**Contribution**

**TITLE:** New sub-section for current Section 5 of the IP Interconnection Routing document (IPNNI-2014-00083R007 – clean version), entitled “Per-TN Overview and Approaches”, which discusses how service providers can support more molecular routing than that based on NANP aggregation elements as discussed in the previous section. The following is new text and proposed to be a new sub-section between current sub-sections 5.2 and 5.3.

**SOURCE\*:** Neustar

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**ABSTRACT**

Section 5 of the Interconnection Routing document currently discusses how service providers can support more molecular routing than that based on NANP aggregation elements as discussed in Section 4. Sections 5.1 and 5.2 propose how the industry NPAC can be used to support either SIP URI records or NS records depending on the desired role. This contribution provides a per-TN routing solution approach for service providers if their existing SOA (or equivalent) and/or LSMS (or equivalent) do not yet support the two previously approved NANC change orders that are required. It builds on other commercial services that have been in place for more than five years, primarily in the support of ubiquitous, industry SMS routing.

**NOTICE**

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## NPAC TN Registry

## The NPAC as a Tier 1 ENUM Registry

## Utilizing the NPAC Registry with Non-compliant SOA and LSMS

### Overview

The solution introduced in this section leverages the industry NPAC and approved North American Numbering Council (NANC) governance change orders designed to facilitate routing transition to next generation networks. The solution further draws on established practices and commercial third party offerings which have been enabling ubiquitous Short Message Service (SMS) routing, for example, across a broad range of specialized use cases. Specifically, this solution focuses on an approach for supporting the provisioning of per-TN level routing data into the industry NPAC and distributing it at a per-TN level for consumption by any authorized service provider where their existing Service Order Activation (SOA) and/or Local Service Management System (LSMS) do not yet support the previously approved NANC change orders that are required.

### High Level Description

SOA is one of several ways to provision routing data into the industry NPAC. In addition to multiple third party SOA options, there are other ways to directly provision routing data into the NPAC or indirectly provision data through a Service Bureau entity. For the remainder of this solution description, a compliant SOA (or equivalent) is one that supports the following two previously approved NANC change orders: NANC 429, “Uniform Resource Identifier (URI) Field for Voice” and NANC 442, “Pseudo Location Routing Number (LRN)”.

LSMS is used to receive information from the industry NPAC and is the service provider’s database containing all information required for correct call routing when a customer changes from one service provider to another. In addition to multiple third party LSMS options, there are other ways to directly receive routing data from the NPAC or indirectly receive data through a Service Bureau entity. For the remainder of this solution description, a compliant LSMS (or equivalent) is one that supports NANC 429 and NANC 442.

It should be noted that NANC 372, “SOA/LSMS Interface Protocol Alternatives”, supports the addition of an XML-based interface along with the existing, but generally more complex CMIP-based interface. Implementations of NANC 372 could be one way for existing SOA/LSMS to address full industry compliance with NANC 429 and NANC 442. However, this is not assumed in the remainder of this description.

The following description does assume that certain one-time activities previously discussed have already taken place between service providers (e.g., IP connectivity established). It should further be noted that this solution can support the industry NPAC in the role of either a Tier 1 (i.e., routing data in a format that identifies service provider Tier 2 servers – see also Section 5.2) or Tier 2 (i.e., routing data in a format that identifies an interconnect SBC, or I-SBC, domain, where the specific “trunk group” or “route” is ultimately designed through a bi-lateral service provider information exchange – see also Section 5.1). The remainder of this solution description assumes a Tier 2 role, where the routing data to be exchanged in the industry NPAC is in the form of a SIP URI like “sip:<telephone number>@sbc1.sp1.com”. However, the solution doesn’t rely on just this specific URI format.

### Provisioning

Generally, the NPAC Location Routing Number (LRN) for ported telephone numbers or NANP NPA-NXX for native telephone numbers is used to route calls between service providers. Similarly, the NPAC Service Provider IDentification (SPID) or NANP Operating Company Number (OCN) is typically used to route text messages between service providers. Over the past five years or so, multiple commercial wireless use cases have arose where the SPID or OCN associated with a particular telephone number in these recognized authoritative databases (after port-correction) was not sufficient for routing within the ecosystem. Further, these authoritative databases, at the time, were limited in their support of such use cases. Consequently, several commercial third party services were introduced to support these use cases while they work hand-in-hand with the recognized authoritative databases.

The key constraint in the industry NPAC has since been removed through NANC 442 that allows native telephone numbers and associated information to be stored in the industry NPAC. The PSTN to IP transition use case and others being discussed are analogous to those that have naturally evolved around text messaging where additional information beyond an NPAC LRN or NANP NPA-NXX is required in support of routing. The provisioning flow summarized below uses the industry NPAC in support of the use case(s) minimally discussed within this NNI Task Force. Specifically, it proposes to use the industry-approved VOICE URI field (NANC 429) that is one field of many in the existing, standard industry NPAC database record. Further, it leverages at least one established commercial third party service to provision and distribute NPAC database records with URI field data.

Figure 5.3.1 below highlights the provisioning and distribution aspects of the solution. The routing data input is assumed to be in the form of an NPA-NXX-XXXX. Further, SP1 has both a compliant SOA and LSMS while SP2 does not.



Figure 5.3.1: Provisioning

1. SP1 and SP2 negotiate bilateral IP interconnection and exchange. In support of routing data exchange, each provides an agreed to mapping of IP address records (A/AAAA records) to FQDNs (or URI domains) corresponding to their respective I-SBCs. Each SP then provisions these records into their respective local DNS. An example of such a mapping for one URI domain could be:

|  |  |
| --- | --- |
| **URI Domain** | **IP Address** |
| sbc1.sp1.com | 138.34.23.3 |
| sbc1.sp1.com | 182.36.12.1 |
| sbc1.sp1.com | 58.23.12.90 |

1. SP1 populates the NPAC VOICE URI field in the associated subscription version (SV) record through its SOA (or equivalent) as new numbers are provisioned or existing numbers become available for IP interconnection. Again, the routing data to be exchanged is assumed, for this description, to be in the form of a SIP URI like “sip:<telephone number>@sbc1.sp1.com”.
2. SP1 downloads per-TN VOICE URI field data from SP2 (along with other existing NPAC data for number portability) through its LSMS (or equivalent).
3. SP1 extracts per-TN VOICE URI field data from SP2 (along with other existing NPAC data for number portability) and provisions it into their internal route server. Note that the details of how this routing data gets represented and used are specific to SP1.
4. SP2 shares per-TN VOICE URI routing data with an established third party service. For example,
   1. SP2 designates existing TN 508-332-2319 for IP interconnection.
   2. The associated ingress SBC domain is “sbc1.sp2.com”.
   3. SP2 establishes a Letter of Authorization (LOA) with the third party supporting this solution (if such an LOA doesn’t already exist).
   4. The TN/ingress SBC domain/Action is then shared with the third party service over one of several published APIs (e.g., a flat file with a row “5083322319,sbc1.sp2.com,A” where “A”=Add).
5. The third party service for SP2 manages as per-TN VOICE URI field data in the industry NPAC on behalf of SP2. For one example use case,
   1. Third party service interprets row “5083322319,sbc1.sp2.com,A” in a shared flat file and generates the associated industry NPAC provisioning actions. For example,
      1. Modify action is generated to add sip:5083322319@sbc1.sp2.com to the VOICE URI field for this existing SV record in the industry NPAC
6. At a configured interval (e.g., every 15 minutes), the third party service checks for changes in SP1 VOICE URI field data and distributes them over a pre-configured SP2 interface separate from the non-compliant LSMS interface which continues to receive existing NPAC data for number portability.
7. SP2 extracts per-TN VOICE URI field data from SP1 (along with other existing NPAC data for number portability) and provisions it into their internal route server. Note that the details of how this routing data gets represented and used are specific to SP2.

### Call Flow

Figure 5.3.4 below illustrates a call flow with the proposed solution. For illustrative purposes, SP2 initiates a call (session) to SP1:



Figure 5.3.4: Call Flow

1. SP2 customer dials destination number on SP1 network.
2. SP2 S-CSCF queries internal route server and SP2 route server responds back to S-CSCF with a port-corrected SIP URI containing the hostname of an agreed upon SP1 interconnect SBC.
3. SP2 S-CSCF resolves this hostname in the SIP URI through its local DNS to obtain the IP address of the SP1 interconnect SBC.
4. A SIP INVITE is sent to SP2 interconnect SBC that has layer 3 connectivity to the SP1 interconnect SBC.
5. The SIP INVITE is forwarded to the SP1 interconnect SBC.
6. SP1 interconnect SBC forwards the SIP INVITE to the SP1 S-CSCF.
7. SP1 S-CSCF terminates the call to its customer.

### Summary

This solution approach expands on sections 5.1 and 5.2 where the industry NPAC is proposed for supporting per-TN routing. Specifically, it focuses on an approach for supporting the provisioning of per-TN level routing data into the industry NPAC and distributing it at a per-TN level for consumption by any authorized service provider where their existing SOA and/or LSMS may not yet be compliant with the previously approved NANC change orders that are required. Using the industry NPAC to support the PSTN to IP transition use case (and others being discussed) also allows inherent data synchronization with number portability information. Further, the solution has support for local downloads/caches of routing data. The solution is transparent to service providers who have compliant SOA and LSMS. For service providers who do not, their per-TN level routing data can be shared through an established third party and provisioned (on their behalf) into the industry NPAC. This per-TN routing data can then be directly consumed by any participating service provider with a compliant LSMS or distributed through an established third party over a pre-configured interface.

## Utilizing LERG as an ENUM Registry – enhances the LERG to provision Tier 1 NS records at an OCN, LRN, NXX, etc. aggregate level