

Neustar[®] Whitepaper

Data Format Recommendations for Voice/SMS/MMS URI Fields in NPAC

Status of NPAC URI Field Usage

A Whitepaper
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Overview

This whitepaper proposes data format recommendations for three of the five recently added Uniform Resource Identifier (URI) fields in the NPAC across all U.S. and Canada regions. Currently, the NPAC database contains the following URI fields for 7-digit number pool blocks and 10-digit Telephone Numbers (TNs):

1. VOICEURI
2. SMSURI
3. MMSURI
4. PRESURI (currently, only available for use in Canadian region)
5. POCURI (currently, only available for use in Canadian region)

Each of these URI fields can contain an ASCII string of up to 255 characters, excluding the pipe character (|), or ASCII code 0x7C (See NPAC Functional Requirement RR3-3: NPAC Service Management System Input Restrictions). Data format recommendations for the VOICEURI (NANC 429), SMSURI (NANC 435) and MMSURI (NANC 430) are proposed in this whitepaper and look to leverage existing industry standards, where available and applicable. Where industry standards are not available, modest extensions to established ones are suggested. Industry feedback on these proposed recommendations is encouraged.

Reference Material

So that all readers may follow the presentation and recommendations made in this whitepaper, we provide two important sources of reference that went into the research and writing of the document:

- Definitions of abbreviations used in this document
- Descriptions of the Internet Engineering Task Force Request for Comment (IETF RFC) standards used in this document

Abbreviations Used in This Document

Acronym	Definition
ALTSPID	Alternative Service Provider ID
DNS	Domain Name Server
DPC	Destination Point Code
ENUM	Electronic Numbering Mapping
HTTP	Hyper Text Transfer Protocol
IETF	Internet Engineering Task Force
IP	Internet Protocol
LNP	Local Number Portability
MMS	Multimedia Messaging Service
NANC	North American Numbering Council

Acronym	Definition
NAPTR	Naming Authority Pointer
NP	Number Portability
NPAC	Number Portability Administration Center
RFC	Request for Comment
SIP	Session Initiation Protocol
SMS	Short Messaging Service
SPID	Service Provider ID
TN	Telephone Number
URI	Universal Resource Identifier
VoIP	Voice over Internet Protocol

IETF RFC Standards Used in This Document

The guidelines recommended in this whitepaper are primarily supported by the IETF RFC documents. The mission of the IETF is to make the Internet work better by producing high quality, relevant technical documents that influence the way people design, use, and manage the Internet. The IETF RFCs referenced in this whitepaper and their latest publication dates are as follows:

IETF RFC 1035 - Domain names - implementation and specification – 11/1987

IETF RFC 2915 - The Naming Authority Pointer (NAPTR) DNS Resource Record – 09/2000

IETF RFC 3508 - H.323 Uniform Resource Locator (URL) Scheme Registration – 04/2003

IETF RFC 3764 - ENUM service registration for Session Initiation Protocol (SIP) Addresses-of-Record – 04/2004

IETF RFC 4415 - IANA Registration for ENUM service Voice – 02/2006

IETF RFC 4694 - Number Portability Parameters for the "tel" URI – 10/2006

IETF RFC 4769 - IANA Registration for an ENUM service Containing Public Switched Telephone Network (PSTN) Signaling Information – 11/2006

IETF RFC 4904 - Representing Trunk Groups in tel/sip Uniform Resource Identifiers (URIs) – 06/2007

IETF RFC 5341 - The Internet Assigned Number Authority (IANA) tel Uniform Resource Identifier (URI) Parameter Registry – 09/2008

IETF RFC 6068 - The 'mailto' URI Scheme – 10/2010

IETF RFC 6116 - The E.164 to Uniform Resource Identifiers (URI) Dynamic Delegation Discovery System (DDDS) Application (ENUM) – 03/2011

Use of the NPAC for IP Service Communities

The NPAC URI fields can be used for:

1. Broadcasting text messaging capabilities on wireline numbers (whitelisting).

If special commercial arrangements are not made for this today, SMS and/or MMS delivery to non-wireless telephone numbers will fail.
2. Broadcasting IP-based voice termination points, similar to Destination Point Codes (DPCs), of where to discover specific IP-based voice termination routing information.

This use case has been gaining momentum in light of recent regulatory positions and proposed rule makings.

Using an established, authoritative, and neutrally administered registry for these use cases can help save costs relative to existing ad hoc and manual approaches, as well as improve data quality and integrity since now the relevant information is consolidated into one, industry-recognized, authoritative database. (Note: in 2010, as a means of mitigating the capacity constraints of traditional LSMSs, the NPAC was modified per NANC change order 442 to allow for telephone numbers to be provisioned with all 0's in the LRN field. These NPAC records, known as "Pseudo-LRN" records, are designed to store a broader set of telephone numbers and associated attributes, such as NPAC URIs.)

High-level Solution

Although the population of NPAC URI fields is increasing, it is generally held that a set of industry guidelines are required so that all participants in the various ecosystems can efficiently automate direct use of these optional fields in a common way. NPAC URI field values populated today are fully qualified domain names or host names and do not comply with standard URI syntax, as specified in IETF RFC 3896.

Since URI fields are generally intended for IP-related services, DNS ENUM specific URI schemes should be followed, as specified in IETF RFC 6118. If the NPAC URI fields are not used, additional routing mechanisms will be required. The proposed use of these NPAC URI fields is consistent with the concept of DPCs, as well as with more commonly referenced carrier ENUM (tiered) architectures.

Neustar's Data Format Recommendations

The following sections contain three important recommendations:

1. Recommendations for the SMSURI, MMSURI and VOICEURI data fields
2. Recommendations for supporting multiple URI values within a single field
3. Recommendations for Tier-2 delegations as further defined below

SMSURI Format

RFC 6118 contains the following two scheme definitions, as specified by IETF RFC 4355:

1. sms:mailto
2. sms:tel

The recommended value for the SMSURI field in NPAC is one of the following URI schemes:

1. mailto:
2. tel:

The mailto: URI syntax is specified by IETF RFC 6068. The following is an example:

```
mailto:\1@sms.example.com?spid=X109
```

which would be mapped into a NAPTR record, such as:

```
IN NAPTR 10 10 "u" "E2U+sms:mailto" "!^(.*)$!mailto:\1@sms.example.com?spid=X109!" .
```

The tel: URI syntax is specified by IETF RFC 5341. New parameters, such as “spid”, are needed to carry additional data fields, such as:

```
tel:\1;rn=7035551234;npdi;spid=X109
```

which would be mapped into a NAPTR record, such as:

```
IN NAPTR 10 10 "u" "E2U+sms:tel" "!^(.*)$!tel:\1;rn=7035551234;npdi;spid=X109!" .
```

 **Note:** IETF RFC 4694 defines Number Portability (NP) related parameters, while IETF RFC 4904 specifies parameters related to trunk groups. The “spid” parameter is recommended to be defined by NPAC Functional Requirement RR4-6: New Service Provider ID and CMIP ASN.1 Data Type Definition:

```
GraphicFixedString4 ::= GraphicStringBase(SIZE(4))
```

```
ServiceProvid ::= GraphicFixedString4 -- (must be 4 alphanumeric characters).
```

New tel: URI parameters, such as “spid”, would be registered with IANA at:

<http://www.iana.org/assignments/tel-uri-parameters/tel-uri-parameters.txt>

and would follow IETF recommendations for avoiding any possible conflicts.

MMSURI Format

RFC 6118 contains the following two scheme definitions, as specified by RFC 4355:

1. mms:mailto
2. mms:tel

MMSURI values are recommended to follow the same formats of the SMSURI values, except that the URI scheme is mms, instead of sms.

VOICEURI Format

RFC 6118 contains the following five scheme definitions for voice-related DNS ENUM services:

pstn:tel	IETF RFC 4769
pstn:sip	IETF RFC 4769
h323	IETF RFC 3508
sip or sips	IETF RFC 3764
voice:tel	IETF RFC 4415

Because RFC 3764 is an older version of the more generic SIP related protocols, RFC 4415 is more related to peer-to-peer interactive voice sessions, and “h323” would be required for supporting some existing regulated services (e.g., Telecommunications Relay Service), the proposed recommendation is to support the following three URI schemes:

1. pstn:tel
2. pstn:sip
3. h323

with the corresponding DNS ENUM service names, such as:

1. e2u+pstn:tel
2. e2u+pstn:sip
3. e2u+h323

The following are example URI values for each of the above schemes:

```
tel:\1;rn=7035551234;npdi;spid=X109
sip:\1;rn=7035551234;npdi@example.com;user=phone
h323:\1@example.com
```

These would in turn be mapped into NAPTR records, such as:

```
IN NAPTR 10 10 "u" "E2U+pstn:tel" "!^(.*)$!tel:\1;rn=7035551234;npdi;spid=X109!" .
IN NAPTR 10 10 "u" "E2U+pstn:sip" "!^(.*)$!\1;rn=7035551234;npdi@example.com;user=phone!" .
IN NAPTR 10 10 "u" "E2U+h323" "!^(.*)$! h323:\1@example.com!" .
```

Again, any new tel: URI parameters, such as “spid”, would be registered with IANA.

Multiple URI Values

It may be desirable to provision multiple URI values into a single NPAC URI field, e.g., to represent different URI values, redundant name servers, etc. To facilitate this, a URI value separator or delimiter is required. If the character used as the separator or delimiter occurs in a URI value, it should be encoded as %XX, where XX is the hex value of the character. This chosen character is proposed to be an ASN.1 GraphicString character other than “[” (0x7C), which is currently reserved by NPAC.

The order of multiple URI values in a single URI field may be used to derive the order or preference values of NAPTR records. For example, if “!” (hex 0x21) is chosen as the separator, a VOICEURI field with both sip and tel URI values can be specified as:

```
sip:\1;rn=7035551234;npdi@example.com;user=phone!tel:\1;rn=7035551234;npdi
```

which would be mapped into two NAPTR records, such as:

```
IN NAPTR 10 10 "u" "E2U+pstn:sip" "!^(.*)$!\1;rn=7035551234;npdi@example.com;user=phone!" .
IN NAPTR 10 20 "u" "E2U+pstn:tel" "!^(.*)$!tel:\1;rn=7035551234;npdi!" .
```

with the sip URI value as the preferred one.

 **Note:** The LNPA Working Group may need to decide what can be populated in the URI fields, such as:

1. rn
2. spid
3. svtype
4. altspid
5. lastaltspid
6. other?

with a mandatory set, such as “rn” and “spid”, and an optional set, such as “svtype” or “altspid”, etc. Neustar is open to making such recommendations via its representatives to the LNPA Working Group.

Tier-2 Delegation

A Tier-2 delegation in NPAC would be comparable to standard DNS delegation where an authoritative name server for an IP domain receives a request for a sub-domain's records and responds with records for the other name servers.

Two possible mechanisms could be used to facilitate Tier-2 delegations in the NPAC database:

1. Populating non-terminal NAPTR records.
2. Directly specifying name server records.

Non-terminal NAPTR Records

If the URI value populated is simply a fully qualified domain name, it would be treated as a non-terminal NAPTR record, defined by IETF RFC 2915 and IETF RFC 6116.

For example, if the VOICEURI field is:

carrier-a.example.com

The corresponding NAPTR record would be:

```
IN NAPTR 10 10 "" "e2u" "" carrier-a.example.com
```

For example, after receiving the non-terminal NAPTR record, an ENUM client would perform a DNS name server lookup for zone:

carrier-a.example.com

and then send the lookup query to one of the name servers returned, after replacing the terminating domain name to "carrier-a.example.com" in the query string.

Benefits of Non-Terminal NAPTR Records

Pros: Existing mechanism via NAPTR records.

Cons: DNS ENUM clients need to perform additional queries for name server records of the target domains and execute delegation loop detection.

Name Server Records

If the URI value populated starts with a scheme, such as “ns:” (TBD), it would be treated as a name server record, defined by IETF RFC 1035.

For example, if the VOICEURI field is:

```
ns:ns1.example.com!ns:ns2.example.com
```

The corresponding name server records would be:

```
IN NS ns1.example.com  
IN NS ns2.example.com
```

Summary

This whitepaper has proposed data format recommendations for three of the five recently added URI fields in the NPAC. These recommendations leverage industry standards, where applicable and available, and are intended to allow efficient ecosystem adoption of previously unsupported use cases where a universal and authoritative TN database can be beneficial. Where industry standards are not available, modest extensions to existing ones are proposed.

Our interest in publishing this whitepaper is to:

1. Recognize an expressed industry need for such recommendations;
2. Establish a baseline from which industry discussion can take place; and
3. Help facilitate industry adoption where deemed appropriate.

What to Do Next

Readers of this whitepaper are encouraged to provide their feedback to:

Mr. Ken Politz
Product Management Director
Neustar, Inc.
ken.politz@neustar.biz

Benefits of Name Server Records

Pros: Uses well-documented name server mechanism without extra lookups.

Cons: A new scheme needs to be defined for specifying name servers, e.g., as a NPAC standard format and/or through the IETF as a new URI type.