Addition of UMTS radio access

6.3.1 Starting point 2 - N-ISDN

This starting point, shown in Figure 7 is based on N-ISDN with the following assumptions:

- the FT is an ISDN terminal, with DSS1 access signalling;
- the core network uses N-ISDN transport and switching;
- the deployment of network intelligence for the implementation of supplementary and value-added services is optional.

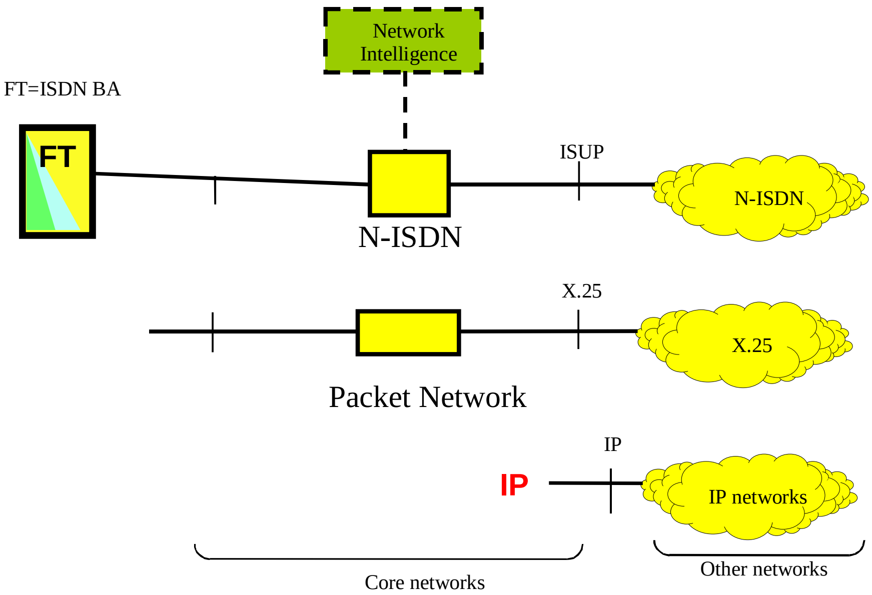


Figure 7: Scenario 2: N-ISDN starting point

6.4 Evolution scenario for starting point 2

As a first step to provide mobility, mobility server functionality may be added to the core network. This is illustrated in Figure 8. This update of the core network provides the user with terminal mobility via fixed access provided that a terminal / user registration procedure is introduced. The maximum bit rate that can be supported over ISDN basic access is 144 kbit/s.

In a next step the N-ISDN network may be updated with radio access. This may be in terms of a UMTS radio access. To support UMTS the DSS1+ (see EN 301 061-1 [1]) protocol used over the user network interface must be enhanced.

The support of mobility in this scenario is still limited so that only mobility within the UMTS BSS coverage area is supported, i.e. no handover support between private and public UMTS networks is assumed. However a UMTS / terminal may roam into another subsystem assuming the necessary access rights have been granted.

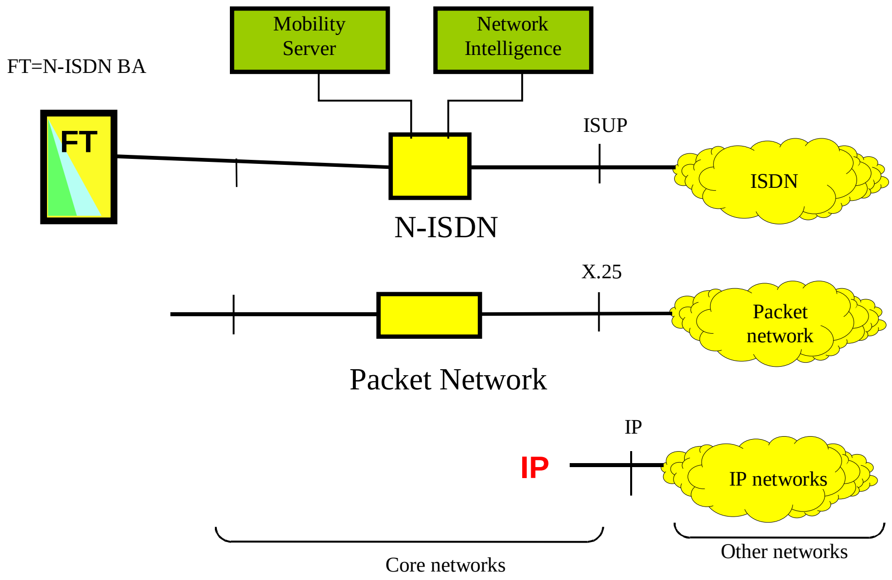


Figure 8: Addition of mobility support

6.4.1 Starting point 3 - B-ISDN

This starting point for fixed networks is B-ISDN based on ATM. Broadband ATM networks, shown in Figure 9 provide the infrastructure to facilitate integration of telecommunication and computer communication for the provisioning of advanced multimedia services to the user. Within the target of 3G UMTS integration with B-ISDN based on ATM transport, integration with Intelligent Network concept and support of numerous and diverse radio interfaces have to be provided. The assumptions for the B-ISDN based network are:

- B-ISDN core network with ATM transport;
- fixed line N- or B-ISDN terminals, with DSS1/DSS2 access signalling;
- the deployment of network intelligence for the implementation of supplementary and value-added services is optional.

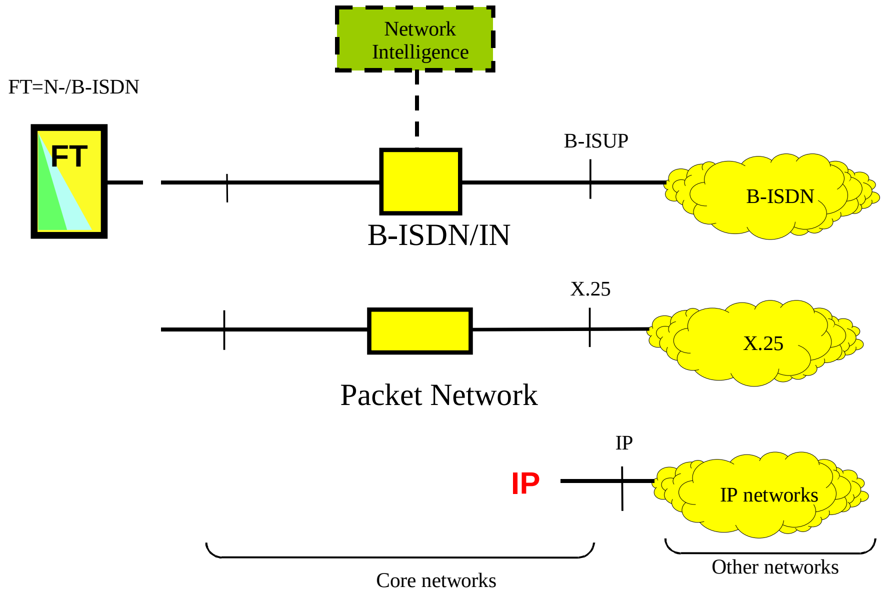


Figure 9: Scenario 3: B-ISDN starting point

6.5 Evolution scenario for starting point 3

From the B-ISDN starting point Figure 9, a first evolution step is illustrated in Figure 10. This step will offer personal mobility and terminal mobility via fixed access. The core B-ISDN network is extended with IN functionality with mobility support.

In order to support terminal mobility via fixed access the DSS2 access protocol has to be extended, in the figure indicated as DSS2+. These enhancements may lead to INAP extensions as well, if INAP is used to implement mobility server functionality.

In a second step radio access may be added to the B-ISDN network. The fixed terminal access is extended with mobile access using a Mobile Terminal (MT).

The B-ISDN network is updated with radio access via an IWU. The IWU is assumed to support both DSS2 and VB5 (see EN 301 005-1 [4] and EN 301 217-1 [5]) interfaces. The transport from the access network to the IWU can be xDSL. In this example, access to the Iu interface is based on xDSL technology.

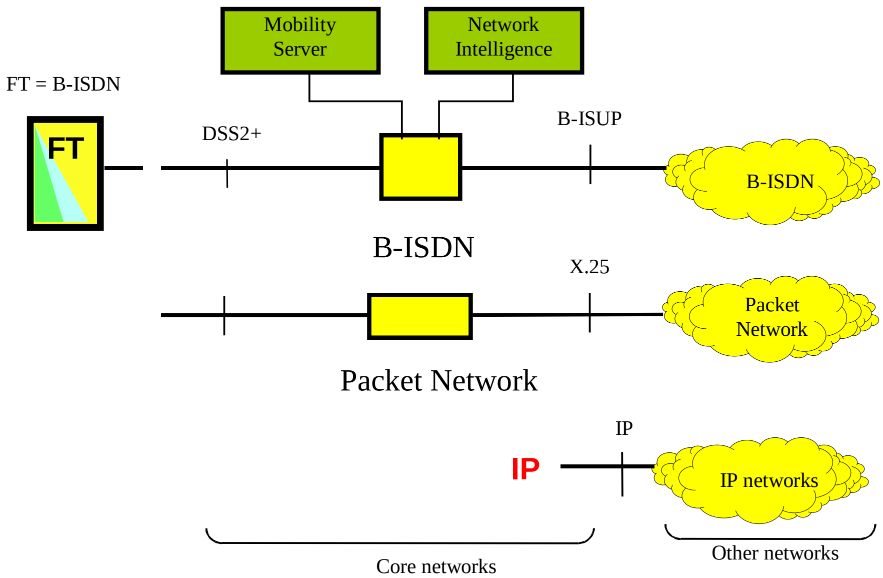


Figure 10: Addition of mobility support

6.6 Addition of BRAN access

The above scenarios all indicate evolutions possible in the short term towards UMTS, while the following evolution will be possible only in a second phase when the Broadband Radio Access Network (BRAN) standardization is completed.

BRAN denotes a number of technologies being suitable for the implementation of broadband radio access networks. The technologies are described in Technical Reports produced by ETSI Project BRAN. These technologies are known as HIPERLAN/2 and HIPERACCESS.

These wireless access networks are intended to support a variety of core networks, including those based on ATM and IP. BRAN networks will provide point-to-point, point-to-multipoint or multipoint-to-multipoint access at a typical rate of 25 Mb/s or more.

From the last steps of the above fixed network evolution scenarios, BRAN access may be added. This scenario shown in Figure 11 will be the last step in the evolution towards a fixed network supporting the target system requirement for broadband multimedia services and mobility.

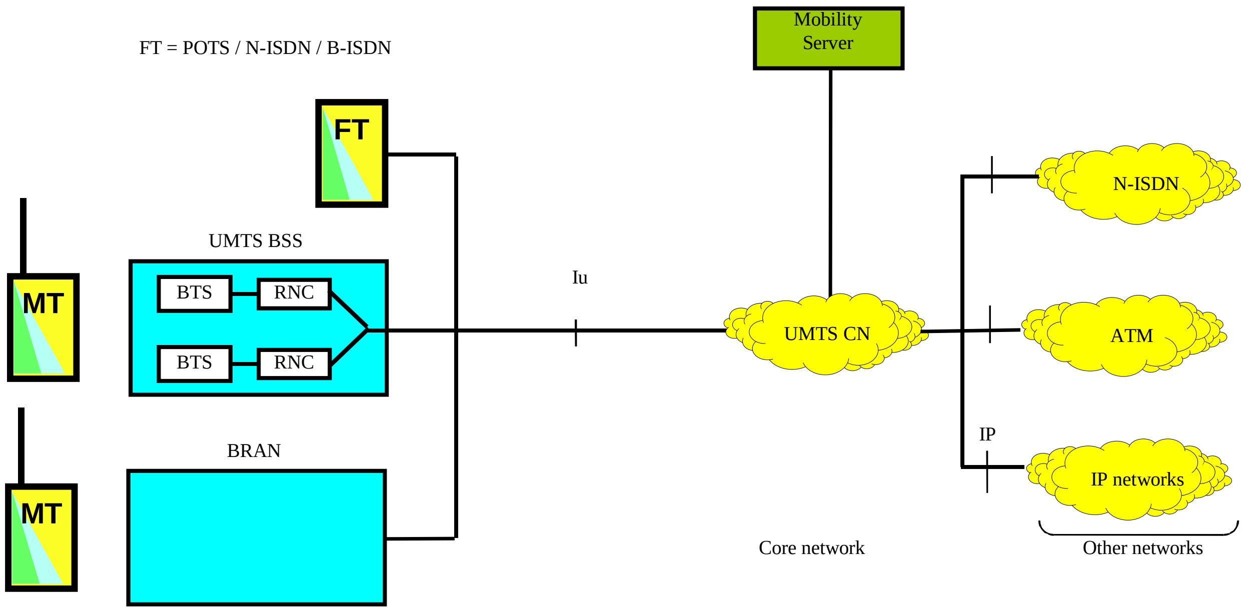


Figure 11: Adding BRAN access to the evolved fixed network

The radio and fixed access may support a number of terminals. The UMTS core network will provide wide area transport for all the access types. Mobility control may be supported in the ATM switches, in mobility servers or via IN with mobility support. Protocol extensions are needed in order to fulfil all the mobility requirements.

6.7 Internet access evolution

The method used today to access the Internet backbone is through a call to a PSTN / Internet Gateway (PIG) provided by an Internet Service Provider (ISP). The essential network components to provide this access are a voice-band modem e.g. V.90 56 kbit/s, using PSTN transport and switching to access an ISP gateway (with a bank of voice-band modems) to the internet backbone.

This arrangement supports "on-demand" access to the Internet, i.e. the user dials the access number of the ISP and a bearer is maintained throughout the internet session, irrespective of any packet transfer. Terminal mobility is supported by using alternative network access points and possibly different access numbers.

Home WWW pages would have to be stored on space provided by the ISP to make them always available to other WEB browsers.

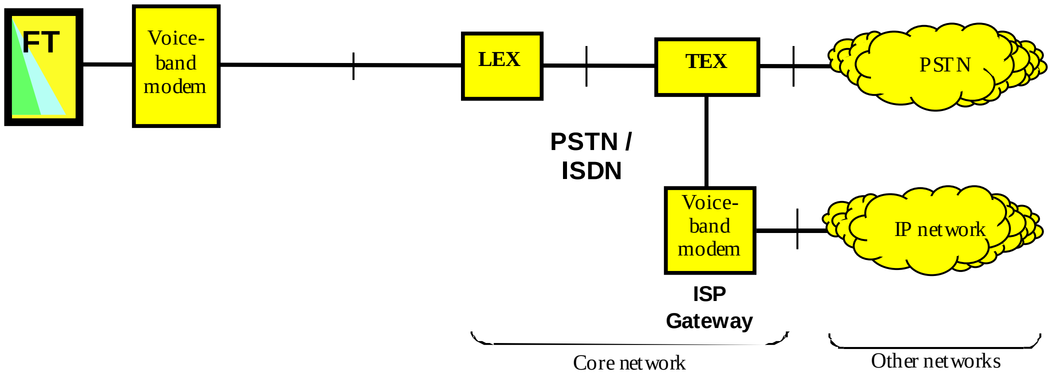


Figure 12: Today's access to internet

"Always-on" broadband access

In this scenario, the essential network components to provide this access are:

- high capacity modem (e.g. xDSL) to carry bearer and signalling over copper line plant;
- packet network transport and routeing;
- ISP gateway to the internet backbone.

This arrangement supports "always on" access to the internet, i.e. the terminal is always connected to the internet backbone irrespective of any requirement to transfer packets. Terminal mobility is unlikely to be supported as this is not compatible with the "always on" feature. Home WWW pages could be stored on space provided by the ISP or on the user's terminal.

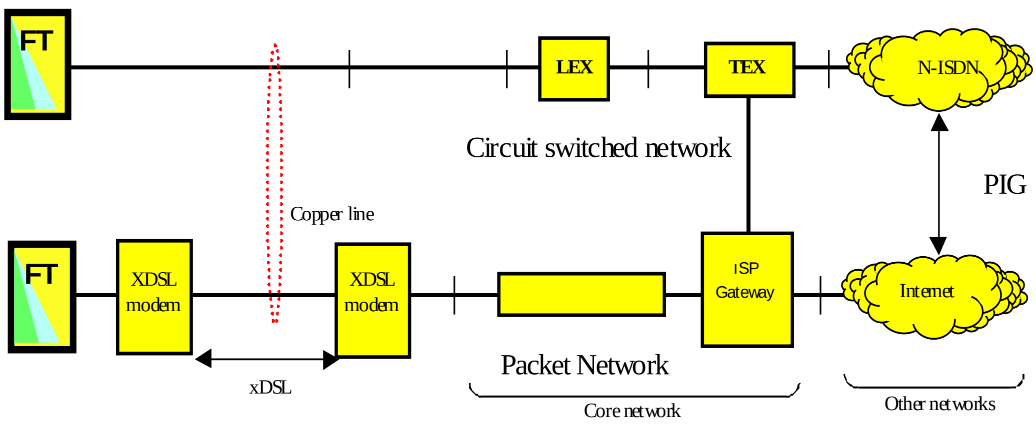


Figure 13: "Always-on" broadband access

"Always-on" broadband access with mobility

In this scenario, the essential network components to provide this access are:

- broadband base-station (e.g. UMTS, Bluetooth™, wireless-LAN);
- high capacity modem (e.g. xDSL) to carry bearer and signalling over copper line plant;
- mobility support using Home and Mobility servers.

This arrangement supports "always on" access to the internet provided the terminal is in range of a radio access, i.e. the terminal is always connected to the internet backbone irrespective of any requirement to transfer packets.

Location and authentication procedures required for terminal mobility are supported through call unrelated signalling mechanisms to the mobility server. The interface between the Home and Mobility servers is the same as for UMTS HLR-VLR. Home WWW pages would have to be stored on space provided by the ISP to make them always available to other WEB browsers.

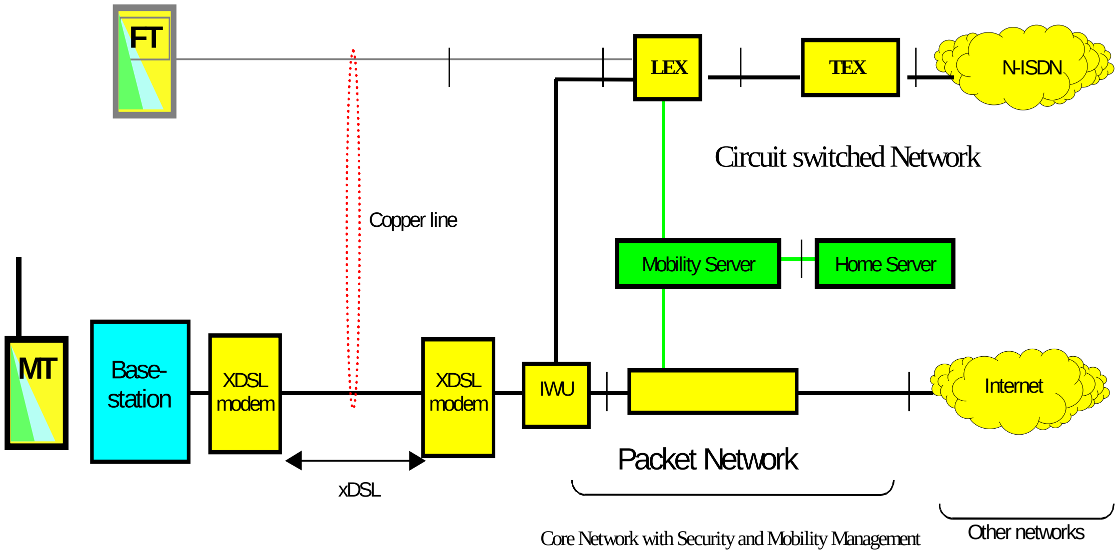


Figure 14: "Always-on" broadband access with mobility

Long-term vision

In this scenario, the essential network components to provide this access are:

- broadband base-station (e.g. UMTS, Bluetooth™, wireless-LAN);
- high capacity modem (e.g. xDSL) to carry bearer and signalling over copper line plant;
- UMTS core network introduced;
- mobile IP used for mobility (Home Agent and Foreign Agent).

The introduction of the UMTS core network as an IP network with QoS guarantees eliminates the need for the circuit switched network to handle any telecom traffic from the terminal. Unnecessary network elements have been removed.

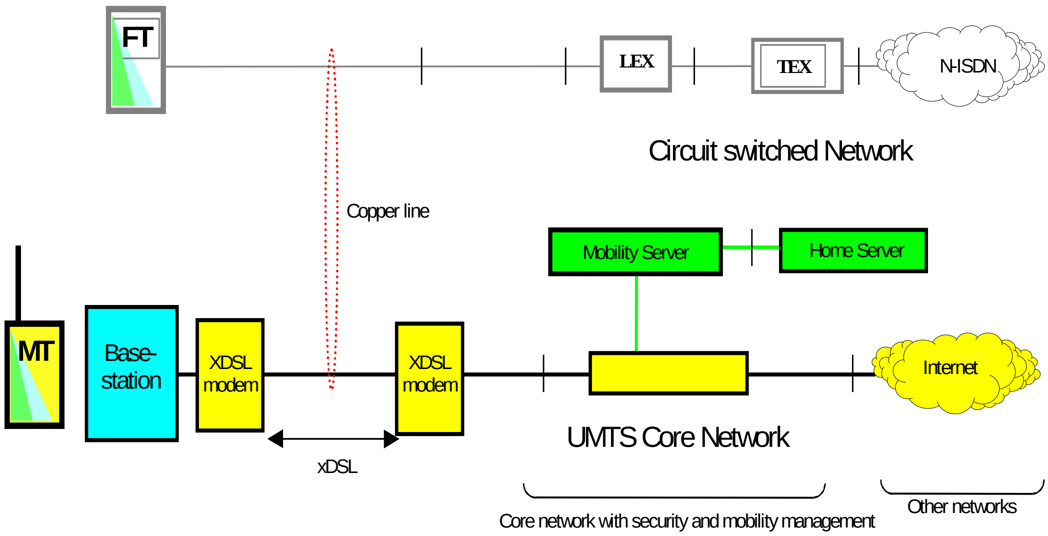


Figure 15: Long-term vision

6.7.1 Mobility spanning IP and IN networks

This subclause addresses the issue of personal mobility in interworking environments that merge traditional switching and IP based ITU-T Recommendation H.323 [2] networks. ITU-T Recommendation H.323 [2] is well adapted to integrated working environments, offering multiparty services that support audio-visual components and data sharing, in conjunction with ITU-T Recommendation T.120 [3] standards.

In order to integrate the two environments, allowing personal mobility interoperation, some evolution needs to be considered in the architecture. Although interworking of ITU-T Recommendation H.323 [2] with switched network calls is already addressed by standards, interworking of features such as personal mobility is still unresolved. In this subclause, the adaptation of IN to an ITU-T Recommendation H.323 [2] environment is foreseen in the medium term and a longer-term convergence towards a wider scenario is considered.

The starting point for interworking of switched to ITU-T Recommendation H.323 [2] networks is shown in Figure 16. Interconnecting the two domains is a Gateway (GW) that converts signalling and communication streams in both directions. A Gatekeeper (GK) assures access control and auxiliary functions. GW and GK, if not associated in the same physical device, communicate with each other using IP. Interface between GW and the external signalling world is through ISUP or TUP.

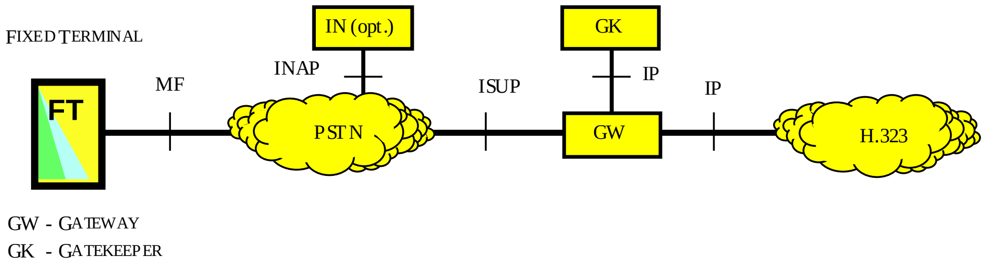


Figure 16: Signalling interfaces in PSTN to ITU-T Recommendation H.323 [2] interworking

In this configuration personal mobility is limited to a ITU-T Recommendation H.323 [2] GK domain area. A local end user is able to use any access point in the network through registration. The GK is able to resolve user aliases transparently to the outside world.

In a first step network intelligence capabilities are added to both ISDN and IP networks, allowing personal mobility through inter-network UPT service provision. Functional architecture is represented in Figure 17. On the IP side, the Gatekeeper is upgraded with IN capabilities, including INAP SCF and SDF functionality.

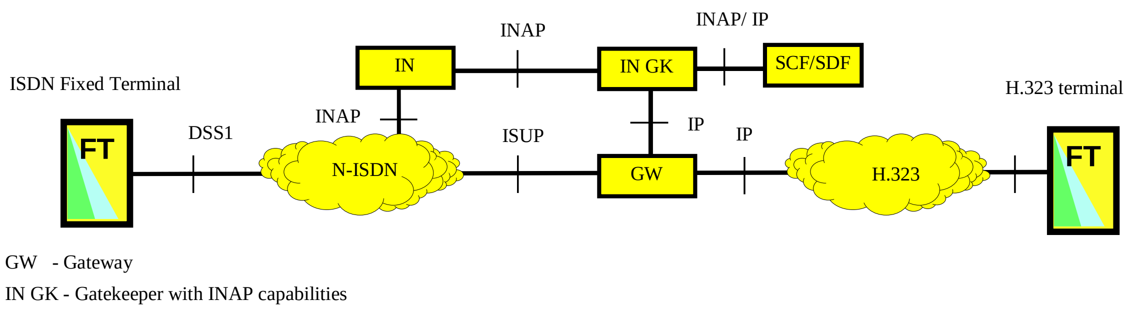


Figure 17: Interworking of PSTN and H323 networks with IN support

In a next step the core ISDN network is upgraded with IN mobility support, (IN CS4). This also changes the way in which personal mobility is achieved within the ISDN / ITU-T Recommendation H.323 [2] environment. Specific location services in the ISDN environment allow mobility interworking between the ISDN and ITU-T Recommendation H.323 [2] environment. The ITU-T Recommendation H.323 [2] gatekeeper is updated to interwork with the new INAP mobility management capabilities.

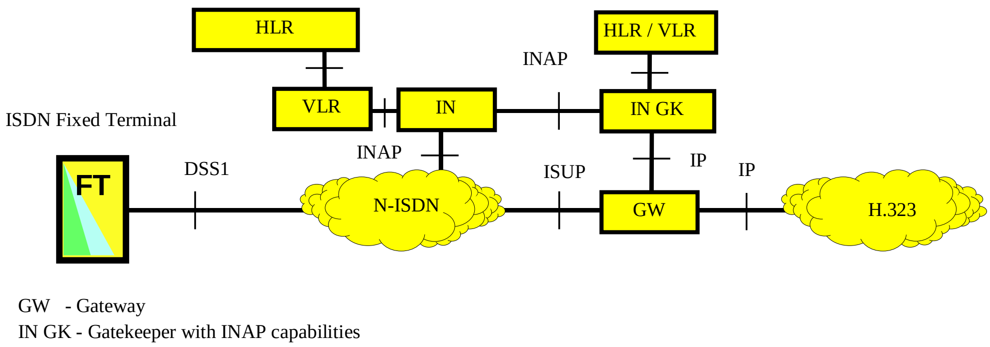


Figure 18: Interworking with mobile networks (cellular)

6.8 Recommendations for standards development

This subclause proposes where the standardization work related to the above scenarios should be carried out for UMTS.

6.8.1 Service aspects

The services are largely expected to be the same as those specified by 3GPP but may require some additional work from SPAN2 and ECMA

6.8.2 System aspects

While this work could be continued within SPAN there is recognition that there is very active IP telephony expertise in EP TIPHON which could be utilized

6.8.3 Radio aspects

The radio aspects are fully covered by 3GPP

6.8.4 Access aspects

The most promising evolution scenario for the access network uses xDSL technology to provide transport rates in excess of 2 Mbit/s over existing copper access. (This technology can also provide an "always on" IP access irrespective of UMTS service).

6.8.5 Protocol aspects

The long term vision for UMTS requires a high speed packet network. An IP network is envisaged with appropriate QoS, mobility, billing and management aspects.

Table 1 indicates specific groups where work may be carried out.

Table 1

Scenario	Service Aspects	System Aspects	Radio Aspects	Access Aspects	Protocol Aspects
Public Access - licensed spectrum	3GPP	3GPP	3GPP	TM6 (xDSL) SPAN5 (DSS*)	3GPP, SPAN, TIPHON, IETF
Private Access	3GPP / SPAN2	SPAN / EP UMTS	3GPP	TM6 (xDSL) SPAN5 (DSS*)	SPAN (ECMA), TIPHON, IETF
Private Network	3GPP / SPAN2 / ECMA TC32	EP UMTS, ECMA TC32	3GPP	ECMA TC32	SPAN + ECMA

Annex A (informative): Standardization committees of interest

3GPP RAN: Third Generation Partership Project - Radio Access Network

IETF: Internet Engineering Task Force

TIPHON: Telecommunications and Internet Protocol Harmonization Over Networks

ECMA TC32: European Computer Manufacturers Association

ETSI NA: Network Aspects

ETSI TM: Transmission and Multiplexing

ETSI SPS: Signalling Protocol and Switching

ETSI BRAN: Broadband Radio Access Networks

ETSI DECT: Digital Enhanced Cordless Telecommunications

ETSI JTC1: Joint Technical Committee

History

Document history		
V1.1.1	November 1999	Membership Approval Procedure MV 200004: 1999-11-30 to 2000-01-28

ETSI EG 201 717 V1.4.2 (1999-11)

ETSI Guide

Universal Mobile Telecommunications System (UMTS); Virtual Home Environment (VHE) in the Integrated Services Digital Network (ISDN); Envolved UMTS core network

Reference
DEG/SPAN-061305 (fwc00jde.PDF)

Keywords
IN, ISDN, UMTS, VHE

ETSI

Postal address
F-06921 Sophia Antipolis Cedex - FRANCE

Office address
650 Route des Lucioles - Sophia Antipolis
Valbonne - FRANCE
Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16
Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Internet
secretariat@etsi.fr
Individual copies of this ETSI deliverable
can be downloaded from
http://www.etsi.org
If you find errors in the present document, send your
comment to: editor@etsi.fr

Important notice

This ETSI deliverable may be made available in more than one electronic version or in print. In any case of existing or perceived difference in contents between such versions, the reference version is the Portable Document Format (PDF). In case of dispute, the reference should be the printing on ETSI printers of the PDF version kept on a specific network drive within ETSI Secretariat.

Contents

Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (http://www.etsi.org/ipr).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Foreword

This ETSI Guide (EG) has been produced by ETSI Technical Committee Services and Protocols for Advanced Networks (SPAN).

1 Scope

The present document covers scenarios and procedures to support the UMTS Virtual Home Environment (VHE). The Virtual Home Environment is a capability for providing operator-specific services to end users with a consistent look and feel which is independent of location and serving network. It facilitates service adaptation to different network environments supporting directly connected, cordless and cellular access. The philosophy of VHE has been proposed by GSM MoU and implementation scenarios have been identified and studied by ITU-T for IMT-2000 work.

2 References

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

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

[1] TR 101 695: "Integrated Services Digital Network (ISDN); Universal Mobile Telecommunications System (UMTS); ISDN-UMTS Framework".

[2] ITU-T Recommendation E.164 (1997): "The international public telecommunication numbering plan".

[3] ITU-T Recommendation E.212 (1998): "The international identification plan for mobile terminals and mobile users".

[4] ITU-T Recommendation E.191 (1996): "B-ISDN numbering and addressing".

[5] ITU-T Recommendation Q.1701 (1999): "Framework for IMT2000 Networks".

[6] ITU-T Recommendation Q.1711 (1999): "Network Functional Model for IMT-2000".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definition applies:

Virtual Home Environment (VHE): system concept for personalized service portability across network boundaries and between terminals. The concept of the VHE is such that UMTS users are consistently presented with the same personalized features, user interface capabilities and services in whatever network and whatever terminal, whereever 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)

3.2 Abbreviations

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

AAL	ATM Adaptation Layer
API	Application Programme Interface
API	Application Programming Interface
ATM	Abstract Test Method
CAMEL	Customized Application for Mobile Enhanced Logic
CoC	Communication Control
CORBA	Common Object Request Broker Architecture
DAT	Service-Profile/Data
EXE	Service Execution Environment
GPRS	General Packet Radio Service
HSCSD	High Speed Circuit Switched Data
IC	Integrated Circuit
INAP	IN Application Protocol
IP	Information Processing
ISDN	Integrated Services Digital Network
ME	Mobile Equipment
MExE	Mobile application Execution Environment
MMI	Man Machine Interface
MMIC	MMI Control
PAD	Packet Assembly/Disassembly facility
PCMCIA	Personal Computer Memory Card International Association
PRG	Service Programme
Q.gft	Generic Functional Transport
Q.sig	Private Network Spelling
RPC	Remote Procedure Calls
SCF	Selective Call Forwarding
SDH	Synchronous Digital Hierarchy
SIM	Subscriber Identity Module
SMS	Service Management System
SONET	Synchronous Optical NETwork
SS7	Signalling System N°7
SSF	Service Switching Function
UMTS	Universal Mobile Telecommunications System
UPT	Universal Personal Telecommunications
URL	User Requirements Language
USIM	UMTS Subscriber Identity Module
USIM	User Service Identity Module
VASP	Value Added Service Providers
VHE	Virtual Home Environment
WAP	Wireless Application Protocol

4 Description of VHE

4.1 Virtual Home Environment capabilities

The Virtual Home Environment supports:

- **service transparency:** between different IMT-2000 networks;
- **transparent execution:** of the "Virtual Home Environment" service features: the VHE service features are used by mobile operators to provide more functionality to mobile users than basic mobility. The services may be executed without necessary sharing of service and subscriber information with the visited mobile operator (except of roaming agreements);
- **customized services:** the means for network operators, service providers and users to define their own specific features/service;
- **a personalized service set:** with user personalization of features/services;
- **service level:** it is desirable that the roaming mobile end-users will experience the same service level as within their home networks (the Virtual Home Environment concept). Therefore, it is desirable that services are provided transparently by the visited networks;
- **provisioning of subscriber specific services:** mobile users may have custom demands for functionality from their home service providers. The Virtual Home Environment intends to make management access to customized services available to mobile users when roaming;
- **limited network load:** the current mobile networks already manage a considerable signalling load to handle a mobile call. This signalling is required to maintain the mobility information of the mobile subscriber up to date. Therefore, the signalling load of new features must be limited as far as possible to ensure that the mobile network's signalling capacity will not be overloaded;
- **activation of mobile related call events;**
- **perform charging activities:** the VHE may be able to exchange charging parameters between the Home Service Provider and Serving (Visited) Network. This exchange is required to have services such as Advice of Charge;
- **perform in-band user interaction:** the VHE shall provide the capabilities to order the playing of announcements and tones towards calling/called subscribers during the call-setup, call disconnection, unsuccessful call establishment, and incoming call procedures;
- **allow for subscriber interaction:** the subscriber should have control capabilities to activate/register/invoke supplementary services. The VHE should be able to add functionality to these supplementary service control mechanisms;
- **interaction with the supplementary services:** the mobile network provides a number of supplementary services; interaction with these services needs to be considered.

4.2 Structure of the issues for mapping functional modularity

The above categories will need to be structured into the following categories.

4.2.1 Applications

Applications by their nature are in the open competitive market and should not be standardized. However, a few widely used applications may benefit from standardization since significant performance advantages may be gained from features having a static distribution.

A basic level of standardization may be and has proven useful to made applications accessible to the marketplace and simpler to use: e.g. the layout of the telephone and typewriter/PC keyboard. Definition of examples is highly useful to understand the implied requirements on the lower layers.

4.2.2 Application support

A vast number of technologies are being pursued in this category some of which are being standardized: e.g. the ISO ECMA-script, based on JAVAscript. Other technologies are being pursued in industry fora: e.g. WTML in the WAP Forum. An initial list of the supporting technologies by which VHE is facilitated is included below:

- CAMEL (Customized Application for Mobile Enhanced Logic), INAP SSF-SCF interaction;
- SIM Toolkit/Smart Card applications;
- WAP (Wireless Application Protocol);
- MExE (Mobile application Execution Environment);
- Internet Protocols Service Negotiation;
- IP Media Controllers and Gateways;
- INAP CS3 SCF-SCF secure interaction;
- Software Agent technologies;
- Technologies for software download;
- Distributed Processing/CORBA.

It is clear that for these technologies to be transparently supported across networks whilst being recognized at the endpoints (terminals and servers) and in the network access points and gateways some standardization is required. It must be noted that that some of the above technologies aim at network independence but all of them are based on a network specific evolution. Some cases imply that the serving network supports knowledge on the service; e.g. CAMEL uses IN triggering.

The major challenge for the computing distributed processing based technologies is the efficiency and speed; it is unlikely that in a competitive world that distributed processing technologies like CORBA will be deployed to interwork throughout global networks. However the software architecture may be deployed on several endpoints (terminals and servers) with high speed links between these endpoints, thus divorcing the software platform from the underlying physical network.

Resource Control in such a scenario is a complex issue of the software requesting resources for handling multiple media streams without having direct control of knowledge of the configuration of where the resources may be sited. Service Mediation is required in an end-to-end sense when setting up the requested service, however negotiation and fall back procedures require definition where one endpoint fails to maintain the service or an intermediate transport network cannot support the required resource.

4.2.3 Transport and signalling capabilities

Transport and signalling capabilities are required and must be standardized to carry the VHE capabilities; some options exist, including:

- encapsulated signalling across SS7: Q.gft protocol; Q.sig;
- INAP CS3 SCF-SCF Service to Service encapsulation;
- INAP CS3 Terminal to SCF user to Service encapsulation;
- INAP CS3 SCF to Terminal Service to user encapsulation;
- session related Internet Protocols (including mobile IP);
- SS7 over IP;
- AAL2 or AAL5 Frame Relay;
- GSM GPRS;
- GSM HSCSD;
- dial-up modem capabilities.

NOTE: VHE may potentially be supported by a variety of transport systems so if these capabilities are to be successful either interworking is required, or ubiquitous deployment becomes necessary. Otherwise one network cannot interwork with another network for VHE.

4.2.4 Fabric management and underlying protocols

Generally, modern digital networks that exist support protocols that may be used and interconnected to support the above capabilities. Given that the world of data communication is using very high bandwidth transport mechanisms (SONET/SDH) and deploying IP switching or ATM multiplexing to support end-to-end connectivity across these networks. For relatively low speed services circuit switched technology may be used as a method of access, interworking or in some cases end-to-end transportation.

Interworking of analogue inband signalling, encapsulated signalling and frame based packet services is well developed and the options understood. A variety of modems, PADs and PCMCIA devices exists for this purpose.

Special bridging, replicating a merging resource will be required, which are requested by the higher layers. In initial implementations these resources may be deployed in servers and terminals. However as more complex services justify the need, resources may need to be deployed within the network switches and multiplexers.

4.2.5 Network access, network and server addressing, user identification and security

The basic process used in GSM and UPT (Network Access, User Identification and Authentication) requires studying further, as new concepts are required for user security and deregulation.

Network access will be enhanced to support network selection and remote endpoint addressing, as deregulation and competition requires that users may select networks and address distinct servers (possibly incorporating new forms of addressing: i.e. ITU-T Recommendations E.164 [2], E.212 [3] and E.191 [4] (IP addresses and URLs)).

User identification and authentication will be enhanced to support mutual authentication allowing the user to authenticate the serving network and its connection to the remote endpoint. Service usage (non-repudiation) and remote server authentication may also be required by sharing secure signed tokens used for later verification during accounting and billing.

5 Architecture for VHE

Figure 1 provides an architecture derived from draft ITU-T Recommendation Q.1751 (Bibliography) presenting the different functional elements and all the system parts (home, visited…) involved in the provision of VHE capabilities. The Functional Entities and networks shown are meant primarily for the purpose of NNI definition. The provision of VHE capabilities does not necessarily involve all of them.

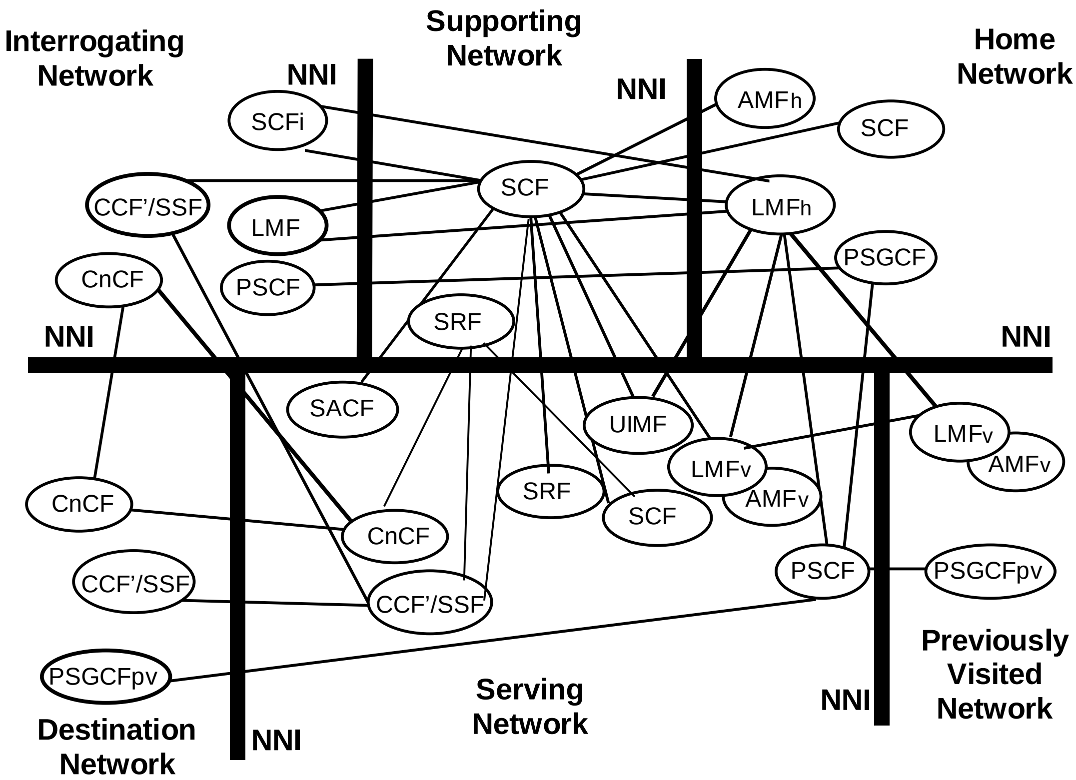
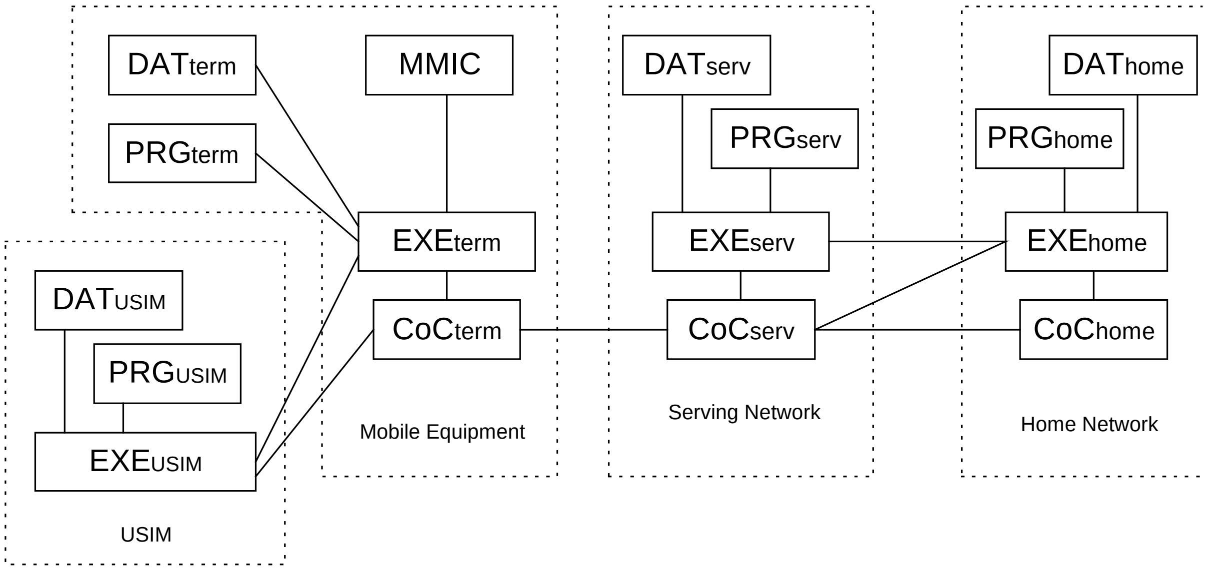


Figure 1: IMT-2000 Network Interconnection Model

This following presents a model to form the basis for development of VHE technical implementation options.



CoC: Communication Control
DAT: Service-Profile/Data
EXE: Service Execution Environment
MMIC: MMI Control
PRG: Service Programme

Figure 2: Generic architecture for VHE

The following **functional components** are introduced:

- the Service Programme **PRG** describes behaviour of a service and its corresponding service elements by means of (standardized) commands. The behaviour described by the PRG may be standardized, network- or even user-specific;
- the Service Execution Environment **EXE** provides (standardized) platform to execute a service programme and provides access to the communication resources. The service execution environment is accessed via (standardized) Application Programme Interfaces (APIs), e.g. Java-based. The execution environment also protects the communication control from unauthorized access;
- the Service Profile/Data **DAT** provides user- or network-specific input data to run a service programme;
- the Communication Control **CoC** handles actual communication (i.e. allocates bearers, handling of SMS, etc.);
- the MMI Control **MMIC** provides network/user-specific control of MMI (triggered by Execution Environment).

The corresponding **network components** are:

- the **ME** (Mobile Equipment) which provides CoC, EXE, DAT, PRG, MMIC;
- the **USIM** (User Service Identity Module), which may provide user-specific and probably also home network specific DAT and PRG as well as an EXE;
- the **Home Network**, which holds CoC, DAT, PRG as well as EXE;
- the **Serving or visited Network**, which holds similar to the home network CoC, EXE, PRG, DAT.

A key characteristic of the architecture model is that service data and service programmes may be stored in a distributed way in the UMTS network (e.g. home network, serving network, ME, USIM). The data and programme codes may be transferred in a flexible way in the network (either "downloaded" or "pushed", indicated by doted arrows in the following figures) as required by the service provider and/or user. A flexible co-ordination and administration (e.g. validity, update procedures, location, etc) of the transferred programmes and data have to be defined to maintain the network.

5.1 Possible mechanisms to realize VHE

The following possible solutions for the realization of VHE have been identified, which differ in the "place" where the service execution (service control) is located:

- service execution in the Home Network;
- service execution in the USIM;
- service execution in the Mobile Equipment;
- service execution in the Serving Network.

The following subclauses will demonstrate how these identified possibilities could be fulfilled by existing GSM toolkits (e.g. CAMEL, SIM-Toolkit, MExE) and new techniques. They also show how the architecture model is used for the different scenarios and which components are involved.

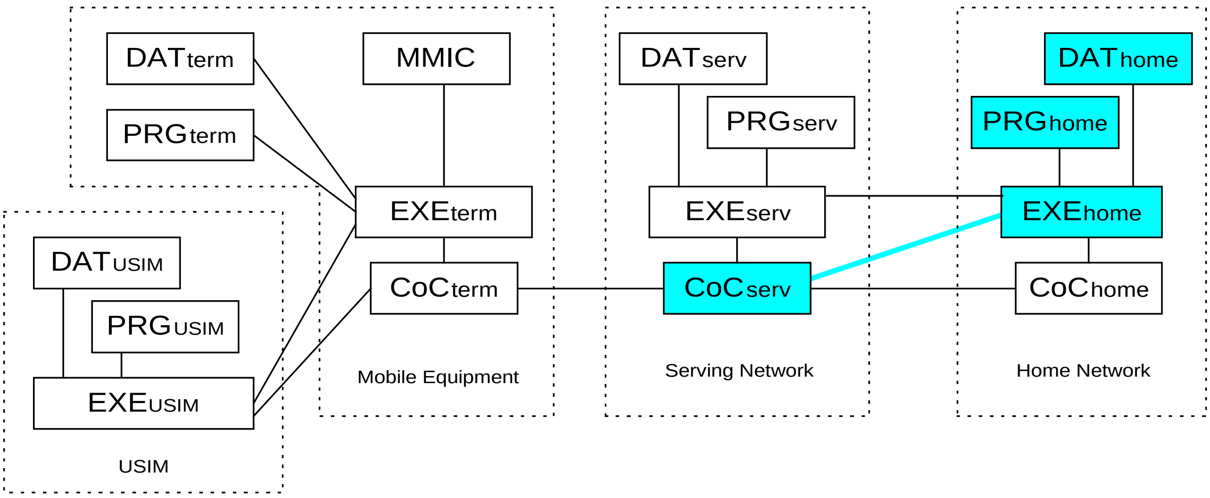
5.1.1 Service execution within the home network

The service execution within the home network gives the subscriber the possibility to use his own VHE services ("service tunneling") although the serving network might not be able to support the desired service or the storage and execution of the appropriate data, e.g. when using some of the second generation systems for access to third generation services.

Possible realization: Evolved CAMEL/IN supports this mechanism by the use of remote procedure calls (RPC).

Requirements: The integration of packet and circuit switched service is one aspect of UMTS. Therefore in GPRS a CAMEL control is also needed. This integrates GPRS into the VHE concept.

Uses: Support of VHE in non-UMTS networks, of GSM CAMEL services in UMTS, of simple terminals and of supplementary services.



CoC: Communication Control
DAT: Service-Profile/Data
EXE: Service Execution Environment
MMIC: MMI Control
PRG: Service Programme

Figure 3: Case 1 - Service execution in the home network

The service control as specified in CAMEL would be described in terms of the architecture model in the following way: The execution environment of the home network directly interacts with the communication control in the serving network. The corresponding interface (API) of the communication control is either standardized (e.g. to one of the CAMEL phases) or bilaterally agreed between home and serving network. No service programme and service data needs to be transferred between home and visited network.

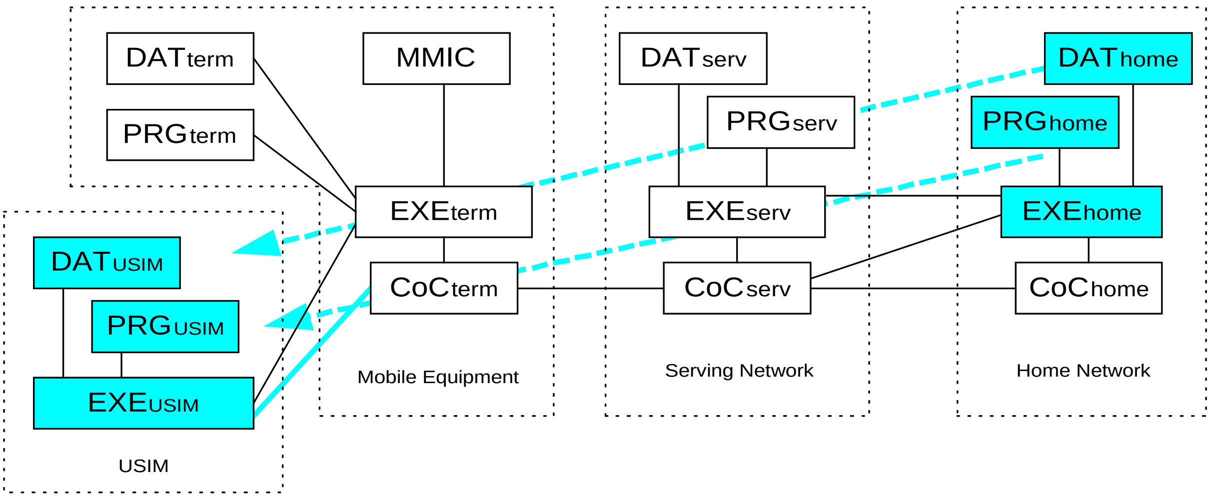
5.1.2 Service execution within the USIM

The support of the VHE can be realized by exchange of service-related data or service logic from the home network to the USIM. The software is then executed on the IC-Card.

Possible Solutions: Remote programming, (enhanced) SIM-toolkit, JavaCard.

Requirements: A secure and standardized execution environment and API within the USIM is needed. This requirement leads to an open USIM operating system. An electronic certification process by using hashing algorithms or encryption techniques can be used to guarantee the source and the quality of the downloaded software. In addition, the copyright question has to be solved.

Uses: This mechanism can be used for personalized MMI for operator specific services, banking application or update of subscriber data.



CoC: Communication Control
DAT: Service-Profile/Data
EXE: Service Execution Environment
MMIC: MMI Control
PRG: Service Programme

Figure 4: Case 2 - Service execution in the USIM

The case of the SIM-toolkit is covered by the capability of the USIM to store service data and programmes as well as to provide an execution environment, which interacts with the mobile terminal.

5.1.3 Service execution within the mobile equipment

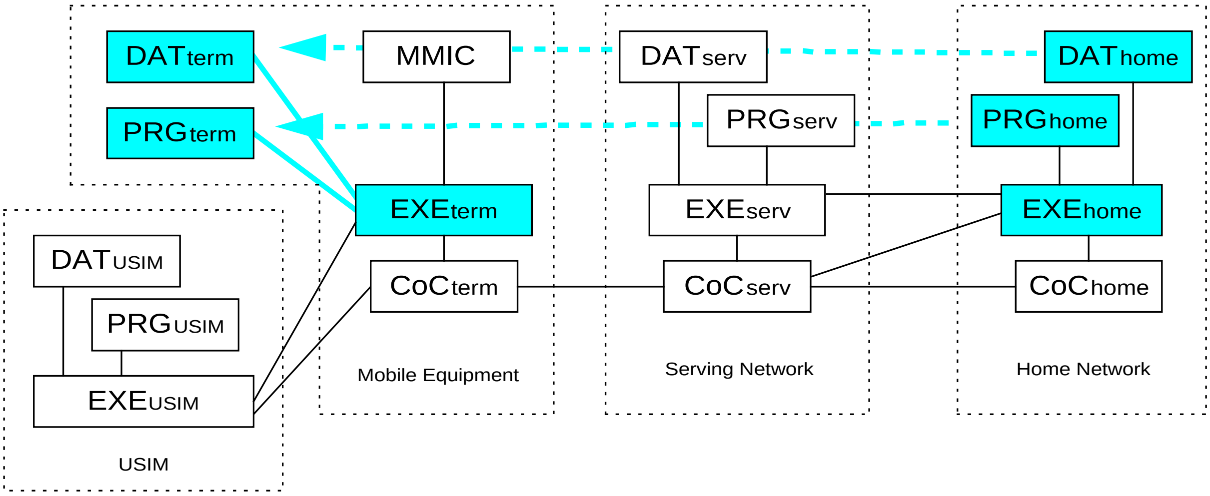
Similarers to the mechanism for the USIM a download of software into the mobile equipment (ME) can also support the VHE. The distinction between two execution environments with different levels of security may be useful: one for the UMTS service provider with larger functionality range and one for value added service providers (VASP) with less functionality but higher security. Functionality and security is meant mainly with respect to the UMTS network and should not limit the range services of the VASP.

Possible solutions: Remote programming, Mobile Station Execution Environment (MExE), Wireless Application Protocol (WAP), Sun's Java-Technology.

Requirements: Similar to the USIM a secure and standardized execution environment and API within the terminal is needed. This requirement lead to an open terminal operating system. Also similar to the USIM requirements an electronic certification process by using hash algorithms or encryption techniques can be used to guarantee the source and the quality of the downloaded software. Also the copyright question has to be solved.

In addition one new aspect has to be considered. ME software could exist which is only operating with a specific USIM enabling adaptation and personalization of ME functions which are related to a specific subscription and should not be available for another one. In contrast is the non-USIM related software e.g. codec updates.

Uses: Codec update, firmware update, download of announcements, enhancements of applications in general.



CoC: Communication Control
DAT: Service-Profile/Data
EXE: Service Execution Environment
MMIC: MMI Control
PRG: Service Programme

Figure 5: Case 3 - Service execution in the mobile equipment

The case of a **mobile station execution environment** is covered in the following way: the execution environment in the terminal would use service programmes and user specific data provided by the ME or the USIM to interact with the communication control and MMI control. The service programme and data may have been downloaded from the home or even serving network.

5.1.4 Service execution within the serving network

Download of software into the serving network.

Possible solutions: Remote programming.

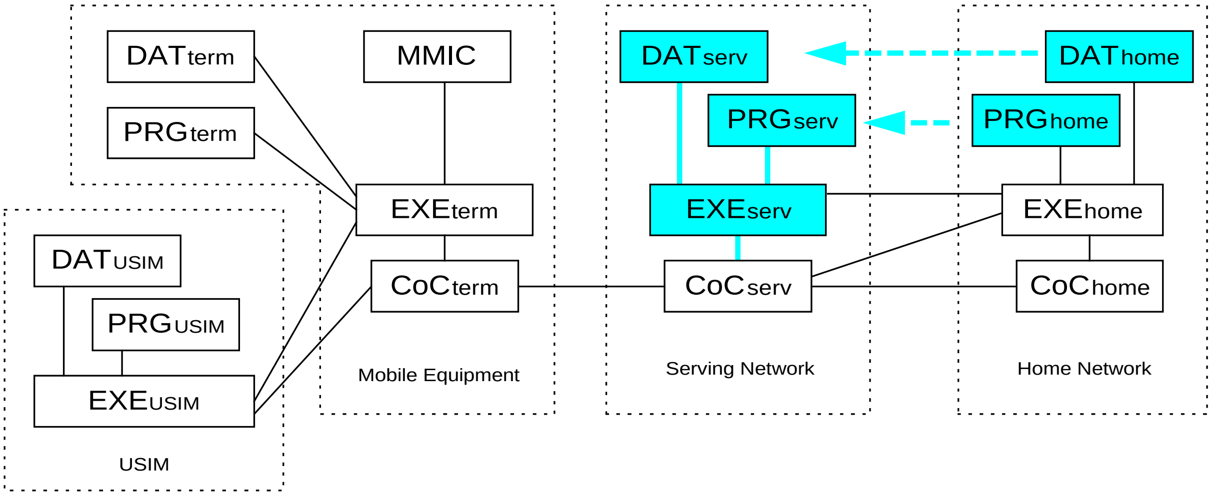
Requirements: Secure and standardized execution environment within the serving network, open system, certification of software, copyrights, secure API. In addition, a standardized protocol is required for the secure and efficient transfer of the relevant service data across network boundaries.

Uses: Download of announcements, upload of user data (e.g. from the USIM) into the visited network e.g. the VLR.

It is not proposed to implement this scenario in the first phase of UMTS. This possibility to realize VHE is only included in the document for completeness and should only be investigated for further phases of UMTS.

5.1.4.1 Downloading from the home network to the serving network

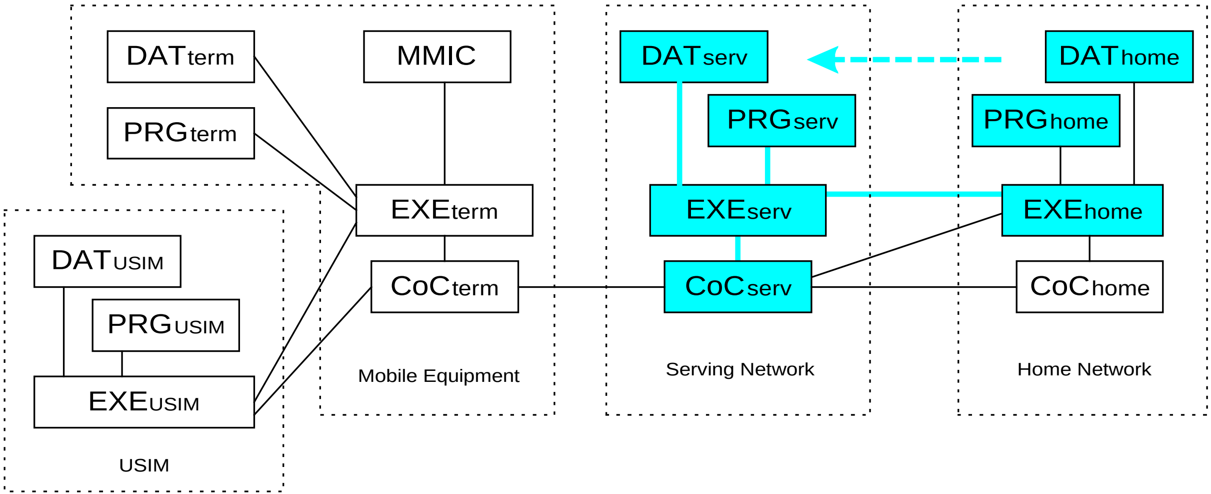
The approach of **downloading of service programmes** (e.g. Java programmes) between networks would be described by a transfer of service programmes and associated service data or only the service programmes from the home to the serving network. The execution environment in the serving network uses these downloaded programme and data to interact with the communication control. The execution environment needs to be standardized.



CoC: Communication Control
DAT: Service-Profile/Data
EXE: Service Execution Environment
MMIC: MMI Control
PRG: Service Programme

Figure 6: Case 4a - Service execution by downloading of service programme and data from the home

Another mechanism relies on interaction between execution environments of home and serving network, which may imply the download of user-specific service data from the home network to the serving network. The actual interaction with the communication control of the serving network will be carried out by the serving network. No programme code is exchanged, as the behaviour and input parameters of the services are either standardized or bilaterally agreed between home and serving network.



CoC: Communication Control
DAT: Service-Profile/Data
EXE: Service Execution Environment
MMIC: MMI Control
PRG: Service Programme

Figure 7: Case 4b - Service execution by downloading of only data from the home network

5.2 Mapping services onto VHE architecture

This subclause provides a mapping between proposed VHE service features and a VHE mechanism.

Table 1: Proposed VHE Mechanisms

Case	Description
1	Service execution in the home network
2	Service execution in the USIM
3	Service execution in the mobile equipment
4a	Service execution by downloading of service programme and data from the home
4b	Service execution by downloading of only data from the home network

Table 2: Mapping between proposed VHE network aspects onto VHE mechanisms

Service Feature - Network Operator Aspect	Proposed VHE Mechanism
Support of VHE in non UMTS networks	1
Remote programming of USIM applications	2
Remote programming of mobile equipment applications	3
Remote programming of serving network service applications and service data	4a, 4b

6 VHE service components

6.1 Services provided by VHE

This subclause contains example services and service presentation styles that are considered potential candidates for UMTS and may need to be delivered via VHE mechanisms.

6.1.1 User aspects

This subclause lists requirements from a user perspective.

6.1.1.1 Networks and their supportable QoS

The user can select how it wants the networks and QoS to be displayed for different types of calls and services.

6.1.1.2 Service cost

The user is able to determine how much a call will cost, did cost or is costing (see advice of charge). The user can select how this information is displayed (tone, icon) globally and on a per call basis.

6.1.1.3 Service selection

To indicate to the user of the services that are (un)available. The user is able to easily find out what services are available or not, particularly when roamed to another network. The user may elect to use a preferred network for outgoing calls of a particular type (can be overridden).

6.1.1.4 Service (profile) modification

Can modify service characteristics from any terminal either globally or on a per call (override) basis.

6.1.1.5 Language preferences

The user can specify language preference in which spoken announcements will be received, even when roaming in another country.

6.1.1.6 Location information

This function keeps track of the user terminal's location. The user can permit release of location information on a per-call or global basis.

6.1.1.7 Roaming

The user is able to roam to any network where commercial roaming agreements exist and is able to have access to all the personalized services which he used in the home environment. The VHE features need to be portable across networks.

6.1.1.8 Call management

This includes, for example, the range of supplementary services e.g. call divert, call barring, call me free. The user is able to divert calls and also specify callers for which the divert is bypassed, is able to bar calls according to time of day, day of week, etc., is able to provide a free call service for specific people/number and is able to negotiate the charges for an incoming call while roaming.

6.1.1.9 Outgoing calls including multimedia and conference calls

A call made by the user to a party/parties (person or machine) and the user can select terminal to use, can select called party or parties (person or machine) from a personal directory which is available from any terminal, can select the QoS required (may be default), may ask for QoS negotiation to take place and can select to pay for all/part/none of the call.

6.1.1.10 Incoming calls including multimedia and conference calls

A call received by the user/person/machine which is made by an external party/parties, who can select the terminal to use, can select to bar/divert/deflect the call, can select to pay for all/part/none of the call and can select the QoS required.

6.1.1.11 VASP incentives and opportunities

The user should be informed (in real time) about VASP incentives and opportunities (advertizing, brokerage) by specifying preferences and should receive information about price changes and special offers.

6.1.1.12 Location services

The user should be able to access personalized location based services. Customers need to allow the context provider to gain location information from the network operator on a per-call or global basis.

6.1.1.13 Video-on-demand

The user should have access to favourite channels/programmes according to stated VHE preferences and should be able to view favourite programmes at most convenient time of day/day of year as specified by the user.

6.1.1.14 Electronic banking

The user shall have access to banking applications over electronic media. Customer should deal directly with the bank and the context provider gives value added, personalized services.

The user can view his statements in real time, set alerts on specific transactions, bank balance etc., make payments for electronic transactions, has access to personalized banking services and can configure his personal preferences.

6.1.2 Network operator aspects

This subclause lists requirements from a network operator perspective.

6.1.2.1 Support of VHE in non-UMTS networks

The service execution within the home network gives the subscriber the possibility to use its own VHE services ("service tunneling") although the serving network might not be able to support the desired service or the storage and execution of the appropriate data, e.g. when using some of the second Generation systems for access to third generation services.

6.1.2.2 Remote programming of USIM applications

The support of the VHE can be realized by custom applications resident on the USIM. A mechanism is needed for the exchange of service-related data or service logic from the home network to the USIM. A secure and standardized execution environment and API within the USIM is needed.

6.1.2.3 Remote programming of mobile equipment applications

The support of the VHE can be realized by custom applications (codec, etc.) resident in the mobile equipment. A mechanism is needed for the exchange of service logic or service-related data from the home network to the mobile equipment. A secure and standardized execution environment and API within the terminal is needed.

6.1.2.4 Remote programming of serving network service applications and service data

The support of the VHE can be realized by service applications resident on a temporary basis in the serving network. A mechanism is needed for the exchange of service-related data or service logic to the serving network. Sources of this information may be the home network. A secure and standardized execution environment and API within the serving network is needed.

6.2 Functions related to support VHE

The VHE capability is an integrated network capability that provides operator specific services that are accessible to the user even when this user is roaming outside the home network (ITU-T Recommendation Q.1711 [6]).

The following functions are identified to support the provisioning of VHE supplementary services:

- provisioning of VHE specific service profiles: this function is required to ensure that the visited network receives the appropriate information to invoke the VHE supplementary services. The VHE service profiles are part of the IMT-2000 subscriber profiles. They contain the trigger information that has to be exchanged between the home network and the visited (serving) network;

- dynamic arming of triggers within the switching network: this function is required to activate the VHE triggers including the trigger profile (e.g. trigger conditions, information, etc.). The arming of these VHE triggers is requested to be activated by the home network or service provider;

- downloading VHE trigger profiles to the visited network: this function is required to reduce the unnecessary signalling between the home and visited network. The VHE trigger profile is downloaded towards the visited network together with the IMT-2000 subscriber profile;

- service logic execution (home network capability): this function requires an agreement between the home network and visited network for the home network to execute service logic from the home network to control the visited network resources. IN supported capabilities must be compatible between the two networks;

- service logic execution (visited network capability): this function requires an agreed upon application execution environment to execute distributed service logic from the home network within the visited network;

- service addressing (visited network capability): this function is required to allow the visited network to address specific service control functions. This is used to request the initiation of a VHE context between the visited network and the home network;
- security and screening functions (visited to home network): these functions are required to enable the networks to verify each other's identity and bind the context between the networks for the execution of the VHE services.

6.3 VHE scenarios

A description of VHE scenarios is proposed by ITU-T Recommendation Q.1711 [6].

Direct Home Command: This scenario (figure 8) calls for invocation of service logic to query for instruction/information to the SCFsn. In this scenario the pre-arrangement between the supporting and the home networks or between the supporting and the visited networks may need screening capabilities of triggering invocation.

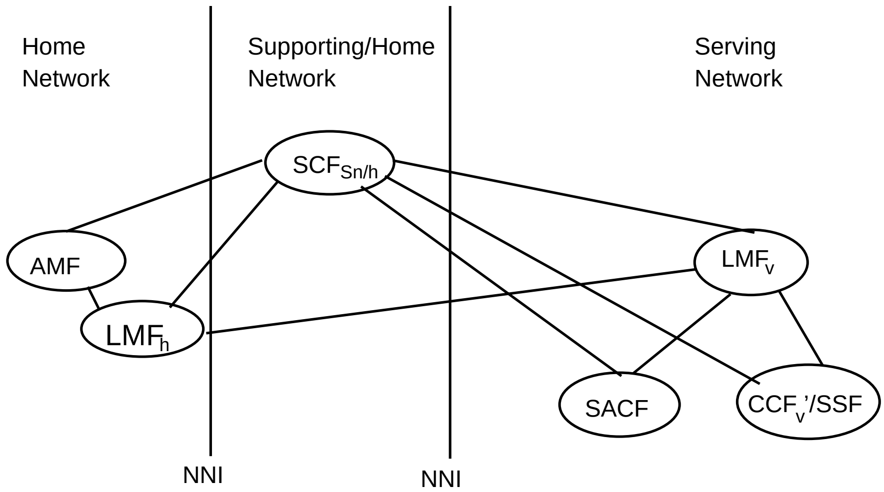


Figure 8: Direct home command

Relay Service Control: This scenario (figures 9 and 10) calls for the invocation of the service logic via the SCFh or the SCFv to query for instruction/information to the SCFsn. In this scenario the pre-arrangement between the supporting and the home networks or between the supporting and the visited networks ranges from relaying, security/screening capabilities to shared service logic.

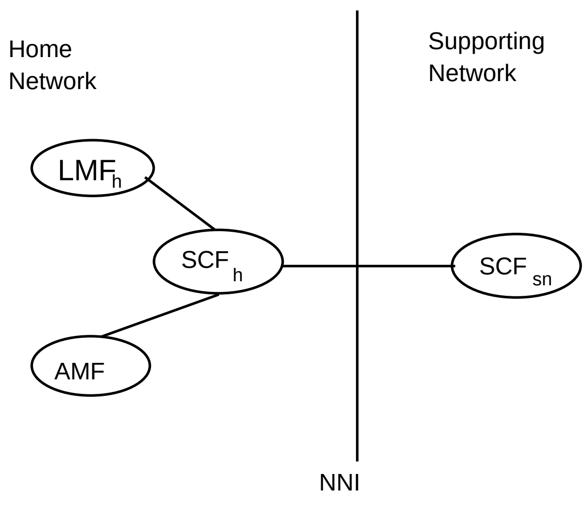


Figure 9: Relay service control mobility management triggers from home network

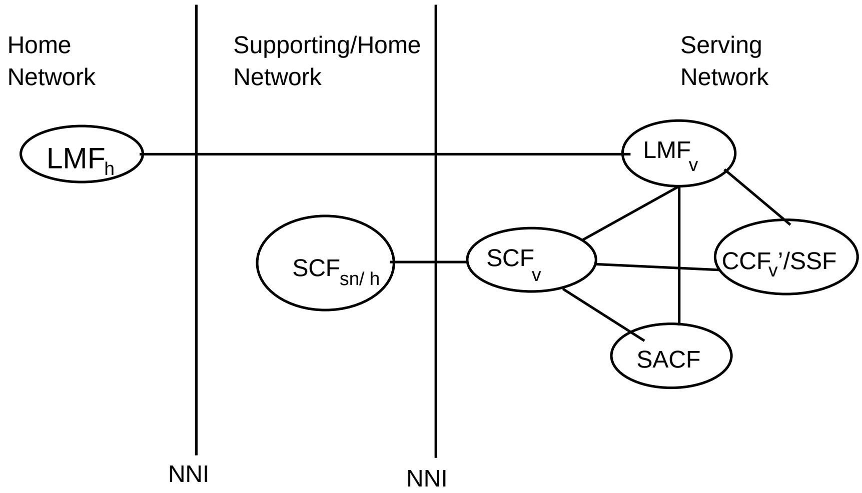


Figure 10: Relay service control call related, call unrelated, and mobility management triggers from visited network

7 Requirements on inter-network interfaces

The invocation of services including the VHE services occurs in the process of a call origination/termination from/to a user. The services are offered according to the information contained in the user service profile. This subclause addresses the "Direct Home Command" scenario. The Direct Home Command VHE scenario calls for the supporting (or home) network to provide service command/logic to the visited/serving network. It is to invoke the service logic in the supporting network via the triggering invocation capability of the visited network. In this scenario the pre-arrangement between the supporting and the home networks or between the supporting and the visited networks may be needed for screening capabilities of the triggering invocation.

7.1 VHE service procedure

In an end-to-end information flow scheme, this procedure consists of four components: call origination; VHE service invocation, call connect, and call routeing. This subclause addresses the information flows for the VHE service logic invocation part, and treats the information flows for the other three parts as common procedures within the context of the end-to-end information flow.

7.2 Assumptions

The following assumptions are made related to this information flow:

- in this scenario the pre-arrangement between the supporting and the home networks or between the supporting and the visited networks is needed for screening capabilities of triggering invocation;
- the serving/visited network has IN capability for triggering the required service logic.

7.3 Common procedure modules used

This scenario uses the following common procedures:

1) Call origination;
2) Call connect;
3) Call routeing.

7.4 Information flow diagram

Figure 11 presents the information flow diagram for the direct home command VHE scenario. The diagram includes only the call origination side of the flows, calling party A.

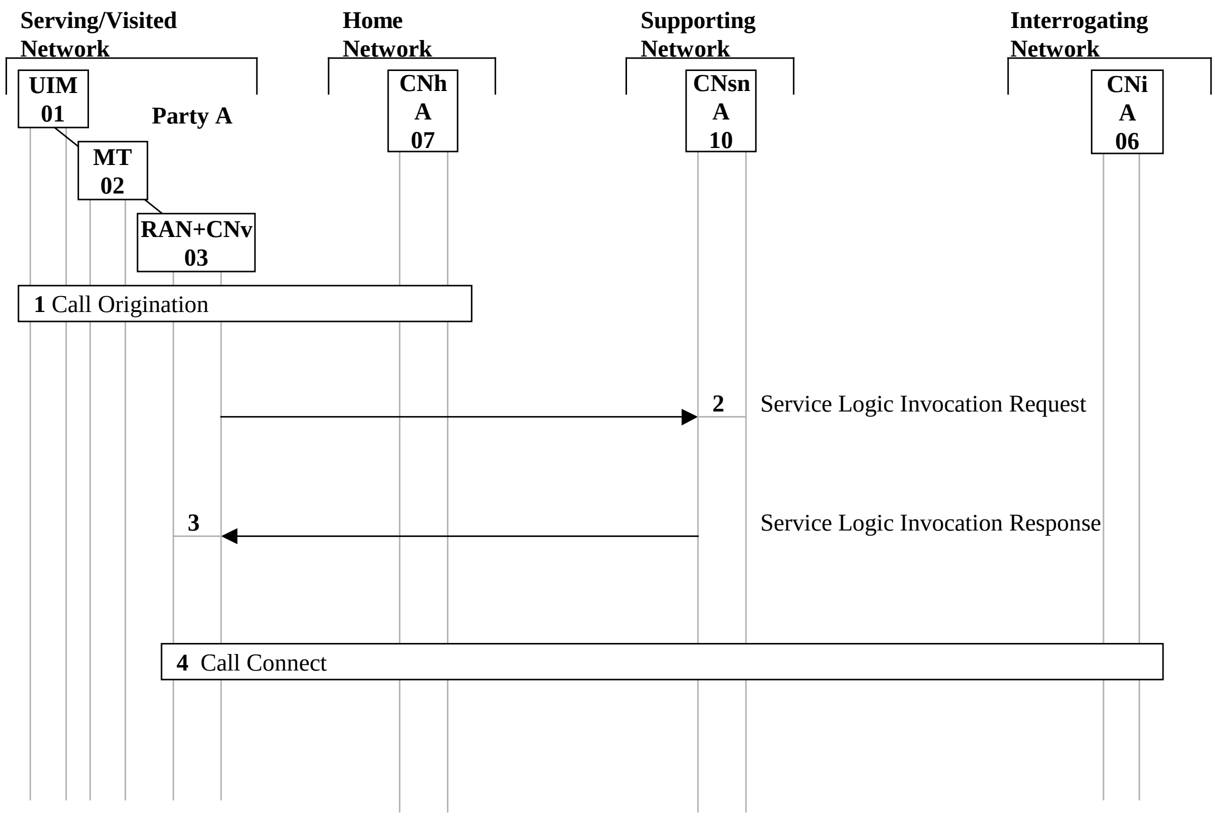


Figure 11: Information flow diagram for IMT-2000 VHE direct home command scenario

7.5 Information flows description

Information flows and functional group actions are described below in the same order as it is in figure 11.

1) **Call origination:** This common procedure is to originate a call by the calling party in a visited network (home or elsewhere). The information obtained from the home network will contain instructions to the serving network for the VHE service invocation (this information/instruction is inclusive of any user data obtained during MT registration).

2) **Service logic invocation request:** This flow is for the serving radio access network or core network to invoke VHE service logic/command per instruction and information contained in the user service profile, and from any active trigger detection point encountered during call processing.

3) **Service logic invocation response:** This flow is from the supporting (home service) network to the serving network for the service logic/command.

4) **Call connect:** This common procedure is employed to continue the process and to connect the call to the interrogating network.

Bibliography

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

- ITU-T Recommendation Q.1751: "IMT-2000 network interconnection Model".

History

Document history		
V1.4.1	September 1999	Membership Approval Procedure MV 9945: 1999-09-07 to 1999-11-05
V1.4.2	November 1999	Publication