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Trunk Group Use in ENUM
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Abstract

This document describes a method for incorporating trunk group parameters into an E.164 Number Mapping (ENUM) response for the

Session Initiation Protocol (SIP) [RFC3261] service URI. It defines the use of trunk group contexts as defined in [RFC4904] as additional parameters in the E2U+SIP enumservice NAPTR record [RFC3403] URI.

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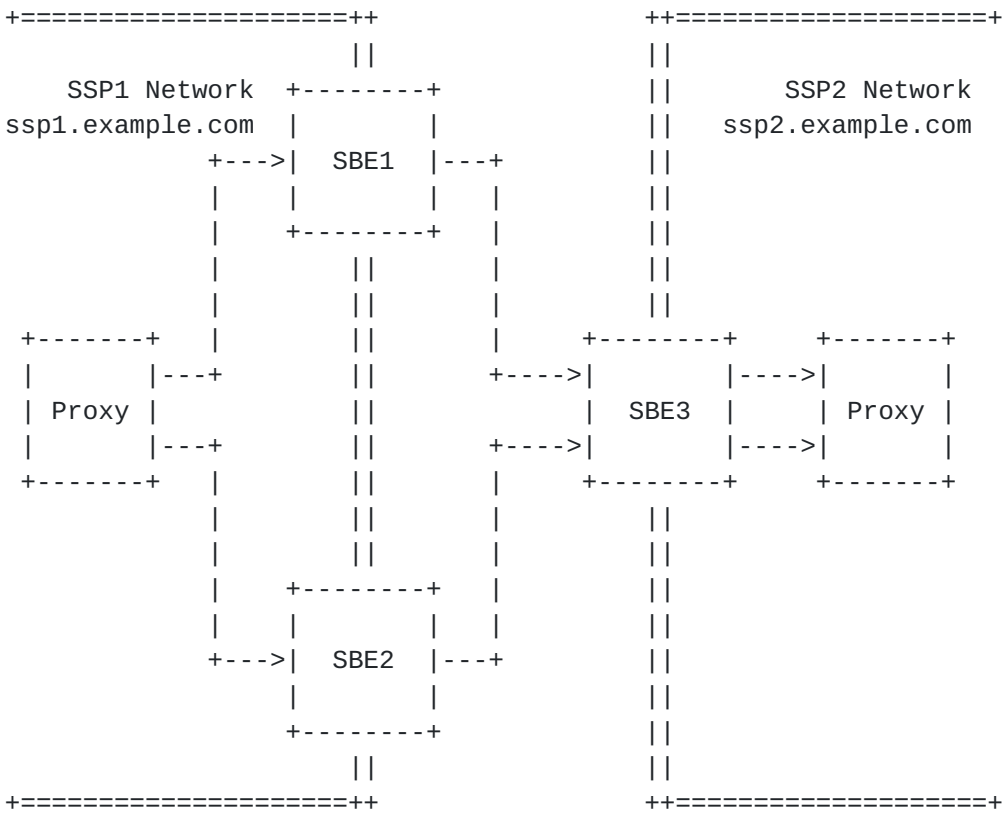
1. Introduction

ENUM (E.164 Number Mapping, [RFC3761]) is a system that transforms E.164 numbers into SIP URIs and then uses DNS [RFC1034] features such as delegation through NS records, or the use of Naming Authority Pointer (NAPTR) records, to provide the communication services available for a specific domain name. This draft refers to the resulting SIP enumservice NAPTR record type received by an ENUM client request. Simplified methods for provisioning call routing data in ENUM servers have developed a desire among SIP Service Providers (SSPs) to manage all call routing data in an ENUM database versus managing some call routing in both ENUM and DNS.

The use of trunk groups is well described in [RFC4904] for IP to PSTN gateway scenarios. In addition to this trunk group usage, more and more SIP service providers (SSPs) are defining trunk groups as SIP IP network end-points. This can be thought of as a SIP trunk group. While there have been other attempts to define a SIP trunk group, in this draft, they are simply referred to as an IPv4/v6 address or a fully qualified domain name (FQDN) representing the target SIP UA or proxy. In addition, SIP trunk groups are becoming popular for defining an associated egress Signaling Path Border Element (SBE) for preferred routing to a peer's ingress SBE.



The above figure illustrates the problem. SSP1 has two options to send a request to SSP2. For reasons outside the scope of this draft, SSP1 would prefer to use SBE2 to send a request to SSP2. Based on the information from SSP2, an example ENUM response for SSP1 would look something like the following:

```
$ORIGIN 8.4.1.0.6.4.9.7.0.2.4.4.e164.arpa.
   NAPTR 10 100 "u" "E2U+sip" "!^.*$!sip:\1@sbe3.ssp2.example.com!" .
```

While SSP1 can use a subsequent private DNS look-up on sbe3.ssp2.example.com to discover and manipulate a preferred call routing path to SBE3, it prefers to use defined trunk group parameters to specify SBE2 as the egress point to reach SBE3. Trunk group use is especially applicable if SSP2 uses an IPv4/v6 address to specify SBE3 with no additional DNS look-ups to discover the preferred path via SBE2. This draft defines a method for SSP1 to determine the preferred call routing path to reach SBE3 through the results of an ENUM query.

1.1. Terminology

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [RFC2119].

Additional terms used in this document for describing aspects of the problem and solution are defined in RFC 5486 [RFC5486].

1.2. Trunk use in the 'E2U+SIP' enumservice URI

The following example shows how the'trunk group' parameters are returned in the existing 'SIP' ENUM service type.

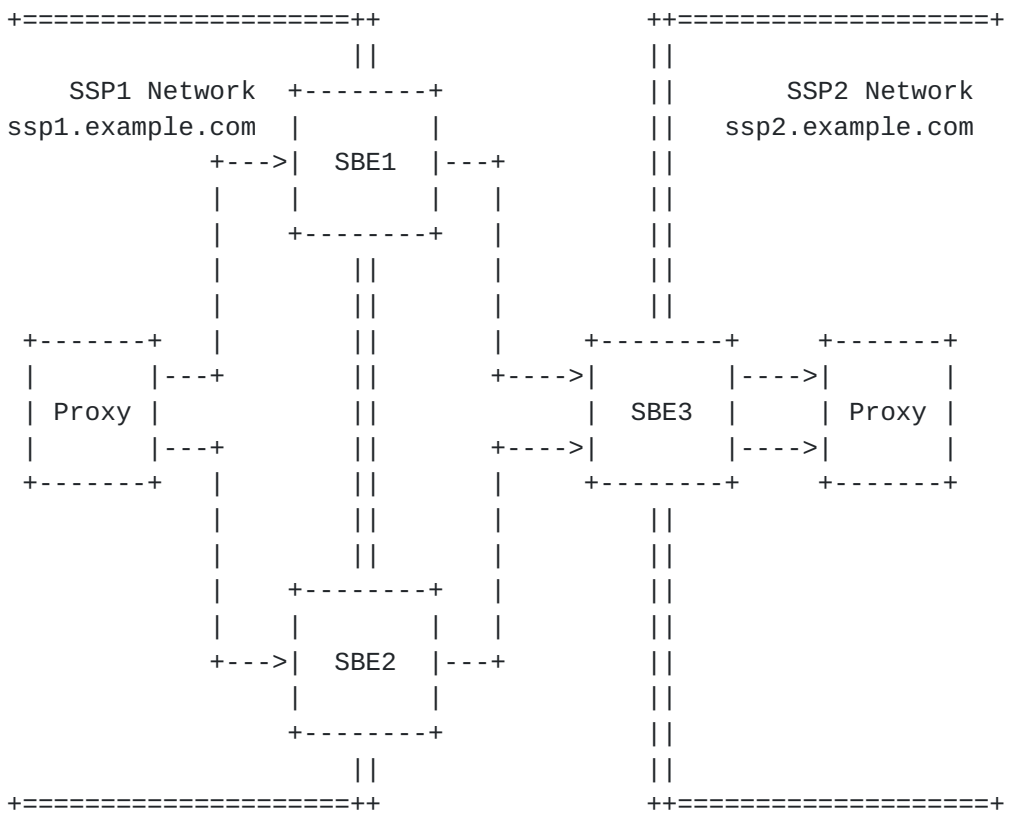
NOTE: The NAPTR records shown in this section are intended for illustration purposes only, and are not intended as good examples of how to do ENUM provisioning.

Example:

```
$ORIGIN 8.4.1.0.6.4.9.7.0.2.4.4.e164.arpa.
   NAPTR 10 100 "u" "E2U+sip"  "!^.*$!sip:\1;tgrp=TG-1;
                trunk-context=+44-207@sbe1.example.com;user=phone!" .
   NAPTR 10 101 "u" "E2U+sip"  "!^.*$!sip:\1;tgrp=TG-2;
                trunk-context=+44-207@sbe2.example.com;user=phone!" .
```

In this example, the additional 'trunk' parameters defined in [RFC4904] are included in the SIP URI NAPTR response. Since, the

result of the query provides a URI response for the Service field 'E2U+sip', the client now has all of the information available to it to route the call. The following figure and subsequent explanation illustrates this in more detail:



In the above figure, SSP2 notifies SSP1 to reach +442079460148, send your SIP request to sbe3.ssp2.example.com. SSP1 decides it prefers to send all requests to sbe3.ssp2.example.com via SBE2. In order to do this, it assigns a trunk group to SBE2. The trunk group, for example purposes, is SBE3-SSP2. The Trunk Context is sbe2.ssp1.example.com. In order for the request to be routed correctly from SBE2 to SSP2, there is a logical association on SBE2 to interpret sbe3-ssp2 to sbe3.ssp2.example.com. The trunk group and context are provisioned into the ENUM server, so when the Proxy (in this example, also the ENUM client) queries for +442079460148 it receives the following response:

```
$ORIGIN 8.4.1.0.6.4.9.7.0.2.4.4.e164.arpa.
   NAPTR 10 100 "u" "E2U+sip"  "!^.*$!sip:\1;tgrp=SBE3-SSP2;
            trunk-context=sbe2.ssp1.example.com
                                 @sbe3.ssp2.example.com;user=phone!" .
```

If SSP1 desires SBE1 to be a fail-over solution to SBE2, then this would be an example response:

```
$ORIGIN 8.4.1.0.6.4.9.7.0.2.4.4.e164.arpa.
   NAPTR 10 100 "u" "E2U+sip"  "!^.*$!sip:\1;tgrp=TG1-SBE3-SSP2;
                 trunk-context=sbe2.ssp1.example.com
                              @sbe3.ssp2.example.com;user=phone!" .
   NAPTR 10 101 "u" "E2U+sip"  "!^.*$!sip:\1;tgrp=TG2-SBE3-SSP2;
                 trunk-context=sbe1.ssp1.example.com
                              @sbe3.ssp2.example.com;user=phone!" .
```

In the above fail-over solution a logical association to sbe3.ssp2.example.com would be required on both SBE1 and SBE2.

1.3. Why Not Create a new ENUM Service Type?

One method for identifying a trunk group in ENUM could be to define a new service type "trunk". This new service type would return a tel URI containing the "tgrp" and "trunk context" parameters that can then be carried in IP signaling to control trunk group selection in downstream gateways. While this new ENUM service type may work in production environments, it places an unnecessary burden on ENUM clients to either assume a trunk group exists by always initiating a second ENUM query for the "trunk" service type, or evaluating the entire list of NAPTRs in the response for additional service types, potentially beyond what it originally queried for.

An evaluation of [RFC3402], [RFC3403], and [RFC5483] reveals there is no clear definition that says an ENUM client MUST only determine the use of one returned NAPTR and ignore any other NAPTRs returned by the server. While this may be true, it can also be argued that an ENUM client will only choose one NAPTR (and ignore the rest) after evaluating the Services field value, along with the ORDER and PREFERENCE/PRIORITY values, and assuming the NAPTR identifies an acceptable URI that is not rejected by the client due to some other circumstance. Assuming the ENUM client accepts a NAPTR based on this criteria, it is possible a client may never evaluate additional service field values.

This is illustrated in the following example of a client querying the server for a SIP URI available for the telephone number +442079460148. The example illustrates a potential additional service type mechanism, where the trunk group parameters are returned in a new ENUM 'trunk' service type.

NOTE: The NAPTR records shown in this section are intended for illustration purposes only, and are not intended as good examples of how to do ENUM provisioning.

The following example illustrates a potential scenario indicating how an ENUM client MAY not ever evaluate a NAPTR with the 'trunk' service type.

```
$ORIGIN 8.4.1.0.6.4.9.7.0.2.4.4.e164.arpa.
  NAPTR 10 100 "u" "E2U+sip"  "!^.*$!sip:\1@sbe3.ssp2.example.com!" .
  NAPTR 10 101 "u" "E2U+sip"  "!^.*$!sip:\1@sbe3.ssp2.example.com!" .
  NAPTR 11 100 "u" "E2U+trunk" "!^.*$!trunk:sip\1;tgrp=SSP2-SBE3;
                 trunk-context=sbe2.ssp1.example.com
                              @sbe3.ssp2.example.com;user=phone!" .
```

In this example, the ENUM client will likely select the first NAPTR, because of a match on the queried Services field value, and the ORDER and PREFERENCE/PRIORITY value. It will never evaluate the 'trunk' NAPTR unless the previous two fail for some other circumstance. Even if the client does not specify a service in the original query, the ENUM client will likely choose one of the first two NAPTRs due to the inherent choice based on the clients understanding of the preferred service. In order for the client to choose the 'trunk' NAPTR, it would need to either evaluate two NAPTRs in the response based on a client configuration to look for both, or it would have to place a query specifically for the 'trunk' service regardless of knowing whether trunk parameters exist or not. This is due to the fact the client will always have to assume trunk parameters exist as to avoid routing failures due to not having the complete information associated with the destination SIP URI.

It is recognized that one potential option is to change the order of the service types to process the 'trunk' service type first. While more and more SIP user agents are supporting ENUM clients, they are only supporting a subset of ENUM service types (primarily SIP). Adding a new service requires two changes to the SIP ENUM client

- it needs to support the new URI type (in this case 'trunk:'), and

- a new ENUM service type and processing logic.

Eliminating the new service type in favor of embedding the parameters in the SIP URIs now only requires the SIP ENUM client to support the URI extensions with no impact to how it processes NAPTR records or how it queries the ENUM server.

1.4. ENUM Client, Proxy, and User Agent Considerations

It should not be assumed the originating proxy or user agent (UA), acting as the ENUM client, will perform an action based on the received trunk group information. With this in mind, it is recommended that if the proxy or UA does not know how to interpret or

act on the trunk group parameters it should simply forward the URI as received from the ENUM server to the next downstream SIP signaling element.

1.5. Acknowledgments

The authors of this draft would like to recognize Kevin Johns, David Hancock, and Jean-Francois Mule for their comments.

1.6. IANA Considerations

This memo includes no request to IANA.

1.7. Security Considerations

This draft contains no additional security considerations other than those already defined within [RFC3764], [RFC4904], and [RFC3761].

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