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Technical Report

Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Portability of telephone numbers between operators for Next Generation Networks (NGNs)

ETSI

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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).

1 Scope

The present document focuses on number portability (NP) for telephone numbers from national numbering plans (NNP) for Next Generation Networks (NGNs). These national numbering plans are based on ITU-T Recommendation E.164 [i.19]. Identifier Portability, i.e. portability of other public identifiers than telephone numbers (e.g. name based SIP URIs or SIP/tel URIs with a specific phone-context) is outside the scope of the present document, but it is recognized that this could be the topic of a future separate study.

The present document identifies ways to support portability of telephone numbers (e.g. E.164 numbers) between Service Providers (SP) - so called "service provider portability" (SPP). The term operator in the present document is used instead of Service Provider and the report identifies functionality needed to support the following portability scenarios:

- Between NGN operators;

- From NGN operators to PSTN/ISDN SPs;

- From PSTN/ISDN SPs to NGN operators.

    NOTE: The types of telephone numbers that are subject to portability is a national matter, and are therefore not addressed in the present document.

The support for number portability can be divided in two distinct processes:

a) the process of porting a telephone number from one operator to another; and

b) the process to establish a call to a telephone number that may be ported.

The first process a) would include the actions from:

- the request of the telephone number to be ported;

- the distribution and storage of NP Data (NPD) that the telephone number is ported from one operator to another operator, and at which time the porting takes effect;

- making the necessary NPD available to the data base environment that are accessible in real time from the communication processing systems;

- allowing communication establishment to the operator that currently serves the telephone number.

The second process b) would include information:

- how data bases in the real time environment can be accessed and NPD can be retrieved;

- from where the NPD can be retrieved;

- how the NPD can be carried and used and transformed to NP Routing Information (NRI) for the establishment of the communication to the current operator.

The detailed process of porting a telephone number and storage and distribution of NPD is essentially an administrative process, that may differ very much from country to country. The present document considers mainly the following:

- NGN network architecture specific for number portability;

- how the NPD obtained from the real time data base environment is used to route sessions, based on NRI, within and between networks.

However, some information relating to the process of porting a telephone number is provided in annex A, and how to populate and make NPD and ENUM data available to the real time environment is provided in annexes B and C.

Clause 5 gives an high level framework concerning different kind of DBs in the real time and in the non-real time environment of the NGN on different levels (i.e. operator, national and international level).

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the reference document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

2.1 Normative references

The following referenced documents are necessary for the application of the present document.

Not applicable.

2.2 Informative references

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1]   ETSI TR 101 119 (V1.1.1): "Network Aspects (NA); High level description of number portability".

[i.2]   ETSI TR 101 122 (V1.1.1): "Network Aspects (NA); Numbering and addressing for Number Portability".

[i.3]   ETSI TR 101 118 (V1.1.1): "Network Aspects (NA); High level network architecture and solutions to support number portability".

[i.4]   ITU-T Supplement 2 to E.164/I.331/Q.11 (2009): "Supplement 2: Number portability".

[i.5]   ETSI TR 101 697 (V1.1.1): "Number Portability Task Force (NPTF); Guidance on choice of network solutions for service provider portability for geographic and non-geographic numbers".

[i.6]   ETSI TS 184 006: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Interconnection and Routeing requirements related to Numbering and Naming for NGNs; NAR Interconnect".

[i.7]   IETF RFC 4769: "IANA Registration for an Enumservice Containing Public Switched Telephone Network (PSTN) Signaling Information".

[i.8]   IETF RFC 4694: "Number Portability Parameters for the tel URI".

[i.9]   ETSI TS 182 006: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); IP Multimedia Subsystem (IMS); Stage 2 description (3GPP TS 23.228 V7.2.0, modified)".

[i.10]   ITU-T Recommendation E.101 (2009): "Definitions of terms used for identifiers (names, numbers, addresses and other identifiers) for public telecommunication services and networks in the E-series Recommendation".

[i.11]   IETF RFC 3761: "The E.164 to Uniform Resource Identifiers (URI) Dynamic Delegation Discovery System (DDDS) Application (ENUM)".

[i.12]   ETSI TS 184 010: "Telecommunications and Internet Converged Services and Protocols for Advanced Networks (TISPAN) ENUM & DNS Principles for an Interoperator IP backbone network".

[i.13]   ETSI TS 123 228: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; IP Multimedia Subsystem (IMS); Stage 2 (3GPP TS 23.228)".

[i.14]   ETSI ES 282 002: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); PSTN/ISDN Emulation Sub-system (PES); Functional architecture".

[i.15]   ETSI TS 129 235: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; Interworking between SIP-I based circuit-switched core network and other networks (3GPP TS 29.235)".

[i.16]   IETF RFC 3261: "SIP: Session Initiation Protocol".

[i.17]   ETSI TR 101 698: "Number Portability Task Force (NPTF); Administrative support of service provider portability for geographic and non-geographic numbers".

[i.18]   IETF RFC 3966: "The tel URI for Telephone Numbers".

[i.19]   ITU-T Recommendation E.164 (2005): "The international public telecommunication numbering plan".

3   Definitions and abbreviations

3.1   Definitions

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

data base query function: function whereby a data base is accessed in order to ascertain whether a telephone number is ported, and if it is, a Routeing Number or a domain name is obtained that may be used to route the call to a destination

donating network: network from which the number has been ported out in the last porting process

NOTE: Source TR 101 122 [i.2].

donor network: initial Network where a number was assigned by the Numbering Plan Administrator before ever being ported

E.164 number: string of decimal digits that satisfies the three characteristics of structure, number length and uniqueness specified in ITU-T Recommendation E.164 [i.19]

NOTE 1: The number contains the information necessary to route the call to the end user or to a point where a service is provided.

NOTE 2: Source ITU-T Recommendation E.101 [i.10].

ENUM data: data for mapping an E.164 number to an URI

NOTE: Mapping can be done directly or by providing pointers to other ENUM DBs according to ordinary DNS procedures.

ENUM DB: real time data base that store ENUM data. It is used to resolve E.164 numbers to URIs at session initiation

ENUM query: query made on the Shared ENUM infrastructure in order to resolve a specific E.164 number to an routable URI

location portability: ability of an end user to retain the same telephone number when moving from one location to another

National Operational Data Base (NOpDB): real time common data base that store data from the NPDB to be transformed to NRI used for routing by all operators within one country

NPA Data: off-line data published by the numbering plan administrator (NPA) which provide the number block assignments to operators that provides services within the jurisdiction of the NPA

NOTE: If the telephone numbers are subject to number portability the actual operator serving a specific telephone number may differ from the one provided by these data. In cases where telephone numbers are assigned directly to end users, the operator chosen by the end user to provide services is due to spread information that he is serving that telephone number.

NPA DB: non-real time data base that store NPA Data run by the NPA

NP Data (NPD): off-line data linked to ported telephone numbers as they are stored in and retrieved from the NPDB

NOTE: This data consist of a list of ported telephone numbers with associated domain names or routeing numbers and optionally further information of traffical and/or administrative nature. Normally these data are provided in a format which requests for further processing in order to render routeing information.

NPDB: non-real time data base that is used to store NP Data

NOTE: As an option the NPDB may contain information for all telephone numbers (i.e. also non-ported telephone numbers). Such additional information would be based on NPA Data.

NP query: query using the data base query function

NP Routing Information (NRI): information needed to complete the E.164 number based communications request to ported telephone numbers

OpDB: real time data base that store data from the NPDB to be transformed to NRI used for routing

operator: entity providing public telecommunications networks and/or public telecommunication services

ported number: number that has been subject to number portability

NOTE: Source TR 101 122 [i.2].

recipient network: network where a number is located after being ported

NOTE: Source TR 101 122 [i.2].

RefNPDB: non-real time reference NPDB

NOTE: It is national matter whether there is one physical RefNPDB or a logical one, which may be distributed over the operators involved

Service Provider Portability (SSP): ability of an end user to retain the same telephone number when changing from one service provider to another

service portability: ability of an end user to retain the same telephone number when changing from one type of service to another

Shared ENUM Infrastructure: inter-operator infrastructure according to ENUM technology as defined in RFC 3761 [i.11], used by the originating or an intermediate network to map a specific E.164 number into a URI that identifies the network actually serving that specific E.164 number

NOTE: Shared ENUM infrastructure is different from User ENUM infrastructure [i.11] where the end-user may register his E.164 number to be associated with a URI of his desire.

telephone number; directory number: number, derived from the E.164 numbering plan, used by the originating party to establish a call/communication to an end user or a service

NOTE 1: The number may also be used for identification/presentation services and may also be published in different directories and/or directory enquiry services.

NOTE 2: Source ITU-T Recommendation E.101 [i.10]. The E.101 definition has been modified here to be independent of the network technology, e.g. NGN, PSTN/ISDN and other technologies.

3.2 Abbreviations

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

ACQ	All Call Query
AGCF	Access Gateway Control Function
AGW	Access GateWay
AS	Application Server
BGCF	Breakout Gateway Control Function
CC	Country Code
CdPN	Called Party Number
CS	Circuit Switched
CSCF	Call Server Control Function
CS-IBCF	CS (domain) IBCF
CS-TrGW	CS (domain) TrGW
DB	Data Base
DN	Directory Number
DNS	Domain Name System
ENUM	tElephone NUMber mapping
FQDN	Fully Qualified Domain Name
I/S-CSCF	Interrogating/Serving Call Server Control Function
IAM	Initial Address Message
IBCF	Interconnection Border Control Function
IETF	Internet Engineering Task Force
IMS	IP Multimedia Subsystem
INAP	Inteligent Network Application Protocol
ISDN	Integrated Services Digital Network
ISUP	ISDN User Part
IWF	InterWorking Function
LNP	Local Number Portability
MAP	Mobile Application Part
MGCF	Media Gateway Control Function
MGW	Media GateWay
MRFC	Multimedia Resource Function Controller
N(S)N	National (Significant) Number
NAPTR	Naming Authority Pointer
NDC	National Destination Code
NGN	Next Generation Network
NNP	National Numbering Plan
NOpDB	National Operational Data Base
NP	Number Portability
NPA DB	Numbering Plan Administrator Data Base
NPA	Numbering Plan Administrator
NPD	NP Data
NPDB	Number Portability Data Base
npdi	NP Database Dip Indicator
NRA	National Regulatory Authority
NRI	NP Routing Information
OP	Operator
OpDB	Operational Data Base
OR	Onward Routeing
OSS	Operations Support Systems
P-CSCF	Proxy-Call Session Control Function
PES	PSTN/ISDN Emulation Subsystem
PLMN	Public Land Mobile Network
PSTN	Public Switched Telephone Network
RefNPDB	Reference Number Portability Data Base
rn	routing number
S-CSCF	Serving CSCF
SIP	Session Initiation Protocol
SIP-I	SIP with encapsulated ISUP

SLF   Subscription Locator Function
SN   Subscriber Number
SP   Service Provider
SPP   Service Provider Portability
SS7   Signalling System Number 7
SS-CF   Soft Switch Control Function
TCAP   Transaction Capabilities Application Part
TDM   Time Division Multiplexing
TGCF   Trunking Gateway Control Function
UE   User Equipment
UPSF   User Profile Server Function
URI   Uniform Resource Identifier

4   Background on portability of telephone numbers

The service features associated with portability of telephone numbers (Number Portability) are independent from the technology with which they are implemented. The requirements that have been defined by ITU-T and ETSI in the past are recommended to be carried forward to NGN.

In particular the service provider portability is referring only to the delivery of publicly available electronic communication services which are delivered by means of telephone numbers (e.g. E.164 numbers) and other capabilities related to them that ought to be implemented also through NGN networks.

The main focus of the present document is the portability of telephone numbers. Number Portability (NP) only refers to the E.164 number part of the user's public identifier that, in NGN, can be represented with either a tel URI or a SIP URI (the user part of SIP URI) with the parameter "user=phone".

In the PSTN/ISDN network environment, three types of number portability have been recognized:

- Service Provider portability (SPP);

- Location portability;

- Service portability.

Definitions for these are shown in clause 3.1.

Strictly, in the NGN environment we should be talking about "portability of public identifiers" between operators. The type of public identifier portability considered in the present document is portability between operators providing equivalent electronic communication services - the NGN equivalent of service provider portability as defined in clause 3.1. References to number portability elsewhere in the document should be taken to have this meaning.

The following portability types are out of the scope of this study:

- Location Portability;

- Service Portability.

The decision on the method of implementation of number portability in PSTN/ISDN networks within a particular country has been made at a national level and that will continue to be the case also in the NGN context. This decision will ultimately be made by National Regulatory Authorities (NRAs), with operators and equipment suppliers contributing to the process. For this reason, the present document does not mandate a particular implementation for NGNs.

Factors that may influence national decisions will include the following:

- the inherent capabilities offered by the NGN architecture;

- the relative costs of implementing the various options in an NGN environment;

- service interconnect scenarios and requirements;

- interoperability with existing legacy NP solutions;

- experience from existing NP solutions;

- different options to handle NP data in the non-real time environment and how to make this data available to the networks.

The responsibilities of the entity delivering service provider portability as described in TR 101 119 [i.1] are still valid and applicable in the NGN, in particular the responsibilities to route a call to the ported number are consistent with the Routeing Roles defined in the TS 184 006 [i.6] including donor, donating and recipient roles.

On the basis of the description provided by TR 101 122 [i.2] the NGN will not change the features of the service providers portability: the main routeing problem to solve when Number Portability (NP) is involved is to be able to route the call to the recipient network. Also appropriate non-real time number portability data base environment has to be agreed by operators in advance, assuring population and updating procedures to OpDBs, as a basis for voiceband calls/sessions routing process.

Triggering function for NP resolution can be provided by different operators acting specific NP role (originating, donor or donating).

It should be noted that, in a circuit-switched telephone network SPP technical solutions were based upon the use of the SS7 stack (specifically ISUP and Core INAP protocols). SPP solutions, also in an NGN environment focus are on services with telephone numbers and should be evaluated on NGN technologies and architectures; also query mechanisms have to be considered based on innovative and legacy technologies and data base systems.

Where NGN SPP functionality differs from that already in place, it is recommended that the NGN SPP functionality can co-exist and interoperate with the existing solution for services in the legacy networks.

NGN technology should consider utilizing existing technical capabilities such as Reference NPDB (RefNPDB) implementations where they can assist in providing the required functionality for distributing NPD to the real-time environment.

More detailed information on the various technical options appropriate to legacy networks has been provided in detail in earlier ETSI documents, as follows:

- TR 101 119 [i.1];

- TR 101 122 [i.2];

- TR 101 118 [i.3];

- TR 101 697 [i.5].

When examining Number Portability, it is instructive to consider the domains to which it applies. In addition to the portability domain (P), i.e. the scope of portability, there is another domain, the routeing domain (R) which describes that part of the network(s) that is able to recognize a number as ported, and route accordingly.

In figure 4.1, area 'P' is the domain over which it is possible to port a number, area 'R' is that part of the network that recognizes a number is ported, and carries out appropriate action. Domain W describes the rest of network, that has no way of detecting a number is ported, and therefore should route using normal principles. For portability of national telephone numbers domain 'R' is likely to be at most the national boundary, but other arrangements could exist where R might be outside the national boundary if so agreed in the specific case.