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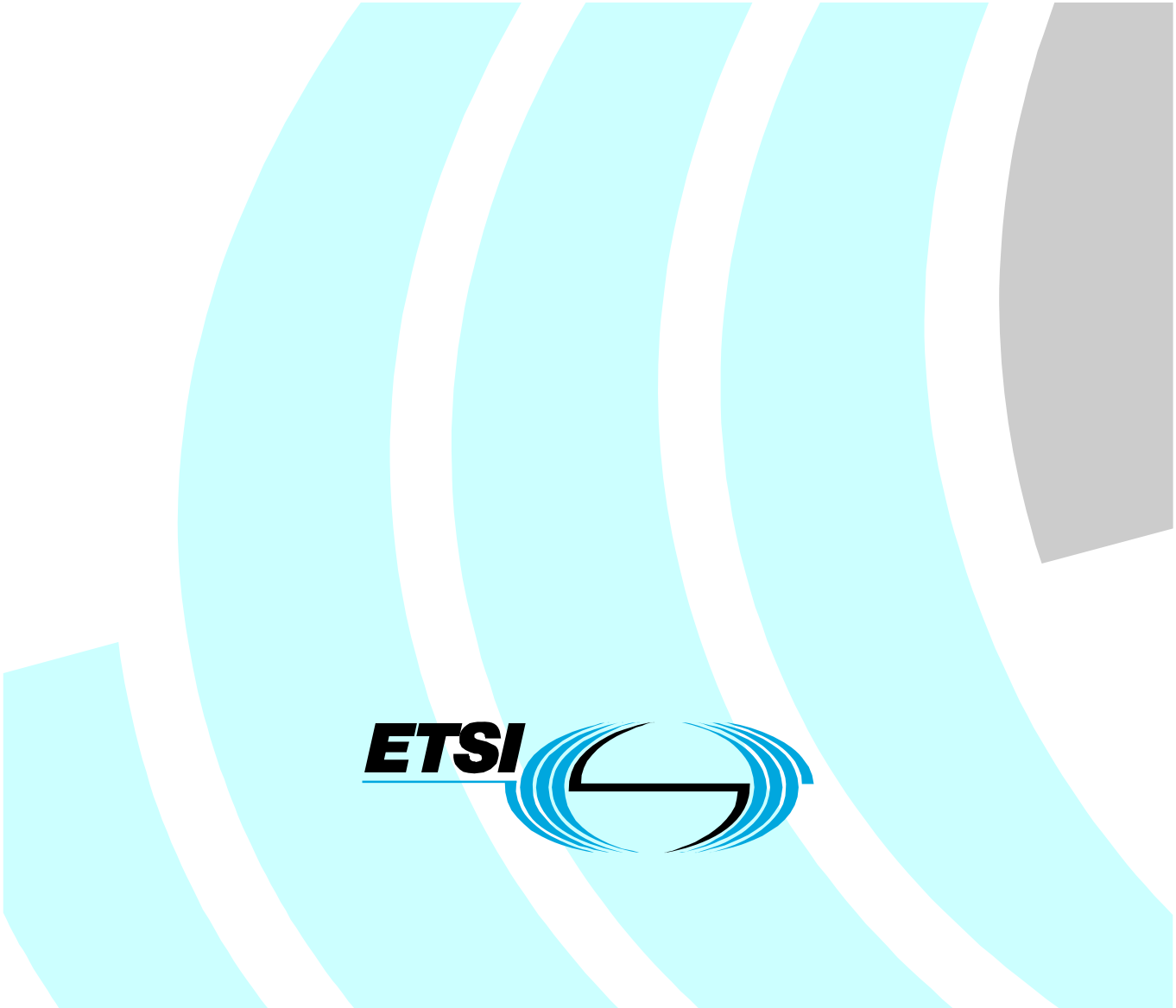
Technical Report

Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Types of numbers used in an NGN environment



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Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN).

Introduction

The present document covers aspects how international E.164 numbers and E.164 numbers in the national formats should be treated in ETSI TISPAN NGNs. The present document also identifies further work how non-E.164 numbers should be treated.

1 Scope

The present document describes the public identifiers, in the numeric format, used in NGNs: international E.164 numbers, E.164 numbers in the national formats and different types of non-E.164 numbers.

It describes the processing of dialled digits to achieve these numbers and the usage of all these kinds of numbers. For E.164 numbers also the processing to a target name in an NGN environment for further name/number to address translation is explained. The processing (treatment) of non-E.164 numbers is FFS but some initial discussion could be found in annex A.

2 References

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2.1 Informative references

[1] ITU-T Recommendation E.164 (2005): "The international public telecommunication numbering plan".

[2] ETSI TS 184 002: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Identifiers (IDs) for NGN".

[3] IETF RFC 3966: "The tel URI for Telephone Numbers".

[4] ETSI TS 123 228: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); IP Multimedia Subsystem (IMS); Stage 2 (3GPP TS 23.228)".

[5] IETF Internet-Draft: "A Uniform Resource Name (URN) for Emergency and Other Well-Known Services", draft-ietf-ecrit-service-urn-07, work in progress (http://www.ietf.org/internet-drafts/draft-ietf-ecrit-service-urn-07.txt).

[6] IETF Internet-Draft: "LoST: A Location-to-Service Translation Protocol", draft-ietf-ecrit-lost-06.txt, work in progress (http://www.ietf.org/internet-drafts/draft-ietf-ecrit-lost-06.txt).

[7] ITU-T Recommendation Y.2201 (2007): "NGN release 1 requirements".

[8] IETF RFC 4967: "Dial String Parameter for the Session Initiation Protocol Uniform Resource Identifier".

[9] ITU-T Recommendation E.191 (2000): "B-ISDN addressing".

[10] ETSI TS 124 229: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); Internet Protocol (IP) multimedia call control protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP); Stage 3 (3GPP TS 24.229 version 7.9.0 Release 7)".

[11] ETSI TS 123 003: "Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); Numbering, Addressing and Identification (3GPP TS 23.003)".

[12] IETF RFC 3406: "Uniform Resource Names (URN) Namespace Definition Mechanisms".

[13] IETF RFC 3261: "SIP: Session Initiation Protocol".

3 Definitions and abbreviations

3.1 Definitions

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

area code: combination of the national (trunk) prefix and the trunk code (TC) that identifies a specific geographic part/numbering area of the national E.164 numbering plan

closed dialling plan: dialling plan where the national (significant) numbers [N(S)N] are used when dialling geographic numbers

dialling plan [1]**:** string or combination of decimal digits, symbols, and additional information that defines the method by which the numbering plan is used. A dialling plan includes the use of prefixes, suffixes, and additional information, supplemental to the numbering plan, required to complete the call.

global number: number defined in RFC 3966 [3] in the format of an international E.164 number

emergency services: legally recognized service, reached via a national emergency number (e.g. 112), that provides immediate and rapid assistance in situations where there is a direct risk to life or limb, individual or public health or safety, to private or public property, or the environment but not necessarily limited to these situations

international E.164 number [1]**:** string of decimal digits that, for a geographic country code, uniquely identifies a subscriber or a point where a service is provided. For the case of a global service code, it identifies the subscriber of the service. For Networks, it identifies a subscriber of the Network.

An international E.164 number can act in the "role" of both a name and an address. Portability is reducing a number's role as an address. Numbers are increasingly acting in the role of a name only.

The number, which includes the country code and subsequent digits, but not the international prefix, contains the information necessary to route the call to this termination point on a public network (it may also contain the supplementary information necessary to forward it on a private network).

NOTE: It is sometimes referred to as an "international number", "international public telecommunication number" or "E.164 number".

international prefix [1]**:** digit or combination of digits used to indicate that the number following is an international E.164-number

local number: number defined in RFC 3966 [3] which is anything that is not a global number and with the context defined. It can be E.164 numbers in the national formats or non-E.164 numbers.

location dependent number: number that is routed through networks on the basis of calling party location

MSISDN: mobile E.164 number used by the calling party to establish a call to the end user

national destination code (NDC [1]**:** nationally optional code field, within the international public telecommunication numbering plan (hereafter referred to as the "international E.164-numbering plan"),
which - combined with the Subscriber's Number (SN) - will constitute the national (significant) number of the international E.164-number for geographic areas. The NDC will have a network and/or trunk code selection function.

The NDC can be a decimal digit or a combination of decimal digits (not including any prefix) identifying a numbering area within a country (or group of countries included in one integrated numbering plan or a specific geographic area) and/or network/services.

national (significant) number [1]**:** that portion of the international E.164 number that follows the country code for geographic areas. The national (significant) number consists of the National Destination Code (NDC) followed by the Subscriber Number (SN). The function and format of the N(S)N is nationally determined.

national (trunk) prefix [1]**:** digit or combination of digits used by a calling subscriber, making a call to a subscriber in his own country but outside his own numbering area. It provides access to the automatic outgoing trunk equipment.

non-E.164 number: any number, defined inside national E.164 numbering plan, which does not conform to the structure of international E.164 numbers as defined in ITU-T Recommendation E.164 [1] and is only used and meaningful in the national dialling plan and is not reachable from abroad

NOTE: An explanation of non-E.164 numbers is in ITU-T Recommendation E.164 [1] in annex A.8.

number [9]**:** number is a string of decimal digits

numbering plan: plan that specifies the format and structure of the numbers used within telecommunication networks. The numbers in the plan can either have uniform length or variable length or include both numbers of uniform and variable length.

E.164 numbering plan: E.164 numbering plan specifies the format and structure of the numbers. It typically consists of decimal (and hexadecimal) digits segmented into groups in order to identify specific elements used for identification, routing and charging capabilities, e.g. to identify countries, national destinations, and subscribers. An E.164 numbering plan does not include prefixes, suffixes and additional information required to complete the call. The national E.164 numbering plan is the national implementation of the international E.164 numbering plan (sometimes called the international public telecommunication numbering plan).

open dialling plan: dialling plan where both numbers on the local level (subscriber numbers (SN) without area code) and numbers on the national level are used when dialling geographic numbers

prefix [1]**:** prefix is an indicator consisting of one or more digits, that allows the selection of different types of number formats, networks and/or services

private numbering plan (PNP): numbering plan that specifies the format and structure of the numbers used within an organizations private/corporate/enterprise telecommunication network. PNPs may be wholly separate from the E.164 numbering plan or may overlap with it e.g. in the case of DDI.

Public Safety Answering Point (PSAP): physical location where emergency calls are received under the responsibility of a public authority

NOTE: Within the present document, it is assumed, unless stated otherwise, that PSAPs support the receipt of emergency calls over IP, using appropriate application layer protocols such as SIP for call signalling and RTP for media.

PSAP URI: SIP AoR pointing to a PSAP

public identifier: a series of digits, characters and symbols used in public networks to identify uniquely subscriber(s), user(s), network element(s), function(s) or network entity(ies) providing services/applications.

(emergency) service identifier: (emergency) service identifier describes the (emergency) service, independent of the user interface mechanism, the signalling protocol that is used to reach the service, or the caller's geographic location

NOTE: It is a protocol constant and used within the mapping and signalling protocols. An example is the service URN [5].

service URN: implementation of a service identifier, which can be applied to both emergency and non-emergency contexts, e.g. urn:service:sos or urn:service:counseling

short code [2]**:** string of digits in the national E.164 numbering plan as defined by the national Numbering Plan administrator which can be used as a complete dialling sequence on public networks to access a specific type of service/network

NOTE: The short code is a non-E.164 number and its length does not exceed five digits, in exceptional cases six digits. An example is the emergency number 112 used in the EU.

SIP Address-of-Record: Address-Of-Record (AOR) is a SIP or SIPS URI that points to a domain with a location service that can map the URI to another URI where the user might be available. Typically, the location service is populated through registrations. An AOR is frequently thought of as the "public address" of the user.

SIP[S] URI: type of Uniform Resource Identifier that identifies a communication resource in SIP. A SIP URI usually contains a user name and a host name and is similar in format to an email address. A SIP URI contains sufficient information to initiate and maintain a communication session with the communication resource. A communications resource could be e.g. user of an online service, a mailbox on a messaging system or PSTN number at a gateway service. Any resource described by a SIP URI can be "upgraded" to a SIPS URI by just changing the scheme, if it is desired to communicate with that resource securely.

subscriber number (SN) [1]**:** portion of the international E.164-number that identifies a subscriber in a network or numbering area

tel URI [2]**:** representation of an international E.164 number or another number with the context defined (e.g. private number, short code)

NOTE: RFC 3966 [3], which defines the use of the tel URI, also uses the term "local number", but uses it in a totally different way from E.164.
RFC 3966 [3] recognizes:

- **"Global number"** - which always start with +CC.
- **"Local number"** - which is anything that is not a "**global number**".

Thus what E.164 refers to as national numbers, "local numbers" and short codes (as well as other types such as private numbers) would all be treated by RFC 3966 [3] as "local numbers". In the case of "local numbers", RFC 3966 [3] uses a context qualifier to distinguish the type of number.

In the context of the present document, the term "local number" will be used in the E.164 sense and international/national format issues has to be defined in the SIP context.

Trunk Code (TC) [1]**:** digit or combination of digits, not including the national (trunk) prefix, identifying the numbering area within a country (or group of countries included in one integrated numbering plan or a specific geographic area)

The trunk code has to be used before the called subscriber's number when the calling and called subscribers are in different numbering areas. The trunk code is a particular application of NDC.

User Agent (UA): user agent is the client application used with a particular network protocol. In SIP, IMS and TISPAN NGN it is defined as a logical entity that can act as both a user agent client and user agent server.

NOTE: UA may be implemented both in UE and in proxies/servers (e.g. a Back-to-Back User Agents (B2BUA) or Application Servers). In the present document only UAs implemented in UEs are discussed.

User Agent Client (UAC): user agent client is a logical entity that creates a new request, and then uses the client transaction state machinery to send it

NOTE: The role of UAC lasts only for the duration of that transaction. In other words, if a piece of software initiates a request, it acts as a UAC for the duration of that transaction. If it receives a request later, it assumes the role of a user agent server for the processing of that transaction.

User Agent Server (UAS): user agent server is a logical entity that generates a response to a SIP request

NOTE: The response accepts, rejects, or redirects the request. This role lasts only for the duration of that transaction. In other words, if a piece of software responds to a request, it acts as a UAS for the duration of that transaction. If it generates a request later, it assumes the role of a user agent client for the processing of that transaction.

User Equipment (UE): the UE in UMTS (3G) mobile systems is the name given to the User Equipment

NOTE: This roughly corresponds to the Mobile Station (MS) in GSM systems. The UE can be, for example, a handheld phone. Alternatively it can be another device such as a card in a laptop computer.

3.2 Abbreviations

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

AOR	Address-Of-Record
AS	Application Server
CAC	Carrier Access Code
CC	Country Code
CIC	Carrier Identification Code
DB	Data base
DDI	Direct-Dial-In
ECRIT	Emergency Context Resolution with Internet Technologies
ENUM	Telephone Number Mapping
GEOPRIV	GEOgraphic location/PRIvacy
GPS	Global Positioning System
I-ENUM	Infrastructure ENUM
IP-CAN	IP-Connectivity Access Network
LoST	Location to Service Translation Protocol
N(S)N	National (Significant) Number
NANP	North American Numbering Plan
NAR	Naming and Addressing Resolution
NDC	Destination Code
NGCN	Next Generation Corporate Networks
NGN	Next Generation Networks
NP	Number Portability
PNP	Private Numbering Plan
PSAP	Public Safety Answering Point
PSI	Public Service Identity
PUI	Personal User Identity
SCP	Service Control Point
S-CSCF	Serving-Call Session Control Function
SIP-AOR	SIP Address-of-Record
SN	Subscriber Number
TC	Trunk Code
UA	User Agent
UAC	User Agent Client
UAS	User Agent Server
UE	User Equipment
URI	Universal Resource Identifier
URN	Uniform Resource Names

4 Introduction

Naming/numbering Address resolution within NGN networks needs to take account of different types of numbers. The requirements concerning naming/numbering/addressing are further explained along with specific treatments of numbers within ETSI NGNs.

Processing of numbers to obtain connection to the terminating point consists of three sub-functions as mainly shown in figure 1:

1) The processing of dialled digits - The input of this sub-function are the dialled digits, the output is a target name, which may either be a tel URI or a service URN. The present document is dealing mainly with these issues.

2) The target name/number to address translation to find a SIP URI. This can be done with I-ENUM, LoST, or other translation function.

3) Route determination to find the target hostname. This can be done by routing tables or DNS.

If the route is determined and the target is in another service provider an interconnection to the other provider is required.

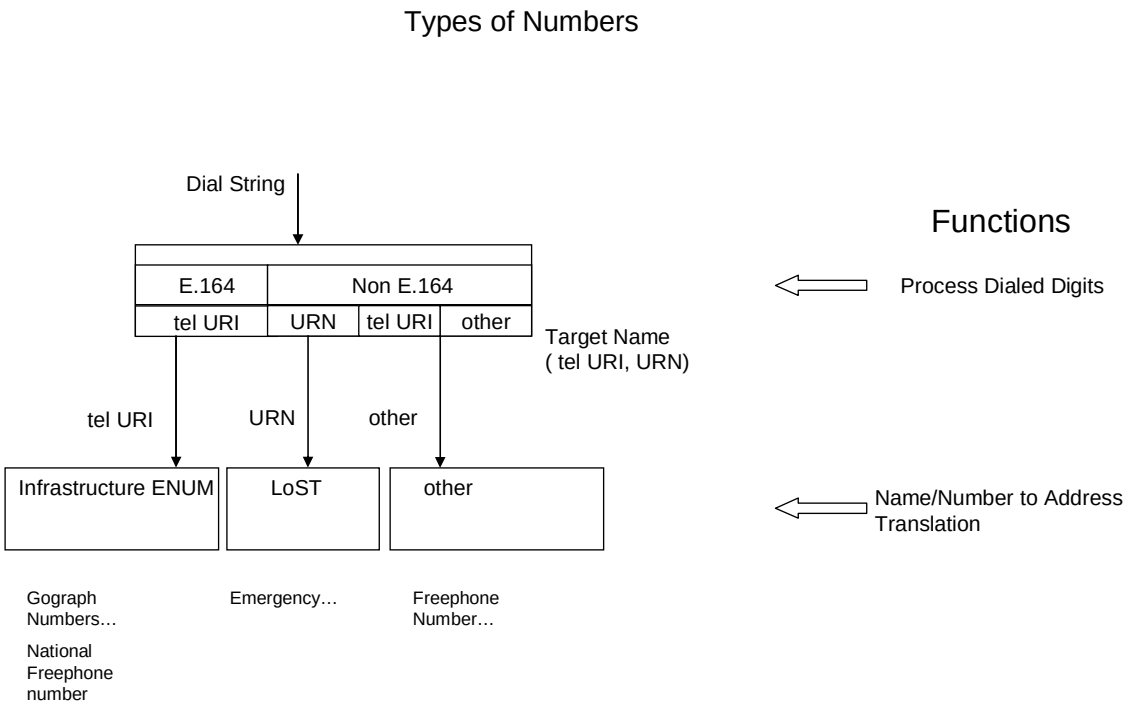


Figure 1

The processing (treatment) of non-E.164 numbers is out of scope for the present document but some initial discussion could be found in annex A.

5 Description of the different types of numbers

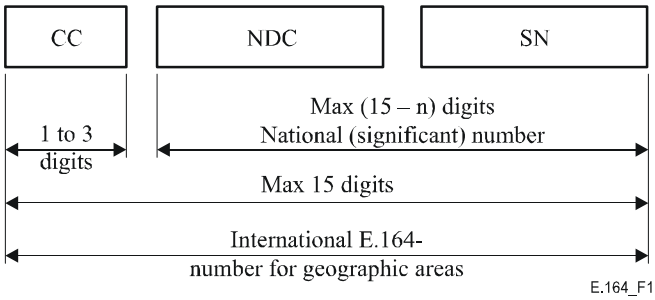
5.1 International E.164 numbers

International E.164 numbers are numbers based on ITU-T recommendation E.164 [1] and are used in different network environments like PSTN, ISDN, and PLMNs based on GSM and UMTS, and are also used in NGNs as public identifiers. The international E.164 number uniquely identifies a subscriber or a point where a service is provided and satisfies the three characteristics of structure, number length and uniqueness as specified in E.164 [1]. The maximum number of digits for the E.164 number is 15 excluding the international prefix. International E.164 numbers are presently used in four different structures and these are described in detail in E.164 [1]:

- International E.164-number for geographic areas.

- International E.164-number for global services.
- International E.164-number for Networks.
- International E.164-number for Groups of Countries.

The structure of the international E.164 number for geographic areas, as an example, is shown below taken from ITU-T Recommendation E.164 [1]:



CC Country Code for geographic area
NDC National Destination Code
SN Subscriber Number
n Number of digits in the country code

NOTE – National and international prefixes are not part of the international E.164-number for geographic areas.

Figure 2

E.164 numbers in the international format can never be accessed directly on PSTN/ISDN systems. A user is always required to first enter the international prefix defined by the national E.164 numbering plan. According to ITU-T Recommendation E.164 [1] it is recommended to use "00" as international prefix, but some countries use a different international prefix (e.g. in the NANP "011" is used).

A user on PLMN devices may also use "+" as international prefix, but this "+" is converted to the international prefix used in the visited network.

VoIP users may also use the "+", which is signalled to the system directly either in a tel URI or a SIP URI with the parameter; user=phone.

5.2 E.164 numbers in the national formats

Each country (except countries covered by integrated numbering plans, e.g. CC 1 and CC 7) defines its own national E.164 numbering and the national dialling plan. These plans are based on ITU-T Recommendation E.164 [1] and defines the prefixes, non-E.164 numbers and how the national formats (i.e. the local and national level) of the international E.164 number are allocated.

Subscribers in other countries are always reached by dialling the international prefix and the international E.164 number.

An international E.164 number of the own country can be used in different formats by the users: international format, national format and local format. Which of these formats are accessible is dependant of the national E.164 numbering plan and the dialling plan.

1) International format:

   Some networks allow to dial the national E.164 numbers of the own country in the international format by using the international prefix.

2) National format:

   On the national level the number is used in the national (significant) number [N(S)N] format, i.e. the National Destination Code (NDC) and the Subscriber Number (SN), eventually together with the national (trunk) prefix.

Countries with a closed dialling plan do not have a local format. This may also be the case for certain networks (mostly mobile networks). In some countries with a closed dialling plan there is no national (trunk) prefix required to dial such numbers.

3) Local format

In some national dialling plans a user may also dial an E.164 number in the local format. This means dialling just the subscriber number (SN) without any area code (i.e. national (trunk) prefix and trunk code). This dialling procedure might not be applicable in some countries and networks.

In this case there is always an area code required to access other national E.164 numbers on the national level.

Private/corporate numbers may exist for example at a NGCN within a company. These numbers have their own private numbering plan and dialling plan. In some cases these numbers may be accessed from the NGN using direct-dial-in (DDI) numbers. Typically these DDI numbers are national E.164 numbers where the first digits belong to the national E.164 numbering plan and the last digits are part of the private numbering plan. This however does not apply to all private/corporate networks.

In most of these private/corporate networks also the NGN can be accessed. To do so, a prefix (in most cases "0" or "9") is defined. This prefix provides access either to the local or national formats E.164 numbers.

5.3 Non-E.164 numbers

The national E.164 numbering plans may also include non-E.164 numbers. These are numbers which do not conform to the structure of international E.164 numbers as defined in ITU-T Recommendation E.164 [1] and are only used in the national dialling plan and are normally not reachable from other countries. For a discussion of non-E.164 numbers see clause 9.

6 Requirements for numbering, naming and addressing

This clause is based on ITU-T Recommendation Y.2201 [7] and modified.

NGN is intended to provide an efficient, secure and trustworthy numbering, naming and addressing environment for users, network operators and service providers. Regulatory requirements as well as interoperability with PSTN/ISDN will be taken into account where applicable.

Evolution to NGN shall ensure that the sovereignty of ITU Member States with regard to numbering plan is fully maintained, as described in ITU-T Recommendation E.164 [1].

The following are the requirements to support numbering, naming and addressing capabilities. Except where noted, they apply to both the transport and service layer.

6.1 Numbering

The numbering requirements applicable to NGN are the following.

1) Numbering functions shall support the ability to differentiate between the dialling plan and the numbering plan.

2) Numbering functions shall support the ability to translate a dial string into the numbering scheme.

3) NGN shall support E.164 numbering in the international and national formats

4) NGN shall allow non-E.164 numbering, including short codes, in national dialling plans.

5) NGN shall allow access to private/corporate numbering used in NGCNs

6) When non-E.164 numbers or dialling strings are used, NGN numbering shall provide the scope within which these numbers are correctly handled.

7) NGN shall support the ability to differentiate alphanumerical identifiers that happen to be consisting of only digits from those which are numbers (e.g. E.164 numbers) and should be treated as such in routing procedures.

8) NGN shall support IP multimedia communication establishment (in both the originating and terminating case) using at least tel URIs, e.g. tel:+441234567890, and SIP URIs, e.g. sip:my.name@company.org, as a minimum. For tel URIs:

   - global numbers, i.e. international E.164 numbers, shall be supported;

   - local number form, i.e. national E.164 numbers and non-E.164 numbers, shall be supported.

9) In some service scenarios, e.g. interworking with PSTN/ISDN, the NGN shall support IP multimedia communication establishment (in both the originating and terminating case) using E.164 numbering with I-ENUM-like (or translation functions similar to I-ENUM) support where appropriate.

7 Treatment of numbers in the User Agent in UEs

The treatment of numbers is dependant on the capabilities of the User Agent in the UE. Every User Agent in an UE must have the capability to receive a dial string. This clause deals with the different treatments of these dial strings. Some User Agents and UEs may have in addition the capability to enter a personal user identity (PUI) directly. This PUI may either be an E.164 number, a SIP AOR or a service URN.

7.1 Simple UA not capable of using a dialling plan

If an UA is not capable of interpreting a dialling plan, all other numbers must be entered according to the dialling plan in the home network given to the user at subscription time (including E.164 numbers prefixed with the international prefix for that dialling plan). If the UA is able or configured to use more than one E.164 number, then the dialling plan might be different for each of these numbers. It must therefore be clearly defined for which of these numbers the dialling plan is valid.

In this case only the phone-context parameter must be known by the UA and is either set at configuration time or signalled to the UA at the registration.

The UA must signal the dialled digits in the request URI and the To: header field in the format as defined in [8] sip:nnnn;phone-context=diallingplan@homenetwork.com;user=dialstring.

This case will for example be used for PES.

The user may access the IMS via an access network different from the home network, but is registered always with the home network. No "roaming" occurs.

NOTE: The result in this situation is that the user cannot reach non-E.164 numbers in the visited network. In current pre IMS-based PLMNs the visiting user is using the dialling plan of that visited network. In ETSI NGNs a visiting user is always using the dialling plan of the home network.

7.2 Treatment of emergency numbers and other service numbers

Some devices will be capable of retrieving location information, either on its own or via the access network. In this case it is also recommended that they are able to analyze the dialled digits at least to detect the dialling of the emergency numbers used in the home network. It is also recommended that they are able to detect the emergency numbers used in the visited network.

The reason for this is that in this case the emergency numbers may be translated by the UA to emergency service URNs and the location information needs to be transmitted to the CSCF automatically only in case of an emergency call.

The table with the home short codes and the service URNs is preloaded at configuration (or registration) time to the UA. The table with the visited short codes and the relevant service URNs is loaded at registration time in the visited country to the UA as defined in [6].

If an emergency call is made, the emergency number for the emergency service is recognized by the UA and mapped to the service URN. The service URN is signalled in the request URI and the call eventually marked as emergency call.

For a general discussion on national service numbers, see annex A.

7.3 Treatment of dialling plans in the UA

In this case the UA is doing the complete dial string processing. The output of the UA to the CSCF is either a tel URI in the global format (international E.164 number), a SIP AOR or a service URN.

7.4 Direct input of E.164 numbers

As stated above, some UA and UE may have the capability to enter the PUI directly (e.g. UE featuring an alphanumeric keyboard). They have also the capability to enter an SIP AOR or service URN directly. This SIP AOR and service URN are transmitted in the Request URI and To field as entered.

If end user devices have the capability to enter the "+" sign, also E.164 numbers may be entered directly. The UA signal these E.164 numbers directly by placing a global number tel URI in the Request URI and the To field.

NOTE: A UA may query User ENUM and translate the E.164 number directly to a SIP AOR, which is sent transmitted in the Request URI and To field e.g. in the format sip:<+CC_NDC_SN@destnetwork.org;user=phone

8 Treatment of E.164 numbers in ETSI NGNs

8.1 General treatment

An ETSI NGN is, from technological point of view, an IP-based network with service and transport layers and SIP signalling. Users (and service entities) are identified by E.164 numbers, as described in previous clauses.

From the signalling protocol point of view, E.164 numbers are conveyed using tel URI and/or SIP URI formats and coding. As a consequence, for routeing purpose, tel URI and SIP URI have to be translated to IP addresses, for establishing a communication. In ETSI NGN context, tel URI and SIP URI can be considered a "naming" representation of E.164 numbers.

Translation functions for tel URI and SIP URI have to be provided by ETSI NGN, and, usually, are in charge of control function (S-CSCF). Different implementations of translation functions can be realized by operators, also basing on Naming and Addressing Resolution (NAR) process described in clause 4.

As described in previous clauses, E.164 numbers represented in tel URI and SIP URI formats and coding, shall be supported using all the formats defined by ITU-T Recommendation E.164 [1]. Therefore SIP protocol format indicators are to be used, basing on global and local numbers, and, also, considering the opportunity to define further values of SIP protocol format indicators to comply with different numbering plans (for instance including a new national plan format indicator).

8.2 Treatment of International E.164 numbers

An international E.164 number is globally unique and can be used as such to uniquely identify a subscriber or a point where a service is provided on NGNs, PSTNs or PLMNs. The use of international E.164 number is only mandatory at international interfaces between networks.

E.164 numbers in the international format have to be handled by a name/number to address translation function, e.g. I-ENUM as described in TS 123 228 [4], clause 4.3.5, or another translation mechanism or existing solutions.

In case a number is terminated on an ETSI NGN or on any other IP based network, the translation functions, realized inside the operators domain, shall returns a SIP URI (or a tel URI) which enables the application of other steps of routeing process, also for interconnection scenarios.

In the case a number is terminated on the PSTN or PLMN the numbering translation function will provide tel URI formats for the interworking function toward the PSTN/PLMN.

If an international E.164 number needs to be converted to an E.164 number in the national format, further information about the numbering plan is needed, such as:

- The national (trunk) prefix for converting to a national format (is done by dropping the CC and adding the national (trunk) prefix). This information is not necessary in a closed dialling plan (in which it is sufficient to drop the CC in order to have the national (significant) number).
- The relevant area code (i.e. the national (trunk) prefix and the Trunk Code (TC)) for converting to a local format (is done by dropping the CC and the area code to get the local level number). Note, that the local level number may have relevance only within a certain numbering area and there may exist same local numbers in different numbering areas (separated by different area codes). This information is not necessary in a closed dialling plan (in which it is sufficient to drop the CC in order to have the national (significant) number)

8.3 Treatment of dialled digits

If the request URI contains dialled digits, the dialled digits must be analysed by the S-CSCF or the translation function according to the dialling plan used by the originating user.

The simplest case is an E.164 number in a national format. The treatment of these numbers is described in clause 8.4.

All other numbers are non-E.164 numbers and are described in annex A.

8.4 Treatment of E.164 numbers in the national formats

The E.164 numbers in the national formats are usually used for communications inside a country. Besides also a local E.164 numbering can be used related to the national E.164 numbering plan structure.

ETSI NGN is compatible with any national E.164 numbering plan and will implement the necessary functionality using numbering translation functions.

In closed dialling plans there is only one national format as the national and local levels are the same. Generally, the national (trunk) prefix does not exist.

In open dialling plans the national format can be separated into national level and local level:

- The structure of a national level number is typically an area code (i.e. the national (trunk) prefix followed by a Trunk Code (TC)) and a subscriber number.
- A local level number is a subscriber number which has relevance only within its home numbering area. In different numbering areas there may exist same subscriber numbers, which are associated with different area codes at national level.

If E.164 numbers in the national formats need to be converted to international E.164 numbers, information about the relevant national (trunk) prefix and numbering area need to be available to make an unambiguous conversion. From national level to an international level the national (trunk) prefix needs to be dropped and a CC added. From local level a relevant area code and a CC need to be added.

Once the number is converted to the international format, the further handling is as described in clause 8.2.

8.5 Treatment of E.164 numbers in private/corporate formats

A private network (also indicated NGCN) to be reachable by public networks have to use E.164 numbers belonging to the national E.164 numbering plan, also using DDI mechanism. Private networks have to comply with the rules of national E.164 numbering plan and no specific requirements are imposed by ETSI NGN.

A private numbering plan can also be defined to be used inside private network and it is outside the scope of the present ETSI document, regarding public numbering handling. As a general rule, only a private numbering plan integrated inside national E.164 numbering plan (i.e. direct dialling in) guarantees to reach and to be reachable by other national and international public networks.

If NGCNs have their own proxy, it is assumed that numbers are either transmitted into the public NGN domain already in the international format or transmitted as dialled digits according to the national dialling plan. The treatment is the same as in clause 8.4

If NGCNs use a hosted service within the ETSI NGN (IP Centrex), the NGN must also understand the private dialling plan. Dialled digits will be signalled in the format:

sip:nnnn;phone-context=privatediallingplan@homenetwork.com;user=dialstring

Annex A:
Discussion of non-E.164 numbers in ETSI NGNs

Non-E.164 numbers are defined in the national E.164 numbering plan where the E.164 number of the originator used as public identifier belongs to. The dialling plan of the originator is therefore defined nationally or in case of geographic numbers even locally. The interpretation of non-E.164 numbers is therefore dependent on the user profile and the home national network and may be done either in the originating user agent or by the S-CSCF or the translation function of the home network.

Since the routing in ETSI NGNs is based on tel URIs or SIP URIs, all non-E.164 numbers must be recognized and translated to either a Public Service Identity (PSI - e.g. a SIP URI or a tel URI) or a service URN. The mapping may be done either directly in the S-CSCF or in a special purpose Application Server (AS). Some of these non-E.164 numbers may also be forwarded to the PSTN, either directly or translated to an E.164 number. The mapping of these numbers might be dependent of the dialling plan used, and, therefore, is a national matter.

A special case are location dependent numbers. These numbers are recognized depending on the dialling plan (user profile), but are routed depending on the location of the UE. See clause A.2.

The national service numbers (freephone, shared cost and premium rate numbers) fit in principle into the international E.164 numbering plan, but are in some cases restricted to national use, i.e. they cannot be reached from other countries. In some cases access exists via bi-lateral agreements, in other cases they may be accessed, but not free-of-charge in the case of freephone numbers.

This raises the question how a mobile UA using his home dialling plan may access these service numbers if visiting the country where these service numbers are in use. Furthermore, service numbers may require two DB queries (e.g. IN-dips). The first DB query is required to find the network hosting the service and could be done querying the normal national NP databases (e.g. SCP or ENUM). The second DB query is done in the network hosting the service to derive the geo-graphic endpoint currently providing the service. The end-point may vary depending on date, time and other parameters.

Some of these service numbers may also be location dependent. An example of this may be a call to a pizza service having the same national freephone number, but the call will be routed to the nearest service point of the caller. The number translation is typically made with Intelligent Network (IN) facilities.

Types of numbers/dial strings which are non-E.164 numbers are a national matter and include for example according to ITU-T Recommendation E.164 [1] in annex A:

1) all numbers that can only be used nationally, except E.164 numbers that are by commercial or other reason not reachable from abroad, e.g. national freephone number not open on the international level;

2) short codes, e.g. emergency number 112 and other short codes;

3) local special purpose numbers;

4) international special purpose numbers used nationally;

5) network-specific numbers;

6) national (significant) numbers with excessive length (i.e. where digits in [CC + N(S)N] > 15);

7) private/corporate numbers in a private numbering plan (e.g. PABX, ISPBX, IP-PBX);

8) location dependent numbers.

In ITU-T Recommendation E.164 [1] in annex A the concepts of some of the above non-E.164 numbers are further elaborated.

Each country defines in its national E.164 numbering plan how the non-E.164 numbers are allocated.

On the PSTN/ISDN all non-E.164 numbers can only be used nationally, because they are imbedded in the national E.164 numbering plan and the national dialling plan.

NOTE: Roaming Users in PLMNs use the dialling plan of the visited network, but may have access to at least some of the non-E.164 numbers of the home network depending on bi-lateral agreements between providers.

A.1 Short codes and special purpose numbers

Typically, short codes are either national level or local level numbers. In some countries with an open dialling plan also operator/service provider specific short codes exist. It is impossible to determine from a short code whether it belongs to national or local level and in the latter case to which numbering area.

In any case, short codes may either be translated to a single end-point for the whole national dialling plan, or they may be location dependent. Local level short codes are in most cases location dependent.

Examples are:

- Emergency numbers.
- Directory Services.
- Other public and private (local) special purpose numbers (e.g. car help, pizza service, etc.).

For emergency numbers a solution is currently under specification in IETF ECRIT and 3GPP (see TS 123 228 [4] and TS 124 229 [10]). These short code are translated either by the UA or a proxy in the network to a URN in the format urn:service:sos. These URNs are then mapped by a database (LoST) to PSAP URIs depending on the location of the caller.

A similar approach could also be used for other short codes, but this requires a definition of the URNs.

A.2 Location dependent numbers

Location dependent numbers need to be routed depending on the location of the UE. This requires two problems to be solved:

1) The location of the UE needs to be involved in the routing decision.
2) The UE (or the P-CSCF or S-CSCF) needs to know the location dependent numbers valid at this location.

The routing of location dependent numbers in NGN environment requires the following:

1) Location of the UE.
2) A mapping of the location dependent numbers to service URNs.
3) The mapping of location and service URN to the local destination (e.g. PSAP URI).

Location of the UE is performed so that the UE may derive his location either by itself (e.g. via GPS) or from the local infrastructure (e.g. IP CAN). A number of different protocols are currently defined in IETF GEOPRIV.

A mapping of the location dependent numbers to service URNs is required because location dependent numbers may differ from location to location. It is therefore necessary to map the different numbers to common globally unique service URNs (see draft-ietf-ecrit-service-urn-07 [5]).

A mapping of the location and the service to the local destination is also required. Each location dependent service needs a database providing the mapping of the location of the UE and the service (defined by the service URN) to the endpoint providing the service for the current location of the UE. This may be done via databases queried by the Location to Service Translation Protocol (LoST) (see draft-ietf-ecrit-lost-06.txt [6]) or by existing numbering arrangement (i.e. routing addresses).

A LoST database requires as input the location and the service and returns the URI of the endpoint providing the service for the given location.

The mapping of the location dependent numbers to service URNs may be done either at the Connectivity Session Location and Repository Function or at the S-CSCF. The mapping at the UE is preferred, because in this case the UE needs only to provide the location information if needed and not with every call.

This problem can easily be solved in case of home location dependent numbers (numbers used in the home dialling plan).

As stated above, UEs may be mobile or nomadic, and at the visited location different numbers may be in use. It may be convenient and in case of emergency numbers also required (by law), that the UE also understands the location dependent numbers used at the visited location.

IETF ECRIT is also working on protocols to provide this information to the UE via the LoST protocol.

A.3 Other non-E.164 numbers from the ITU-T Recommendation E.164 [1]

Annex A.8 of ITU-T Recommendation E.164 [1] lists a number of other non-E.164 numbers. The definition and treatment of these numbers is FFS.

A.3.1 International special purpose numbers used nationally

Taken from ITU-T Recommendation E.164 [1], needs to be defined.

A.3.2 Network-specific numbers

Network-specific numbers may include, for example, fault reporting numbers that have relevance only within a certain operator's/service provider's network.

There are also non-numeric characters used in national dialling plans for network-specific services, for example for wake-up service, that are in format *XY*HHMM# that also have relevance only within certain network, where XY is the supplementary service code (e.g. 55 for wake-up service).

A.3.3 National (significant) numbers with excessive length

The length of these numbers are [N(S)N > 15 - CC]. This kind of numbers may be used, for example, to identify a voice mail box of a user within a network. For example, a mobile network user's MSISDN number with CC and other possible prefixes may already be 15 digits international length. A network operator or service provider may wish to use the SN with a special prefix to identify a voice mail box for each user at a "standard" way.

A.3.4 Prefixes used for Carrier Selection

If call-by-call carrier selection needs to be implemented by an NGN provider, the translation function must be able to detect the Carrier Access Code (CAC) and the Carrier Identification Code (CIC) in the dial string and act on it properly.

A.3.5 Private/corporate numbers in a private numbering plan

Private/corporate numbers may exist, for example, beyond a PBX within a company. These numbers belong to a private numbering plan and private dialling plan. In some cases these numbers may be accessed from the public network by using Direct Dial-In (DDI) numbers. Typically these DDI numbers are national E.164 numbers where the last digits are taken from the private numbering plan. This, however, does not apply to all private numbers and corporate networks.

History

Document history		
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