

Universal Mobile Telecommunication Service (UMTS); Mobility Management for evolved fixed networks; Part 1: Phase 1



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Foreword

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

The present document is part 1 of a multi-part EG covering the Universal Mobile Telecommunication Service (UMTS); Mobility Management for evolved fixed networks, as identified below:

Part 1: "Phase 1";

Part 2: "Phase 2".

Introduction

UMTS is the European standard within the IMT2000 framework. UMTS will specify an IMT2000 system which will be compatible with and use the IMT2000 standards to support the evolving services. It is therefore essential that the features and the requirements identified for UMTS are related to the IMT2000 requirements.

Backward compatibility is a prerequisite of UMTS phase 1. It is expected that the transition from existing networks to UMTS phase 1 will be as soft as possible. As a consequence, the protocol requirements work specified in the present document, as well as the definition of protocols derived from it, should carefully consider the evolution from existing mobility management protocols.

1 Scope

The present document defines the protocol requirements needed to provide third generation mobility management capabilities in evolved fixed networks.

The present document focuses on the protocol requirements for the first phase of UMTS as defined by 3GPP.

3GPP defines G-UMTS based on GSM evolution. The present document studies how these 3GPP requirements can be applied to the evolution from fixed networks towards UMTS.

In particular, the present document will address the case of cordless and fixed access to UMTS, including access from private networks.

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] TS 23.101: "General UMTS Architecture 3.0.1".
- [2] TR 23.930: "Iu Principles 3.0.0".
- [3] ITU-T Recommendation E.164 (1997): "The international public telecommunication numbering plan".
- [4] ETS 300 557: "Digital cellular telecommunications system (Phase 2); Mobile radio interface; Layer 3 specification (GSM 04.08 version 4.22.1)".
- [5] ETS 300 359: "Digital cellular telecommunications system (Phase 2); Mobile-services Switching Centre - Base Station System (MSC - BSS) interface; Layer 3 specification (GSM 08.08 version 4.12.1)".
- [6] ETS 300 974: "Digital cellular telecommunications system (Phase 2+); Mobile Application Part (MAP) specification (GSM 09.02 version 5.12.1 Release 1996)".
- [7] ETS 300 605: "Digital cellular telecommunications system (Phase 2); Information element mapping between Mobile Station - Base Station System (MS - BSS) and Base Station System - Mobile-services Switching Centre (BSS - MSC) signalling procedures and the Mobile Application Part (MAP); (GSM 09.10 version 4.4.1)".

3 Definitions and abbreviations

3.1 Definitions

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

Private access system: access system owned and operated by customer, located within the customer's premises and connected to a public network

Private network: self-contained network owned and operated by customer, located within the customer's premises, possibly may interworking with other private or public core networks

3.2 Abbreviations

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

GPRS	General Packet Radio Service
GSM	Global System for Mobile Communications
HLR	Home Location Register
IMEI	International Mobile station Equipment Identity
IMT-2000	International Mobile Telecommunications for year 2000
IMUI	International Mobile User Identity
MAP	Mobile Application Part
MSISDN	Mobile Station International ISDN Number
TMUI	Temporary Mobile User Identity
UMTS	Universal Mobile Telecommunication System
UNI	User to Network Interface
USIM	User Services Identity Module
VHE	Virtual Home Environment
VLR	Visited Location Register

4 Architecture principles

Uu and Iu reference points are defined in documents TS 23.101 [1] "General UMTS Architecture 3.0.1" and [2], TR 23.930 [2] "Iu Principles 3.0.0".

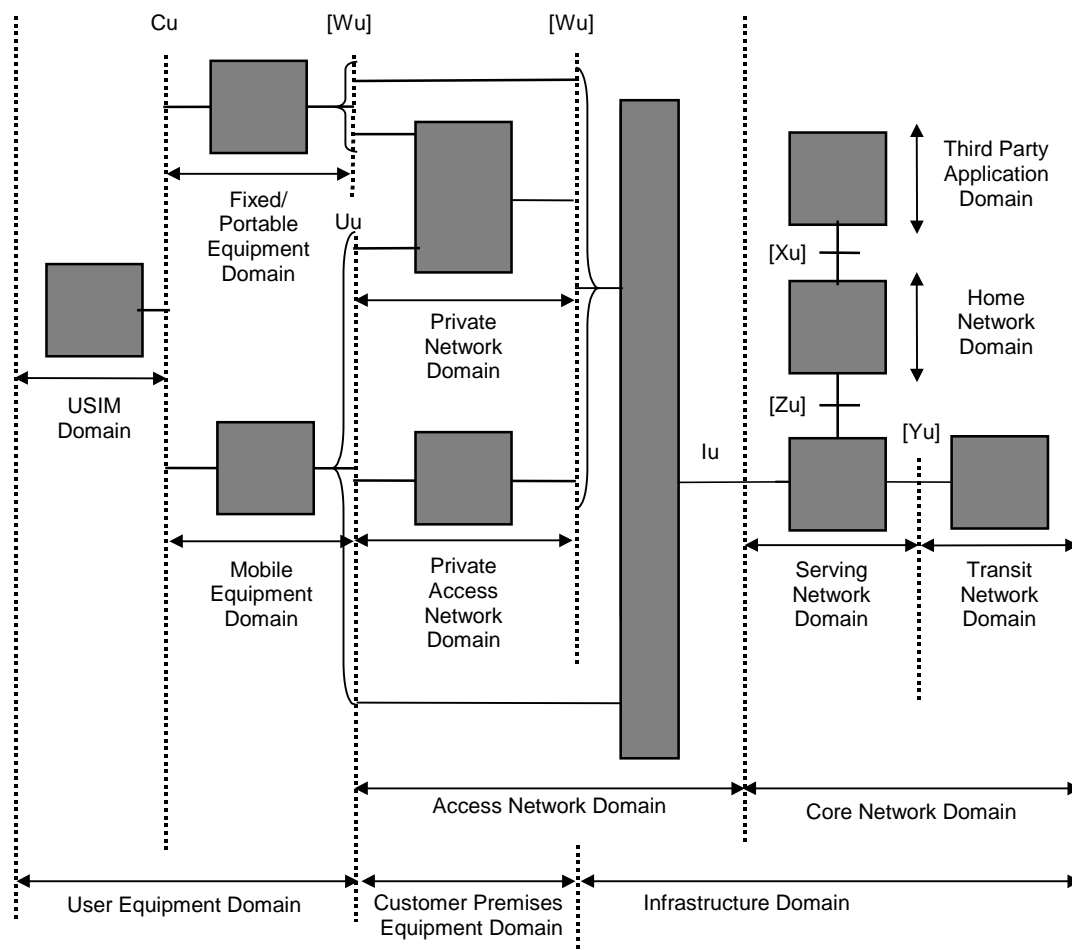


Figure 1: Additional Reference Points for Fixed and Cordless Access to Public and Private Networks

Table 1

	User - Local Mobility Server Interface	Inter Mobility Server Interface
Cellular Scenario	Uu Iu	Zu
Private Access System (Wireless)	Uu Iu	Zu
Private Network (Wireless)	Uu	Zu Iu
Private Network (Wired)	Wu Wu ⁺	Zu Iu
Public Access System (Wired)	Wu Iu	Zu

The definition of the Wu interface is needed in order to provide access to UMTS services from wired access, private networks as private access networks. The Wu standardization is not addressed in the current work of 3GPP. As a consequence, work on the Wu reference point should be started within ETSI.

The introduction of the Private access and wired access also have impact on the Iu interface. These impacts should be taken into account in the definition of the Iu.

5 Parameters relevant for mobility management

The analysis of the required parameters shows that they can be derived from the location management operations designed in GSM.

The following identities are needed:

Table 2

Identities	UMTS phase 1 identity
Mobile Equipment	IMEI
Mobile Subscriber	IMUI MSISDN
TemporaryIdentity	TMUI (used on the radio interface instead of the IMUI)
Routing address/ Roaming Number	MSRN

Some other needed parameters are the network elements addresses.

6 Description of mobility procedures

6.1 List of needed mobility management procedures

All mobile systems, including second generation mobile systems such as GSM, use a very similar set of procedures for the support of mobility management.

These procedures are listed below:

- P1: Location registration/update: updating of location information from the visited network to the home network;
- P2: Location cancellation: indication from the home network to a visited network that a subscriber has left the area it controls;
- P3: Routing information retrieval: from the interrogating network to the home network and from the home network to the visited network;
- P4: Authentication information retrieval: exchange of authentication between the home network and the visited network.

Some other procedures are implied by mobility, but cannot be directly considered as mobility procedures, as they are more closely related to service provision and support of VHE:

- transfer and updating of the service profile from the home network to the visited network;
- per-call basis retrieval by the visited or originating network of subscriber profile elements from the home network.

6.2 Roaming and interworking requirements

In the scenarios, terminal A is used to indicate a user with a UMTS terminal containing a valid UMTS USIM which includes the user's IMUI.

6.2.1 Roaming within a public network using public access systems

This scenario covers the trivial case where terminal A has a subscription to public network PU-1 and can roam within the coverage area of PU-1.

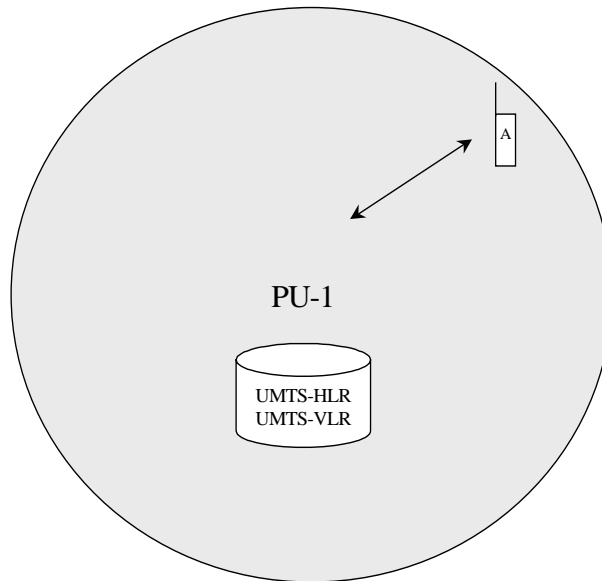


Figure 2: Roaming within a public network using public access systems

The MSISDN relating to the subscription with the public network conforms to ITU-T Recommendation E.164 [3] and the public network numbering plan.

The IMSI/IMUI associated with terminal A identifies the home public network PU-1.

Location registration procedure

The following represents the sequence of events for terminal A performing a location registration procedure in public network PU-1.

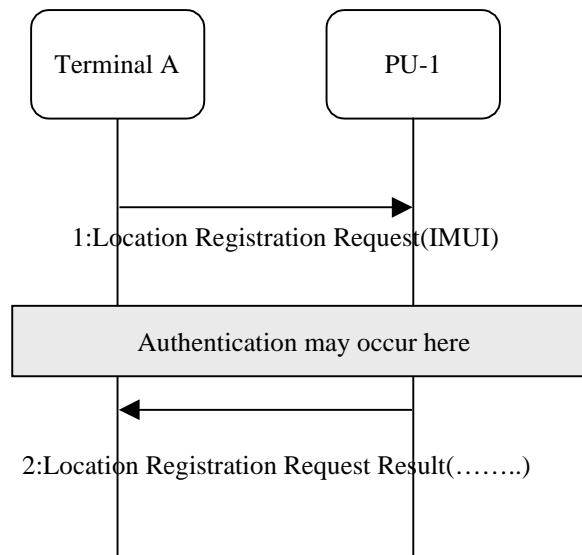


Figure 3: Information Flows for location registration procedure

Table 3

Flow	Comments
1	Terminal A initiates a location registration request to the public network PU-1. The public network PU-1 analyses and recognizes the IMUI and updates terminal's location.
2	The public network confirms the location update to terminal A.

It is assumed for this case that since only one network is involved, only the information flows between the terminal and the access network need be standardized. However, this could be seen as a restrictive practice and not consistent with the objectives of fixed-mobile convergence. Therefore the following scenario is more appropriate for alignment of internetwork signalling interfaces.

6.2.2 Roaming between public networks using public access systems

GSM public network operators have established bilateral roaming agreements with other GSM operators. This approach will form the basis for roaming in the initial phase of UMTS. The subscription associated with terminal A with public network PU-1 allows public-network to public-network roaming.

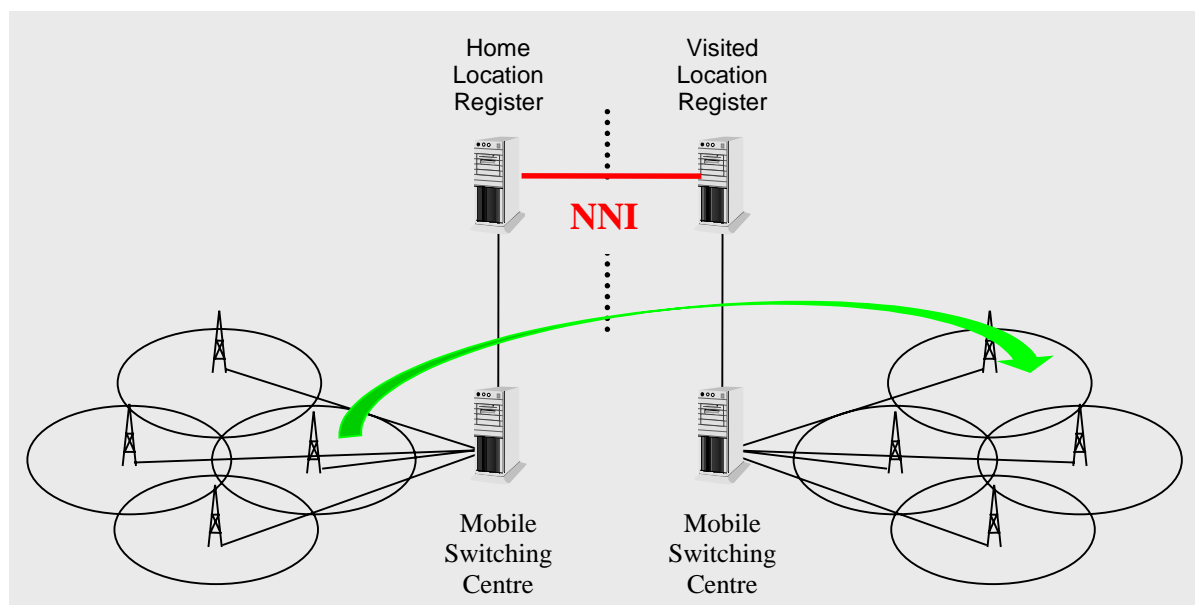


Figure 4: Internetwork roaming scenario

In the following scenario, the public network can be any variant of the UMTS family member of IMT-2000. For example, UMTS cellular using the UTRA and G-UMTS core network or a cordless UMTS access served by an evolved fixed network. Appropriate standardized internetwork interfaces, procedures and roaming agreements need to be in place for seamless service provision across these different access networks. It is these interfaces and procedures for location registration that are addressed in the present subclause.

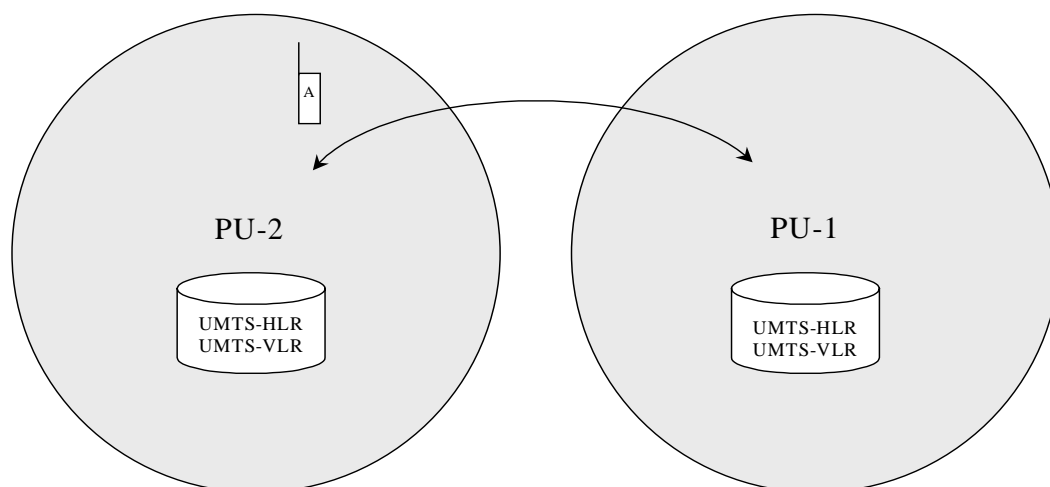


Figure 5: Roaming between public networks using public access systems

The MSISDN relating to the subscription with the public network conforms to ITU-T Recommendation E.164 [3] and the public network numbering plan.

The IMUI associated with the subscription of the user associated with terminal A identifies the home public network PU-1.

Location registration procedure

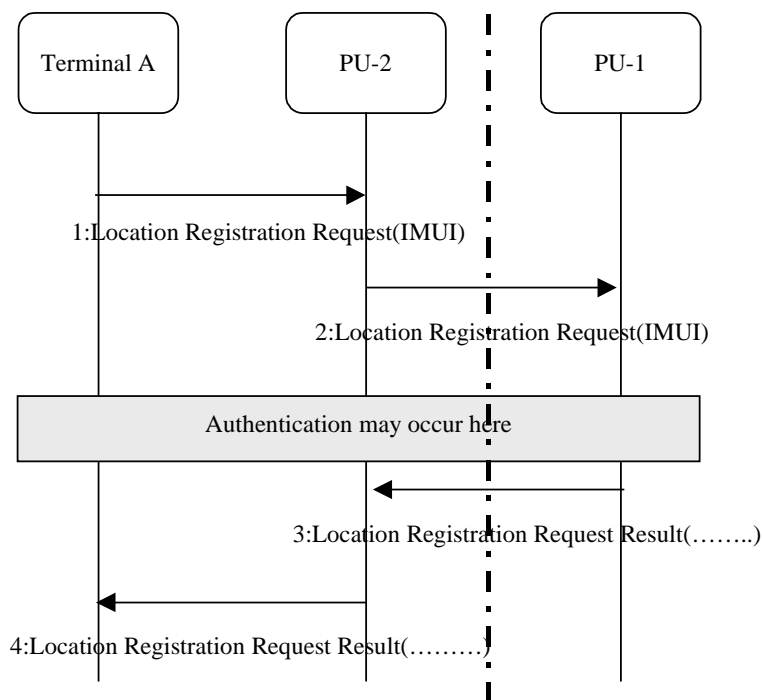


Figure 6: Information flows for location registration

Table 4

Flow	Comments
1	Terminal A initiates a location registration request to the public network PU-2. Public network PU-2 identifies the home public network from the IMUI, allocates a VLR in PU-2 and forwards the location registration request to the public network PU-1
2	The home public network analyses and recognizes the IMUI, identifies the associated public network subscription and updates the terminal's location. A roaming agreement exists between PU-2 and PU-1.
3	The public network PU-1 completes the location registration procedure by sending the location registration request result to the visited public network PU-2.
4	The visited public network PU-2 updates the VLR and confirms the location update to terminal A.

The structure of the information flows 2 and 3 must be harmonized across the different UMTS family members to ensure seamless operation. The mobility procedures are described in ETS 300 557 [4] and should also be used as the basis for the internetwork signalling protocols for evolved fixed networks. In a more general manner, fixed network evolved UMTS needs to be compatible with the UMTS procedures of G-UMTS.

6.2.3 Other roaming scenarios

For the purposes of identifying requirements for protocols across the NNI, the model described for roaming between public networks using public access systems can be used. It allows for different internal implementations of UMTS family members (where required) as long as it retains consistent protocol requirements on the NNI.

6.2.4 Conclusions on protocol requirements

The subclauses above show some requirements on the protocols of fixed-network evolved UMTS. These requirements are related to roaming and interworking between different UMTS systems.

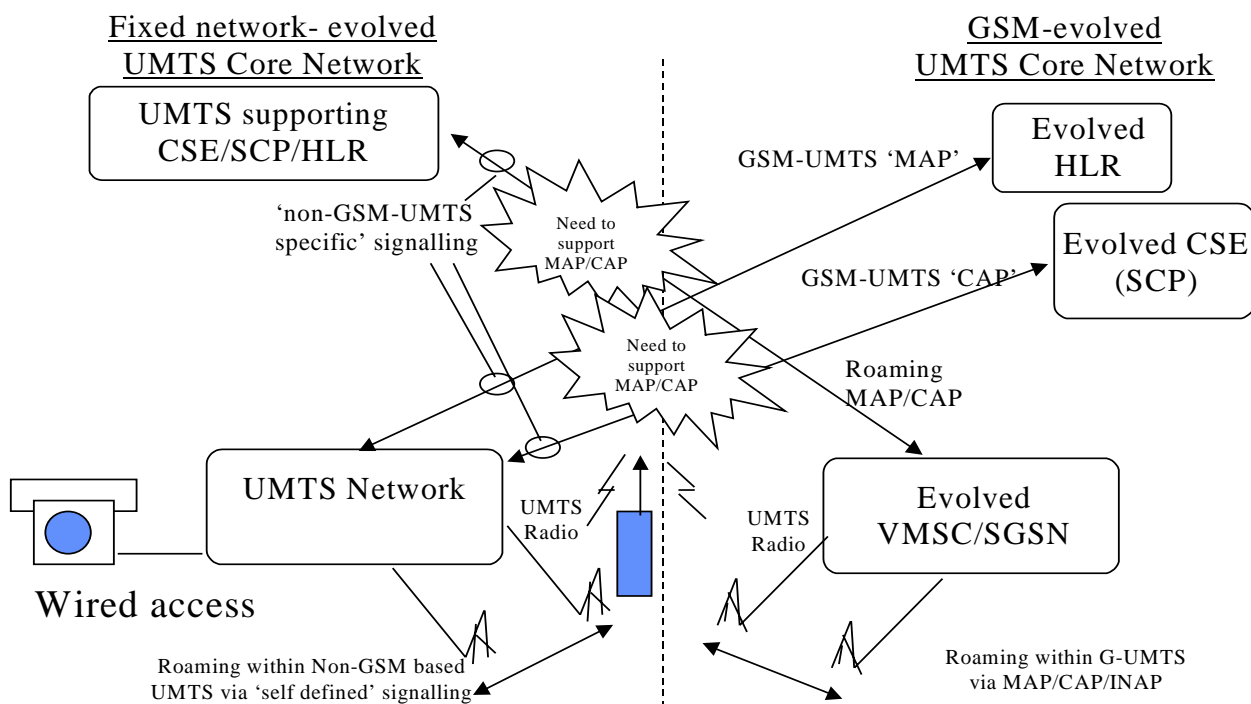


Figure 7: Internetworking architecture between UMTS networks

The interworking of G-UMTS, as defined in 3GPP, with UMTS networks resulting from the evolution of fixed networks will imply the support of the protocols used in the GSM-evolved UMTS core network. In particular, whether it results from the evolution of GSM or from the evolution of fixed networks, UMTS phase 1 will need to be conform to the interfaces defined in the following ETSI standards:

- ETS 300 557 [4] Call Control, Mobility Management on the UNI;
- ETS 300 359 [5] Air interface layer 2 protocol;
- ETS 300 974 [6] MAP;
- ETS 300 605 [7] Inter-switch hand-over protocol.

In a similar manner, the support of packet-switched services will require the conformance to GPRS specifications.

6.3 Classification of mobility management procedures

The mobility management operations listed in clause 6 and its subclauses can be classified as follows:

Location management operations:

Location update	P1;
Location cancellation	P2;
Service profile transfer	(related to service provision).

Routeing data management operations:

Routeing address request	P3, interrogating to home;
Provide roaming information	P3, home to visited.

Authentication operation:

Authentication information retrieval	P4.
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State machines have been developed in the IN context and in second generation mobile systems. These techniques can be applied for the above procedures.

Bibliography

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

- TR 101 695: "Integrated Services Digital Network (ISDN); Universal Mobile Telecommunications System (UMTS); ISDN-UMTS Framework".
- ITU-T Recommendation Q.1701: "Framework for IMT-2000 networks".
- ITU-T Recommendation Q.1711: "Network Functional model for IMT-2000".
- ES 201 721: "Strategies for the evolution of fixed networks to UMTS".

History

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