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Contents

Foreword

This Technical Report has been produced by the 3GPP.

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Introduction

UMTS is a telecommunications system which allows person to person and machine to machine interactions. Addressing schemes allow users (people or machines) to indicate to the system the target of a particular communications session. Traditionally, this has involved a user dialling a telephone number to indicate the destination of a telephone call.

This report describes the desirable features of the UMTS advanced addressing scheme requirements for numbering and addressing for UMTS , and example directory, application and translation mechanisms which could be used to enhance the service to the customer.

A key requirement is the need for UMTS users to be able to interwork with users on legacy schemes. These would encompass telephony, data and multimedia.

The requirements developed in this report are to be used within ETSI NA2 to develop a proposal for numbering and addressing applying existing schemes or developing new ones. Other ETSI groups will be involved in the development of addressing of applications and network elements.

1   Scope

This document defines the requirements for numbering and addressing for UMTS. This technical report is aimed at generating discussion and should agreed with ETSI WG NA2. The responsibility for developing of Numbering and Addressing schemes for all networks being in ETSI NA2.

2   References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies.

- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1]   ITU-T E.164 (1997): "The International Public Telecommunications Numbering Plan".

[2]   ITU-T E.168 (1993): "Application of E.164 Numbering Plan for UPT".

[3]   ITU-T E.212 (1993): "Identification Plan for Land Mobile Stations".

[4]   ITU-T X.121 (1993): "International numbering plan for public data network".

[5]   ITU-T X.400 (1993): "Message handling system and service overview".

[6]   UMTS 22.01 (1997): "Universal Mobile Telecommunications System (UMTS);UMTS Service Principles".

[7]   ITU-T E.191 (1996): "B-ISDN Numbering and Addressing".

3   Definitions and Abbreviations

3.1   Definitions

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

Address: A string or combination of decimal digits, symbols, and additional information which identifies the specific termination point(s) of a connection in a public network(s) or, where applicable, in interconnected private network(s).

Addressable: The ability to direct a call towards a user based on this name or number

Domains: (t. b. d.)

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

Identity: (t. b. d.)

International USIM Identifier: The IUI uniquely identifies a USIM.

Label: A number or name as defined below.

Name: A name is an alpha numeric label used for identification of end users and may be portable.

Network Termination Point: A network termination point is a logical concept which may refer to a person, a persona (e.g. work, home etc.), a piece of equipment (e.g. NTE, phone etc.), an application, or a location. (ITU definition)

Number: A string of decimal digits that uniquely indicates the public network termination point. The number contains the information necessary to route the call to this termination point.

A number can be in a format determined nationally or in an international format. The international format is known as the International Public Telecommunication Number which includes the country code and subsequent digits, but not the international prefix.

USIM: User Service Identity Module is an application residing on the IC-Card used for accessing UMTS services with appropriate security.

NOTE 1: These definitions should be discussed with ETSI NA2

3.2   Abbreviations

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

ASEA	ATM End System Addressing
CC	Country Code
DDI	Direct Dial In
DN	Destination Network
DNS	Directory Name Service
IMSI	International Mobile Subscriber Identiy
IMUN	International Mobile User Number
IUI	International USIM Identifier
MCC	Mobile Country Code
MGT	Mobile Global Title
MNC	Mobile Network Code
MSIN	Mobile Station Identification Number
NDC	National Destination Code
NMSI	National Mobile Station Identifier
NUI	National User / USIM Identifier
NSAP	Network Service Access Point
PSTN	Public Switched Telephone Network
SN	Subscriber Number
TC	Trunk Code
UMTS	Universal Mobile Telecommunication System
UPT	Universal Personal Telecommunication
USIM	User Service Identity Module
VHE	Virtual Home Environment

4 Background

In any discussion on numbering and addressing there first needs to be a clear understanding of the terminology. It should be noted that assumptions have been made in this report which should be agreed with ETSI NA2. For this report the following understanding is used. The name or number are used to uniquely label the users and addresses are used for routing. The user perspective will be that the number will be the way to reach another user but from the network point of view the number may not be directly used to reach the called user.

Traditionally, parties have been called by means of an E.164 telephone number, by a short number (on a PABX), by an X.121 number on packet data networks or by an X.400 or Internet name for electronic mail. UMTS is intended to be universal, so although it may support all these existing mechanisms, it should also support a more integrated approach, where calls can be set up without having to use all these mechanisms together.

5 Requirements

The following subclauses describes different requirements for UMTS numbering schemes, addressing schemes, and identification schemes:

- The user shall be able to initiate communications with another party using a label to identify that party. This might be a logical label referring to a job function, and advertising response line etc. and would be resolved into a real terminal address by the UMTS system transparently to the user. Labels shall be capable of being stored in an address book which shall be accessible from any terminal that the user is registered on.

- Users also have requirements with regard to addressing for receipt of communications. The user shall be able to have a number of different persona (e.g. business and personal), each of which can be managed independently.

- When receiving communications, the recipient shall perceive the caller's label in the appropriate role. For example, when making a call as chairman of an ETSI committee, then that persona will be presented as the caller ID. When making a personal call, then the underlying persona would be presented.

- Some labelling schemes should be fully independent of the supporting serving network and the home environment, allowing users to transfer this label to another home environment.

- Serving networks need to be able to communicate with, authenticate and commercially deal with the home environment associated with any USIM being registered on their network. This shall require a USIM identity scheme which uniquely identifies each USIM, and a mapping scheme which allows the USIM identity to be used as a identifier with the "owning" home environment.

- Serving networks also require to be able to route efficiently any communication to and from USIMs (or rather the devices on which they are registered). An address scheme is therefore required for operators to access and map any outgoing or incoming communication to USIMs and thus devices on their networks.

- Operators will also require mapping functions at locations where interworking with legacy networks is provided.

- The home environment shall be able to Resolve the ownership of any USIM to his own, or another environment.

- The home environment shall be able to map a range of labels to any of his USIM. This shall include one or more labels of the same type, and one or more labels of different types.

- Name labels shall allow extended character sets.

- Labels may be used to identify groups as well as individual terminals or people.

- Support E.164 Number Portability, either directly or indirectly, in accommodation with fixed network number portability schemes is required.

- The UMTS system shall allow a end to end transparent application addressing of a large variety of different applications and services on a terminal.

- 3rd party services should be reached by a label. Based on the selected charging policy for this services the calling party or/and the home environment of the calling party needs to be uniquely identified.

- The possibility to address a terminal (rather than a subscriber) may be required for some applications and shall be supported.

- Although a called party may be addressable via different means, he should be reachable independent of the medium. This would require a new functionality which can map name (alpha numeric string) / number (digits) for call routing purposes. Networks might only support basic functionality while advanced databases might be offered by 3rd parties.

- Sequential label translation shall be supported.

- In order to permit interworking with legacy networks, address interworking with common legacy network addressing shall be supported. In principle, this shall include interworking with any networking addressing scheme, but the following schemes listed below shall specifically be supported:

    - E.164,

    - E.168,

    - E.212,

    - X.121

    - ASEA

    - Internet

6   Discussion

It is likely that subscriber's telephone numbers will be associated with a subscriber and home environment rather than a network. The subscriber may have the flexibility to keep his name or address when changing the home environment. The possibility to address a terminal (rather than a subscriber) may be required for some applications and should not be excluded.

A called party is typically reachable by several, today incompatible, naming, numbering, and addressing mechanisms, yet a user is a single entity with a single identity. Thus, it should be possible to telephone a user with an e-mail address if the user's telephone number is not known, or to e-mail the user to his telephone number, if the user's e-mail address is unknown. This would appear to require access to a database holding the desired information. It may be possible to map the name or number (Internet name, telephone number, NSAP number) to the called party address the user is at.

Thus although a called party may be addressable via different means, he should be reachable independent of the medium. It is recognised that this would require a new network functionality which can map the address, name (alpha string) / number (digits) and service type for routing purposes. This would add significant complexity which is seen as optional in a network, but which should not be excluded. It is also noted that alpha addressing is popular in some countries (especially in US and Australia for advertising), where the association between the alpha characters and numbers on the standard keypad is exploited. Maybe this should be further evolved.

However, this should not prevent the customer having different roles for different environments - e.g. a personal domestic number and a different business number. At home, the different occupants may have separate numbers, although these may be associated together. Thus a caller might call, indicating the desired individual at that house, while also allowing another to respond to the call if the first is not available. This might be achieved by a mixture of Multiple Subscriber Profile and sub-address (as today) or by a new mechanism.

It is clear that the naming mechanism shall not be restricted to numeric format (as today with * and #), but also it shall support alpha-numeric naming, of adequate maximum length. It would seem desirable to be able to provide a user friendly access so that e.g. the " . @ . " format used for the Internet might be prompted in a user friendly format. This might be used as an alternative to traditional numbers for a variety of naming and numbering applications.

More advanced requirement could logically be extended to cover calls to a car, based on the vehicle registration number (either to the person in that car or to the car management system e.g. to avoid breakdown or to arrange a repair), to a house - based on e.g. post code and house number - (i.e. to call or e-mail that house rather than to use the traditional postal service).

6.1 Interworking with Legacy Schemes

In order to permit interworking with legacy networks, address interworking with common legacy network addressing shall be supported. In principle, this shall include interworking with any networking addressing scheme, but the following schemes listed below shall specifically be supported:

- E.164

- E.168

- E.212

- X.121

- Internet

- ASEA

6.2 Unique Internal Identity of all USIMs

Many of today's networks operate an internal numbering scheme which is invisible to the user. For example, GSM allocates IMSI identity to every SIM card and uses these numbers internally for routing of calls and service requests. [3]

Each UMTS USIM shall be allocated a unique identity which may be used for internal call routing and addressing. An administrative procedure shall ensure that duplicate USIM identities cannot be issued.

6.3 Support of Label Portability

The use of label mapping schemes implicitly allows for label portability (i.e. names or numbers can point to different subscriptions on demand). However, additionally there is a requirement to support the E.164 number portability schemes being developed for both fixed and mobile networks. Therefore, label portability within the geographic domains, restricted to the labelling scheme used, shall be supported as stated in UMTS 22.01 [6].

E.164 Number Portability shall be supported within 3rd generation systems and from a 2nd generation system to a 3rd generation system.

7 Suggestions

This clause lists the standardisation requirements based on the advanced addressing schemes discussed in this report.

7.1 UMTS Numbering Scheme

The E.168 [2] scheme describes different possibilities that shall be used in future UPT environments. It is closely related to the E.164 numbering scheme. A similar approach in terms of numbering principles shall be used for UMTS. Numbers shall be assigned to different domains:

- a home environment domain / serving network domain;

- a local area domain (home related scheme);

- a country or geographical domain (national scheme);

- the international domain (international global scheme).

It shall be possible to support all domains in parallel, i.e. that a country can assign numbers e.g. for national services, local services and networks. Number portability shall be restricted to the assigned domain, i.e. numbers assigned to a local area are portable between home environments in this domain.
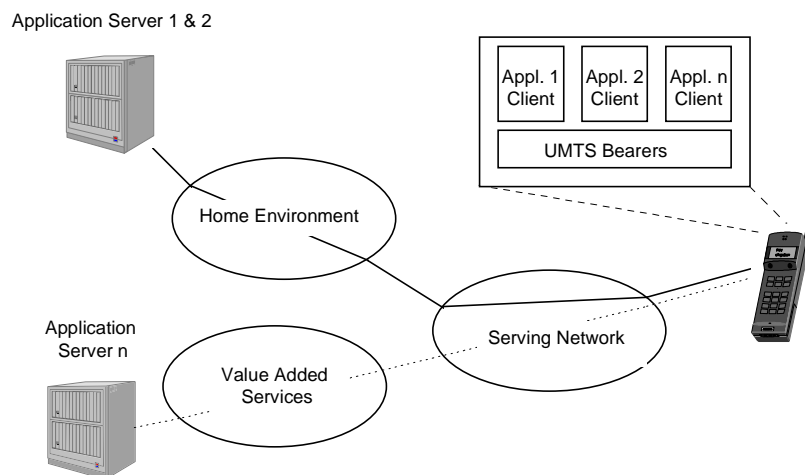
7.2 UMTS Identity Scheme

The purpose of an identity scheme is to allow identification of users/subscriptions independent of the numbering or labelling scheme used by the users. The IMSI shall allow the identification of the services provider and shall be used for signalling and routing purposes ,e.g. using a MGT to reach a HLR like database, and need not to be visible for the user/subscriber. A scheme described in the ITU-T Recommendation E.212 [3] shall be used for USIM identification.

8. Examples

In the following sections examples of UMTS numbering scenarios and realisations were given.

8.1 Application and Service Addressing

Besides standardised telecommunication services a lot of different specialised applications will be developed which may use non standardised application protocols (e.g. a special unique database application of a company, a application for accessing a voicemail system). To easily support those non standardised applications offered by the Home Environment and Value Added Services (see figure 1), the UMTS system shall allow a end to end transparent application addressing of a large variety of different applications and services on a terminal. Similar mechanisms like the ISDN subaddress or a wide non restricted range of teleservice identifiers might be sufficient.

Figure 1: Application and Service Addressing

8.2 Label Translation

User labelling by means of e.g. car registration number, e-mail address or any other future addressing scheme could be offered e.g. by a special address book service / application that will be part of the VHE offered by the home environment and may not need to be standardised. In the following a possible solution is described (see figure 2).

If the user enters a label of a called party or a party he wants to send a message to, a label translation application in the terminal analyses the label and looks for an UMTS routing address that may be stored in the USIM module. This address might be a routing address (e.g. MGT (mobile global title)) toward an HLR like function for UMTS or GSM subscribers or a RN (routing number) for fixed ISDN terminals. This addresses are used inside the terminal / USIM and are not shown to the user. Assuming there is an entry, the terminal initiates a call setup procedure. This implies e.g. sending the HLR address towards the network to start a direct routing number request or sending a direct connect message with a routing number.

If an address is not available, the application contacts a linked label translation service to find the corresponding address via a defined UMTS data channel. The result is transferred to the terminal and it may be stored for future use.

Special databases might be part of 3rd party commercial offerings. Only the basic addressing schemes and mechanisms to store routing numbers or addresses on the USIM have to be standardised.
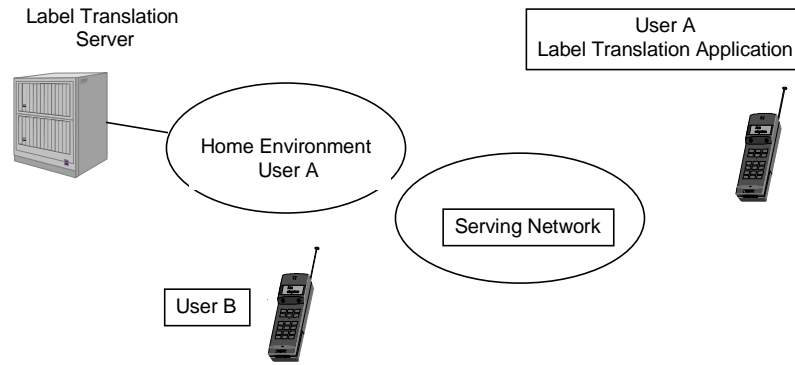
Figure 2: Label Translation Service

With this label translation capabilities, any future possible labelling scheme can be offered to the user and it is up to the home environment to offer it. The service can be speech based, or based on any future labelling scheme. For the final destination addressing a unique UMTS addressing scheme is necessary. This scheme need not to be visible to the user.

Using this kind of addressing even the problems of number portability may be overcome. If the network detects that the address has changed, the label translation application will automatically search for the new UMTS address and add it to the user's personal address book.

8.3 Principle of a Label Translation Database

To fulfil the different requirements a label translation database is required, which can be used for flexible addressing. The following queries to a label translation database shall be possible:

- user initiated (based on an application triggered by the user)

- Network initiated (every time the network faces an unknown label or number for which no further routing can take place)

Furthermore a UMTS user shall have the possibility to access the database for entering label updates for his own identification. The access to the database shall only be possible in secure manner, i.e. the necessary security mechanisms need to be defined to prevent fraudulent use of the access.

Since it is not possible to have just one logical database (even if physically this is possible) which is used for every kind of address translation, the possibility shall exist, that one database can access and address several other databases.
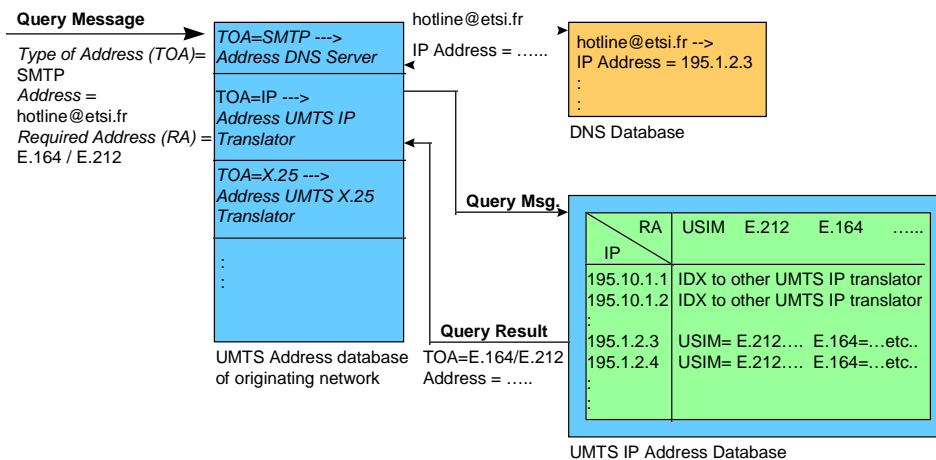
For an example see figure 3.
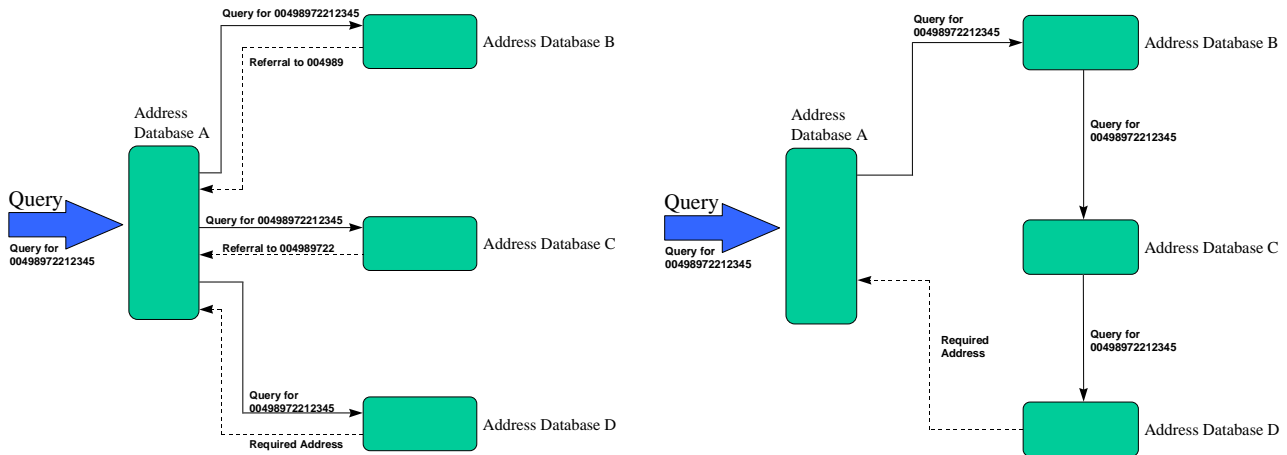

Figure 3: Label Translation Database

To avoid overload of certain label translation servers and to ease maintenance, two different query procedures shall be provided, a recursive procedure and an iteration procedure (see figure 4).

Figure 4: Address Resolution

In the recursion example (left) the label / number database D doesn't respond to the label database the query was coming from but sends the response directly to the database which was initiating the query.

If the database would respond to the database the query was coming from the 'interactive' solution wouldn't avoid signalling traffic but would just distribute it over the whole network.

In the iteration example (right) the query initiating database has to send a temporary ID to database B which forwards it to database C and so on. Database D has to send the temporary ID back to database A. If the ID is known by database A, the response message is accepted.

To speed up label translation caching of already translated addresses in the UMTS CN and/or the USIM/terminal shall be possible. Furthermore the label servers shall have caching capabilities as well. Of course cached data should be refreshed after a certain time of period.

8.4   Interfaces of Label Translation Database

For advanced addressing capabilities a UMTS label translation database is needed. This database shall support queries via the following protocols:

-    TCP / UDP (for interface to INTERNET DNS).

-    INAP / CAP (for compatibility with PSTN / ISDN / PLMN Number Portability for circuit switched calls).

-    SCCP (for compatibility with PSTN / ISDN / PLMN Number Portability for circuit switched and non circuit switched calls).

-    Any UMTS specific interface especially designed for the purpose of home environment specific advanced labelling schemes.

8.5   Sequential Address Translation Schemes

The advanced addressing schemes of UMTS shall allow users to originate communications (voice calls, multimedia calls, datagrams etc) by indicating the desired target of the communication with a series of relevant factors. An address resolution process shall map this to a physical address for internal routing purposes. The physical address may not be known to the originator (or the recipient) of the communication, and be used only internally within the UMTS routing architecture. More than one translation function may be used when resolving the final address.

For example:

A user want to call the chairman of an ETSI standards committee. In today's system, this might involve

-    determining the telephone number for ETSI secretariat;

-    calling the ETSI secretariat and asking who the chair of the committee is;

- asking what his telephone number is;
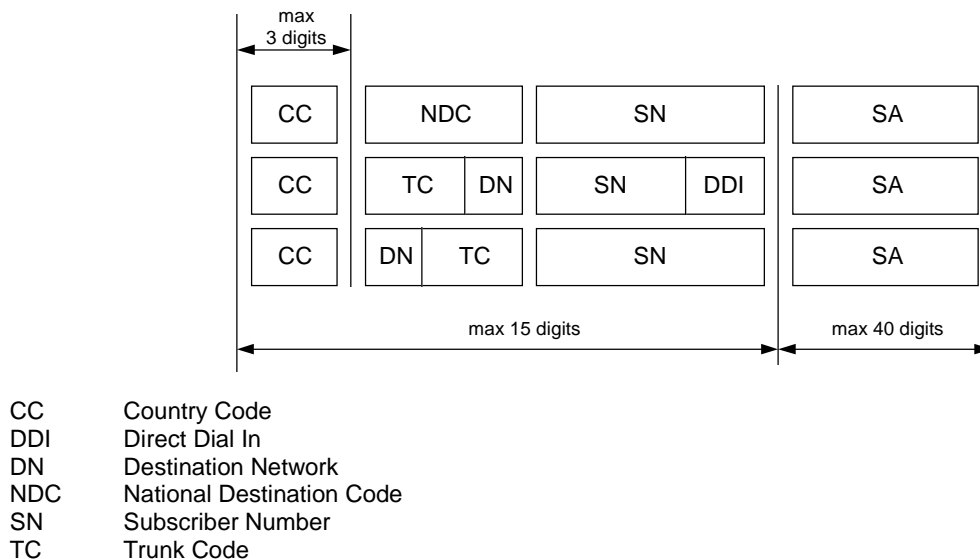
- calling this telephone number.

In order to ensure that the current chairman is always called, this process must be repeated in entirety. It may also be difficult to cope with holidays etc, where calls to this person may be diverted to different people depending on the original target/purpose of the enquiry. For example, telephoning a person in his capacity as chairman of ETSI might be diverted to the deputy chairman of the committee, whilst calling him as co-ordinator of a research project might divert to the deputy project manager.

Annex A:
Addressing Schemes

Traditionally users have been called by means of an E.164 telephone number, by short address (on a PABX), by an X.121 address on packet data networks or by an X.400 or Internet address for electronic mail. UMTS is intended to be universal so although it should support all these existing mechanisms, it should support a more integrated approach, were multimedia calls can be set-up without having to use all these mechanisms together.

A.1   E.164 Scheme

The E.164 [1]scheme is the most common one used for numbering and addressing fixed and mobile subscribers and different network elements like a GSM Home Location Register (HLR) in today's telecommunication environment. The number consists of a Country Code (CC), a Network Destination Code (NDC), a Subscriber Number (SN), and optionally a Sub Address (SA). The NDC optionally can be divided in a Trunk Code (TC) and a Destination Network (DN). The total number length shall not exceed 15 digits for the international ISDN number including optional Direct Dial In (DDI) numbers for a PABX (see figure **5**).

CC	Country Code
DDI	Direct Dial In
DN	Destination Network
NDC	National Destination Code
SN	Subscriber Number
TC	Trunk Code

Figure 5: International ISDN Number (E.164)

A.2   E.168 Scheme

The E.168 [2] scheme describes different possibilities that shall be used in future UPT environments. It is closely related to the E.164 numbering scheme. ITU-T distinguishes between three different schemes that can coexist and are based on the structure shown in figure **6**.
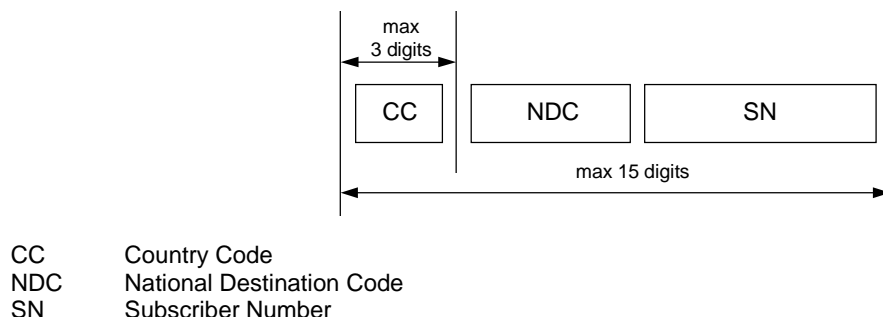
CC   Country Code
NDC   National Destination Code
SN   Subscriber Number

Figure 6: UPT number Structure (E.168)

A.2.1   Home-Related Scheme

In this scheme the address does not contain any indication of the UPT service addressed by this number. The service profile, which contains all information related to the subscriber, is stored in the home domain of the subscriber. A caller could not distinguish if she calls a UPT number, a PSTN number, or an ISDN number.

A.2.2   National Scheme

In this scheme, the National Destination Code (NDC) contains a UPT indicator and optionally a home environment indicator followed by the Subscriber Number (SN). A calling party of the same country and the network can recognize the number as a UPT number. This scheme is used in the personal number services with the recommended NDC „700".
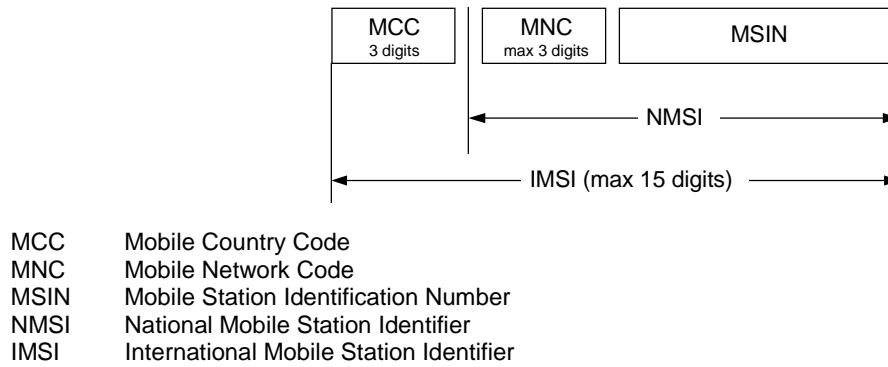
A.2.3   International Global Scheme

In this scheme, a Country Code (CC = „878") is assigned to UPT numbers as a UPT indicator. With this indicator one gets globally recognisable UPT numbers. The NDC element may contain a CC, in which case there is a national number administration. With no CC in the NDC, the administration of numbers is a global matter.

A.3 E.212 Scheme

The purpose of the Recommendation E.212 [3] is to uniquely identify mobile stations with International Mobile Station Identities (IMSI). This identity is only used for identification and not for routing purposes. It includes a 3 digit Mobile Country Code, a Mobile Network Code (MNC) with 3 digits maximum, and a Mobile Station Identification Number. The complete number shall not exceed 15 digits (see figure **7**).

MCC	Mobile Country Code
MNC	Mobile Network Code
MSIN	Mobile Station Identification Number
NMSI	National Mobile Station Identifier
IMSI	International Mobile Station Identifier

Figure 7: IMSI Number Format (E.212)

Annex B (informative): Change history

Change history					
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