

## Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Naming/Numbering Address Resolution (NAR)

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**Reference**

RTR/TISPAN-04016-NGN-R2

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**Keywords**

addressing, enum, DNS

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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).

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# 1 Scope

The present document investigates the need to introduce a Naming/Numbering Address Resolution framework into TISPAN NGN conformant communication networks. To this end the following topics are covered:

- Analysis of the consequences of creating a Naming/Numbering Address Resolution framework.
- Gap Analysis of current TISPAN NGNs specifications in comparison to existing/emerging solutions of NAR methods.
- Identification of items for standardization as a result of the analysis described in the bullet above.

Furthermore the present document investigates the Naming/Numbering Address Resolution (NAR) in NGNs and identifies Naming/Numbering Address Resolution (NAR) use cases used in NGN environments.

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

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The following referenced documents are indispensable for the application of the present document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

Not applicable.

## 2.2 Informative references

The following referenced documents are not essential to the use of the present document but they assist the user with regard to a particular subject area. For non-specific references, the latest version of the referenced document (including any amendments) applies.

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

- [i.2] ETSI TS 184 002 (V.1.1.1): "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Identifiers (IDs) for NGN".
- [i.3] ETSI ES 282 002: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); PSTN/ISDN Emulation Sub-system (PES); Functional architecture".
- [i.4] IETF RFC 3761: "The E.164 to Uniform Resource Identifiers (URI) Dynamic Delegation Discovery System (DDDS) Application (ENUM)".
- [i.5] 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 Release 8)".
- [i.6] ITU-T Recommendation Y.2001 (2004): "General overview of NGN".
- [i.7] ETSI TR 184 005 (V1.1.1): "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Types of numbers used in an NGN environment".
- [i.8] 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 Release 8)".
- [i.9] ETSI TR 123 979: "Universal Mobile Telecommunications System (UMTS); 3GPP enablers for Open Mobile Alliance (OMA) Push-to-talk over Cellular (PoC) services; Stage 2 (3GPP TR 23.979 Release 7)".
- [i.10] ETSI TS 123 140: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); Multimedia Messaging Service (MMS); Functional description; Stage 2 (3GPP TS 23.140 Release 6)".
- [i.11] ETSI TS 123 141: "Universal Mobile Telecommunications System (UMTS); Presence service; Architecture and functional description; Stage 2 (3GPP TS 23.141 Release 7)".
- [i.12] IETF RFC 3966: "The tel URI for Telephone Numbers".
- [i.13] IETF RFC 4282: "The Network Access Identifier".
- [i.14] ETSI TR 184 003: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Number Portability scenarios in Next Generation Networks (NGNs)".
- [i.15] ETSI EG 284 004 (V1.1.2): "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Incorporating Universal Communications Identifier (UCI) support into the specification of Next Generation Networks (NGN)".
- [i.16] IETF RFC 5031: "A Uniform Resource Name (URN) for Emergency and Other Well-Known Services".
- [i.17] ETSI TS 129 228: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); IP Multimedia (IM) Subsystem Cx and Dx Interfaces; Signalling flows and message contents (3GPP TS 29.228 Release 8)".
- [i.18] ETSI ES 282 001 (V2.0.0): "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); NGN Functional Architecture".
- [i.19] ITU-T Recommendation E.191 (2000): "B-ISDN Addressing".
- [i.20] GSMA IR.67: "DNS Guidelines for Operators".
- [i.21] IETF RFC 4769: "IANA Registration for an Enumservice Containing Public Switched Telephone Network (PSTN) Signaling Information".
- [i.22] IETF RFC 4967: "Dial String Parameter for the Session Initiation Protocol Uniform Resource Identifier".

- [i.23] IETF RFC 4694: "Number Portability Parameters for the tel URI".
- [i.24] ETSI TS 182 006: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); IP Multimedia Subsystem (IMS); Stage 2 description [3GPP TS 23.506 Release 8, modified]".
- [i.25] IETF RFC 2822: "Internet Message Format".

## 3 Definitions and Abbreviations

### 3.1 Definitions

For the purposes of the present document, the terms and definitions given in ITU-T Recommendation E.164 [i.1], TS 184 002 [i.2], TR 184 005 [i.7], ITU-T Recommendation E.191 [i.19] and the following apply:

**address:** identifier for a specific termination point and used for routing to this termination point

NOTE: From this understanding e-mail address and SIP addresses are no addresses but names due to utilized by users!

**dialling plan :** string or combination of decimal digits, symbols, and additional information that defines the method by which the numbering plan is used

NOTE: A dialling plan includes the use of prefixes, suffixes, and additional information, supplemental to the numbering plan, required to complete the call.

**Domain Name System (DNS):** most ubiquitous naming service in the world is the DNS system used on the Internet and other IP networks

NOTE: DNS returns the numeric IP address for the submitted domain name.

**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

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

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

NOTE 1: Identifiers can be used for registration or authorization. They can be either public to all networks or private to a specific network (private IDs are normally not disclosed to third parties).

NOTE 2: In 3GPP the term "Identity" or "ID" is typically used instead.

**international E.164 number:** string of decimal digits that, for a geographic country code, uniquely identifies a subscriber or a point where a service is provided

NOTE 1: 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 2: It is sometimes referred to as an "international number", "international public telecommunication number" or "E.164 number".

**name:** identifier of an entity (e.g. subscriber, network element) that may be resolved/translated into an address

NOTE: From this understanding e-mail address and SIP addresses are names and used by users!

**Name number Address Resolution (NAR):** terms "address resolution" and "name resolution" are synonymous and are used in the IP world in different manners:

- In IP networks, there are two types of Address Resolutions defined:
  - The first is the conversion from a domain name into an IP address (see DNS).
  - The second is from the IP address to the Ethernet Address Resolution - this is not in the scope of the present document.
- The Name/Number to Address Resolution is queried using names (E.164 numbers) and responds with addresses (e.g. SIP URIs) associated with that name.
- These functions could be used internal for one operator network or shared between networks.

**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 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 [i.1] in clause A.8.

**number:** string of decimal digits

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

**routing:** in SIP, determination process of a route (which is a series of Route header fields) for delivering a request to the current name or address that identifies the target of the request

**SIP Address-of-Record (AoR):** 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

NOTE: Typically, the location service is populated through registrations. An AOR is frequently thought of as the "public address" of the user.

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

NOTE 1: RFC 3966 [i.12], 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.

NOTE 2: RFC 3966 [i.12] 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 [i.12] as "local numbers". In the case of "local numbers", RFC 3966 [i.12] 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 have to be defined in the SIP context.

## 3.2 Abbreviations

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

3GPP	3rd Generation Partnership Project
AoR	Address of Record
AS	Application Service
BGCF	Border Gateway Control Function
BGCF	Breakout Gateway Control Function
BSF	Bootstrapping Server Function



CC Country Code  
ccTLD country code Top Level Domain

NOTE: (e.g.: .fr)

CLI	Calling Line Identity
CN	Core Network
CP	Communication Provider
CPE	Customer Premises Equipment
CS	Circuit Switched
CS/GPRS	Circuit Switched/General Packet Radio Service
CSCF	Call Server Control Function
CSCF	Call Session Control Function
DNS	Domain Name System
ENUM	tElephone NUmber Mapping
FFS	For Further Study
FQDN	Full Qualified Domain Name
GPRS	General Packet Radio Service
GRX	GPRS Roaming eXchange
GSM	Global System for Mobile communication
GSMA	GSM Association
GW	GateWay
HSS	Home Subscriber Server
ICANN	Internet Corporation for Assigned Names and Numbers
I-CSCF	Interrogating - CSCF
ID	Identifier
IIN	Issuer Identifier Number
IM	IP Multimedia
IMPI	IP Multimedia Private Identity
IMPU	IP Multimedia PUBLIC identity
IMS	IP Multimedia Subsystem
IMSI	International Mobile Subscriber Identity
IP	Internet Protocol
IPX	IP Exchange
ISDN	Integrated Services Digital Network
ISIM	IM Services Identity Module
ISUP	ISDN User Part
LDAP	Lightweight Directory Access Protocol
LoST	Location to Service Translation protocol
MAP	Mobile Application Part
MCC	Mobile Country Code
MGCF	Media Gateway Control Function
MM	Multimedia Message
MM4	Multimedia Message 4
MMS	Multimedia Messaging Service
MMSC	Multimedia Messaging Switching Center
MMSE	Multimedia Messaging Service Environment
MNC	Mobile Network Code
MSISDN	Mobile Station ISDN number
NAI	Network Access Identifier
NAPTR	Naming Authority PoinTer Record
NAR	Naming/Numbering Addressing Resolution
NASS	Network Attachment SubSystem
NDC	National Destination Code
NGN	Next Generation Network
NGN	Next Generation Network
NNI	Network to Network Interface
NP	Number Portability
NRA	National Regulatory Authority
OMA	Open Mobile Alliance
PBX	Private Branch eXchange
P-CSCF	Proxy CSCF

PDBF	Profile Data Base Function
PES	PSTN Emulation Subsystem
PLMN	Public Land Mobile Network
PoC	Push to talk over Cellular
PSI	Public Service Identifier
PSTN	Public Switched Telephone Network
PUA	Personal User Agent
QoS	Quality of Service
RACS	Resource and Admission Control Subsystem
RAN	Radio Access Network
RCPT TO	Recipient Pointer to
RFC	Request For Comments
S-CSCF	Serving CSCF
SGSN	Serving GPRS Support Node
SIM	Subscriber Identity Module
SIP	Session Initiation Protocol
SLF	Subscription Locator Function
SMTP	Simple Mail Transfer Protocol
SN	Subscriber Number
SS7	Signalling System number 7
TCAP	Transaction Capabilities Application Part
TDM	Time Division Mode
TEL URI	Telephony Universal Resource Identifier
TLD	Top Level Domain
UA	User Agent
UCI	Universal Communications Identifier
UE	User Equipment
UICC	Universal Integrated Circuit Card
UMTS	Universal Mobile Telecommunication System
UPSF	User Profile Server Function
URI	Universal Resource Identifier
URL	Universal Resource Locator
URN	Uniform Resource Names
USIM	UMTS Subscriber Identity Module
VPN	Virtual Private Network
WG4	TISPAN Working Group 4
WLAN	Wireless Local Area Network

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## 4 Introduction

The present document covers Naming/Numbering Address Resolution use cases, identified gaps in the current standards and contribute activities how Naming/Numbering Address Resolution (NAR) aspects should be treated in NGN standardization.

The Naming/Numbering Address Resolution (NAR) provides resolution and translation functions for NGN systems.

NAR represent a set of translation functions associated with handling of dial strings, numbers, names and addresses. These are necessary to set up calls / sessions. Some of these functions may already reside within existing entities / subsystems. Analysis of the use cases provides an assessment of where these functions reside and where gaps in NGN standardization exist.

In light of developments in NGNs with a growing number of physically disjoint but logically correlated identifiers (Names, Numbers, Addresses) stored and translated in NAR entities a consolidation and co-ordination of these is needed to prevent further redundancy and possible contradiction and to enable operators to administer and provision complex and combined services.

## 5 Rationale for the Analysis of Naming Numbering Address Resolution and of the Basic Structure of a Naming Numbering Address Resolution Framework

Following is the description of Uses Cases that has been investigated on the base of current NGN specification document that covers some Naming/Numbering Address Resolution (NAR) aspects.

### 5.1 Motivation - Use Cases

#### *Use Case 1: PSTN/ISDN Emulation Sub-system (PES)*

In ES 282 002 "PSTN/ISDN Emulation Sub-system (PES); Functional architecture" [i.3] the following use case is described:

*"There is a general requirement to find the uri to which sip messages should be sent to effect a connection with the customer at a dialled number. Whether the original enquiry is made as a tel URI or using any other scheme. Whilst ENUM appears to be a way of doing this at the level of this requirements document it is used as an indication of the class of system to which the requirement applies rather than a definitive statement of a system or solution.*

*The expected information flow is seemingly simple with a request containing a telephone number returning a response which is the name that will provide an address of the server to which the SIP with encapsulated ISUP message should be sent to establish the call. It should be anticipated that more complex algorithms are required since it is not the case that all applications to the PSTN with a single telephone number result in the next telephony routing hop being to the same telephone exchange, or point code."*

Following are the aspects related to NAR that could represent a potential issue:

- No NAR method recommended, only a non specific reference to ENUM.
- No method for the Interconnection use case proposed.
- No recommendation for the reference point between PES and NAR.

#### *Use Case 2: Number Portability for PES*

In ES 282 002 [i.3] the following use case is described:

*"In complex networks with wholesale and transit provisions the next hop chosen may depend on which person asks, be it a subscriber or an operator customer. It may also depend on where the question is asked from. A further case is the inclusion of network routing principles to minimize the transitions between IP and TDM networks. Logically there is a case for suggesting that a functional replacement for number portability with all call queries should be used. This would allow the originating network to determine if a call is best addressed to a SIP with encapsulated ISUP server which will cause routing to the TDM network or to an IP network. The choice will need to be at a granularity of a single line so that the effect of number portability can be handled through a transition between TDM and IP networks.*

*Nothing in this clause is intended to determine how the function is provided or administered only what the requirements are from the PSTN and in particular during its transition. A further useful facility is to allow the presence of overload to be communicated before a call is placed. This has the effect of reducing the overload on the network at the originating edge during mass calling events Information flows.*

*The numbering database query is a confirmed information flow which provides information that is of use from a requester located anywhere in a PSTN network. The value of this approach is to allow centralized control over some aspect of telephony routing and to allow a common NGN approach to number portability.*

*The query is expected to optionally spawn any appropriate query of the number portability information resulting in what looks like a single query that returns the next hop information. It is expected the next hop will include a decision on whether the route taken by the call should be TDM or IP. That decision could be based on where the call originates or which location it enters the network."*