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IANA Registration for an Enumservice Containing Public Switched Telephone Network (PSTN) Signaling Information

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Abstract

This document registers the Enumservice type "pstn" and subtype "tel" using the URI scheme 'tel', as well as the subtype "sip" using the URI scheme 'sip' as per the IANA registration process defined in the ENUM specification, RFC 3761. This Enumservice is used to facilitate the routing of telephone calls in those countries where number portability exists.

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1. Introduction

ENUM (E.164 Number Mapping, RFC 3761 [1]) is a technology that transforms E.164 numbers (The International Public Telecommunication Numbering Plan, ITU-T Recommendation E.164 [2]) into domain names and then uses DNS (Domain Name System, RFC 1034 [3]) delegation through NS records and NAPTR records (Dynamic Delegation Discovery System (DDDS) Part Three: The Domain Name System (DNS) Database, RFC 3403 [4]) to look up what services are available for a specific domain name.

This document registers Enumservices according to the guidelines given in RFC 3761 [1] to be used for provisioning in the services field of a NAPTR [4] resource record to indicate the types of functionality associated with an end point and/or telephone number. The registration is defined within the DDDS (Dynamic Delegation Discovery System [4][5][6][7][8]) hierarchy, for use with the "E2U" DDDS Application defined in RFC 3761.

Number Portability allows telephone subscribers to keep their telephone numbers when they change service providers, move to a new location, or change the subscribed services [14]. In many countries, such as the United States and Canada, the functions of naming and addressing on the Public Switched Telephone Network (PSTN) have been abstracted. In the case of a ported number, the dialed number is not directly routable on the PSTN and must be translated into a routing number for call completion. Other numbers, which are not ported, and which can be routed directly on the PSTN based on the dialed number, are typically assigned to carriers and other entities in large blocks or pools. Number Portability and other numbering information are distributed in a variety of methods and formats around the world.

The Enumservices described here could enable service providers to place ported numbers, pooled numbers, and blocks of numbers and their associated PSTN contact information, into externally available or highly locally cached ENUM databases. This, in turn, could enable such parties to consolidate all telephone number lookups in their networks into a single ENUM lookup, thereby simplifying call routing and network operations, which would then result in either an on-net (IP-based) response or an off-net (PSTN-based) response.

The following Enumservice is registered with this document: "pstn" to indicate PSTN routing data, including number portability data, non-ported telephone number data (individually or in number blocks), and other PSTN-oriented data that is associated with E.164 telephone numbers. The purpose of this Enumservice is to provide routing information for telephone numbers that do not designate an endpoint resident on the public Internet or a private/peered Internet Protocol

(IP) network. Thus, these are numbers that are only routable via the traditional PSTN, even if the call originates from an IP network. The URIs returned in this service may use the TEL URI parameters defined in RFC 4694 [10], and implementations must be prepared to accept them.

The service parameters defined in RFC 3761 indicate that a "type" and a "subtype" may be specified. Within this set of specifications, the convention is assumed that the "type" (being the more generic term) defines the service and the "subtype" defines the URI scheme.

When only one URI scheme is associated with a given service, it should be assumed that an additional URI scheme to be used with this service may be added at a later time. Thus, the subtype is needed to identify the specific Enumservice intended.

2. Distribution of Data

The distribution of number portability data is often highly restricted, either by contract or regulation of a National Regulatory Authority (NRA); therefore, NAPTR records specified herein may or may not be part of the e164.arpa DNS tree.

The authors believe that it is more likely that these records will be distributed on a purely private basis. Distribution of this NAPTR data could be either (a) on a private basis (within a service provider’s internal network, or on a private basis between one or more parties using a variety of security mechanisms to prohibit general public access), (b) openly available or, (c) distributed by the relevant number portability organization or other industry organization, but possibly on a national basis and subject to or in accordance with national regulatory policy.

If such data were distributed nationally, the national telephone numbering authority, or some other regulatory body or numbering organization, may have jurisdiction. Such a body may choose to restrict distribution of the data in such a way that it may not pass over that country’s national borders.

3. ENUM Service Registration for PSTN

3.1. ENUM Service Registration for PSTN with Subtype "tel"

Enumservice Name: "pstn"

Enumservice Type: "pstn"

Enumservice Subtype: "tel"

URI Scheme: ’tel:’

Functional Specification:

These Enumservices indicate that the remote resource identified can be addressed by the associated URI scheme in order to initiate a telecommunication session, which may include two-way voice or other communications, to the PSTN. These URIs may contain number portability data as specified in RFC 4694 [10].

Security Considerations: See Section 7.

Intended Usage: COMMON

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Any other information the author deems interesting:

A Number Portability Dip Indicator (npdi) should be used in practice (see examples below in Section 4).

3.2. ENUM Service Registration for PSTN with Subtype "sip"

Enumservice Name: "pstn"

Enumservice Type: "pstn"

Enumservice Subtype: "sip"

URI Scheme: ’sip:’

Functional Specification:

These Enumservices indicate that the remote resource identified can be addressed by the associated URI scheme in order to initiate a telecommunication session, which may include two-way voice or other communications, to the PSTN.

Security Considerations: See Section 7.

Intended Usage: COMMON

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Any other information the author deems interesting:

A Number Portability Dip Indicator (npdi) should be used in practice (see examples below in Section 4).

4. Examples

The following sub-sections document several examples for illustrative purposes. These examples shall in no way limit the various forms that this Enumservice may take.

4.1. Example of a Ported Number, Using a 'tel' URI Scheme

```
$ORIGIN 3.2.1.0.5.5.5.5.1.2.1.e164.arpa.
   NAPTR 10 100 "u" "E2U+pstn:tel"
   "!^.*$!tel:+1-215-555-0123;npdi;rn=+1-215-555-0199!".
```

In this example, a Routing Number (rn) and a Number Portability Dip Indicator (npdi) are used as shown in RFC 4694 [10]. The 'npdi' field is included in order to prevent subsequent lookups in legacy-style PSTN databases.

4.2. Example of a Ported Number, Using a 'sip' URI Scheme

```
$ORIGIN 3.2.1.0.5.5.5.5.1.2.1.e164.arpa.
   NAPTR 10 100 "u" "E2U+pstn:sip"
   "!^.*$!sip:+1-215-555-0123;npdi;rn=+1-215-555-0199
@gw.example.com;user=phone!".
```

In this example, a Routing Number (rn) and a Number Portability Dip Indicator (npdi) are used as shown in RFC 4694 [10]. The 'npdi' field is included in order to prevent subsequent lookups in legacy-

style PSTN databases. The method of conversion from a tel to a SIP URI is as demonstrated in RFC 3261, Section 19.1.6 [11], as well as in RFC 4694, Section 6 [10].

4.3. Example of a Non-Ported Number, Using a 'tel' URI Scheme

```
$ORIGIN 3.2.1.0.5.5.5.5.1.2.1.e164.arpa.
   NAPTR 10 100 "u" "E2U+pstn:tel"
   "!^.*$!tel:+1-215-555-0123;npdi!".
```

In this example, a Number Portability Dip Indicator (npdi) is used [10]. The 'npdi' field is included in order to prevent subsequent lookups in legacy-style PSTN databases.

4.4. Example of a Non-Ported Number, Using a 'sip' URI Scheme

```
$ORIGIN 3.2.1.0.5.5.5.5.1.2.1.e164.arpa.
   NAPTR 10 100 "u" "E2U+pstn:sip"
   "!^.*$!sip:+1-215-555-0123;npdi@gw.example.com;user=phone!".
```

In this example, a Number Portability Dip Indicator (npdi) is used [10]. The 'npdi' field is included in order to prevent subsequent lookups in legacy-style PSTN databases. The method of conversion from a tel to a SIP URI is as demonstrated in RFC 3261, Section 19.1.6 [11], as well as in RFC 4694, Section 6 [10].

4.5. Example Using a Regular Expression

```
$ORIGIN 3.2.1.0.5.5.5.5.1.2.1.e164.arpa.
   NAPTR 10 100 "u" "E2U+pstn:tel"
   "!(^.*)$!tel:\1;npdi!".
```

In this example, a regular expression replacement function is used to reduce the size of the NAPTR record. The tel URI uses "\1", which would dynamically replace the expression with the TN plus the leading "+" -- in this case, +1-215-555-0123.

5. Implementation Recommendations

5.1. Call Processing When Multiple Records Are Returned

It is likely that both E2U+sip and E2U+pstn Enumservice type records will be returned for a given query. In this case, this could result in what is essentially an on-net and off-net pstn record. Thus, one record gives the associated address on an IP network, while the other gives the associated address on the PSTN. As with multiple records resulting from a typical ENUM query of the e164.arpa tree, it is up to the application using an ENUM resolver to determine which

record(s) to use and which record(s) to ignore. Implementers should take this into consideration and build logic into their applications that can select appropriately from multiple records based on business, network, or other rules. For example, such a resolver could be configured to grant preference to the on-net record, or execute other logic, as required by the application.

5.2. NAPTR Configuration issues

It has been suggested that tel URIs may be easier and more efficient to use in practice than SIP URIs. In addition, the use of tel URIs may result in somewhat smaller NAPTR records, which, when considering adding hundreds of millions of these records to the DNS, could have a substantial impact on the processing and storage requirements for service providers or other entities making use of this Enumservice type.

Implementers may wish to consider using regular expressions in order to reduce the size of individual NAPTRs. This will have a significant effect on the overall size of the database involved. Using the example in Section 4.5, above, this is 11 bytes per record.

6. Examples of E2U+pstn in Call Processing

These are examples of how a switch, proxy, or other calling application may make use of this Enumservice type during the call initiation process.

6.1. Dialed Number Not Available On-Net

When the dialed number is not available on-net, the call processing is as follows.

a) A user, which is connected to a calling application, dials an E.164 telephone number: +1-215-555-0123.

b) The calling application uses the dialed number to form a NAPTR record: 3.2.1.0.5.5.5.5.1.2.1.e164.arpa.

c) The DNS finds an E2U+pstn:tel record and returns a tel URI for processing by the calling application: tel:+1-215-555-0123;npdi.

d) The calling application uses routing logic to determine which media gateway is the closest to this number and routes the call appropriately.

6.2. Dialed Number Available On-Net and on the PSTN

When the dialed number is available on-net and on the PSTN, the call processing is as follows.

a) A user, which is connected to a calling application, dials an E.164 telephone number: 1-215-555-0123.

b) The calling application uses the dialed number to form a NAPTR record: 3.2.1.0.5.5.5.5.1.2.1.e164.arpa.

c) The DNS finds both an E2U+pstn record, as well as an E2U+sip record, since this number happens to be on the IP network of a connected network.

d) The calling application prioritizes the on-net record first: sip:+1-215-555-0123;npdi@gw.example.com;user=phone.

e) The calling application sets up the SIP call to gw.example.com.

f) Should the IP call route fail for whatever reason, the calling application may be able to utilize the E2U+pstn record to invoke a fallback route to a media gateway that is connected to the PSTN.

7. Security Considerations

DNS, as used by ENUM, is a global, distributed database. Should implementers of this specification use e164.arpa or any other publicly available domain as the tree for maintaining PSTN Enumservice data, this information would be visible to anyone anonymously. While this is not qualitatively different from publication in a telephone directory, it does open or ease access to such data without any indication that such data has been accessed or by whom it has been accessed.

Such data harvesting by third parties is often used to generate lists of targets for unsolicited information. Thus, a third party could use this to generate a list that they can use to make unsolicited "telemarketing" phone calls. Many countries have do-not-call registries or other legal or regulatory mechanisms in place to deal with such abuses.

As noted earlier, carriers, service providers, and other users may simply choose not to publish such information in the public e164.arpa tree. They may instead simply publish this in their internal ENUM routing database that is only able to be queried by trusted elements

of their network, such as softswitches and SIP proxy servers. They may also choose to publish such information in a carrier-only branch of the E164.ARPA tree, should one be created.

Although an E.164 telephone number does not appear to reveal as much identity information about a user as a name in the format sip:username@hostname or email:username@hostname, the information is still publicly available; thus, there is still the risk of unwanted communication.

An analysis of threats specific to the dependence of ENUM on the DNS and the applicability of DNSSEC [12] to this is provided in RFC 3761 [1]. A thorough analysis of threats to the DNS itself is covered in RFC 3833 [13].

8. IANA Considerations

This document registers the 'pstn' Enumservice type and the subtype "tel" and "sip" under the Enumservice registry described in the IANA considerations in RFC 3761. Details of this registration are provided in Section 3 of this document.

9. Acknowledgements

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