ATIS/SIP Forum NNI Task Force  
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**Contribution**

**TITLE:** Text for Section 4 of Interconnection Routing Outline (IPNNI-2014-64XX)

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**ABSTRACT**

This document describes a routing method currently in use and being adopted by some SPs to exchange VoIP traffic via IP interconnection. This method uses existing data distributed via the LERG and NPAC (i.e., LRNs, OCNs, NPA-NXXs) and does not require new investment in legacy databases.

This text replaces existing Section 4 text in its entirety for display in Revision 3 of the Interconnection Routing Technical Report outline IPNNI-2014-64XX.

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**Section 4.0 - Aggregation Method Using Existing NPAC/LERG Identifiers**

# 4.1 - Introduction

This section describes how some SPs have already implemented an internal IP routing service using data available from the LERG and NPAC. This is possible because when SPs obtain numbering resources they are associated with the SP’s OCN, the serving switch’s CLLI code, an NPA-NXX, as well as a 10-digit LRN for those TNs which are ported or pooled. These “identifiers” are shared among SPs through existing NPAC and LERG feeds and no new industry systems development or standards were required to implement this solution. Sometimes referred to as the “aggregation method,” the use of these existing identifiers to efficiently represent (or aggregate) large groups of TNs significantly reduces the quantity of routing records, and avoids the need for SPs to provision multiple instances of the same routing data for each of its customers’ TNs. During the development of the interconnection agreement, SPs exchange these “identifiers” (aka “group identifiers”) and ingress SBC IP addresses to establish routes between their networks via an IP interconnection.

**4.2 - Use Cases**

The makeup of an SP’s switching infrastructure and the degree to which customer TNs are served via IP will influence which identifier(s) may be used to represent the groups of TNs to which traffic should be sent via an IP interconnect. The following use case examples are not intended to serve as an exhaustive list of possible scenarios:

An SP may specify calls to all of their customers’ TNs on all of their switches should be sent over an IP interconnection. Here, the SP can simply specify their Operating Company Number (OCN) as the identifier since all the TNs associated in the LERG and NPAC with their switches are related to their OCN. This is likely attractive if the SP is an OTT VoIP provider or a cable company if all of their customers are served via IP.

If an SP has specific switches to which calls should be sent via IP, they could simply identify those switches by their switch CLLI code. This is likely attractive for SPs with a mixed TDM and IP switching infrastructure that prefer traffic associated with certain or all of their IP switches be sent via an IP interconnect. Also, SPs transitioning their TDM interconnects to IP can manage the rate of transition by adding switch CLLI codes to the list of identifiers as it grows its IP interconnection capacity.

The 10-digit LRN is a flexible vehicle for identifying a subset of TNs associated with a particular switch that, for example, serves both TDM and IP customer endpoints. Although SPs are required to establish at least one LRN per switch per LATA, they can create additional 10-digit LRNs to uniquely identify those TNs to which calls should be sent over an IP interconnection. This is likely attractive where one IP switch is used to serve both TDM and IP customer endpoints where the SP establishes second unique LRN to identify those TNs served via IP for which traffic should be sent over the IP interconnection. For example, an LTE wireless carrier may choose to establish unique LRNs to identify TNs belonging to VoLTE customers. Another example is where a CLEC provides TNs to an OTT VoIP provider and creates a unique LRN to identify those TNs assigned to customers of the OTT VoIP provider (that should be sent via and IP interconnection).

Below is a table summarizing the group of TNs represented by a “group identifier” as described in the above examples:

|  |  |
| --- | --- |
| **Group Identifier** | **Group of TNs Represented By the Identifier** |
| OCN | All TNs associated with all SP switches |
| Switch CLLI | All TNs associated with an single SP’s switch |
| LRN | A subset of TNs associated with a single switch |
| NPA-NXX | A subset of TNs associated with a single switch |

**4.3 - Implementation**

Many SP core networks are IP based and utilize an internal “routing service” to determine how to forward service requests. SIP redirect and DNS capabilities common in IP core networks provide the basic building blocks to implement real-time call processing for external NNI routing applications using “group identifiers.” This solution can be accommodated by commercially available routing (DNS and ENUM) infrastructure and each SP is free to determine when and how to implement a "routing service” solution appropriate for their business and operational needs. SPs have options given vendors are actively engaged in providing solutions of this nature and the following general description is provided for illustrative purposes only.

# 4.3.1 - Provisioning

A Provisioning diagram is shown below in Figure 1:

In this provisioning example, SP1 provisions its Routing Service and DNS based upon information provided by SP2. In this example, group identifiers (LRNs) are correlated with SBC interconnect IP addresses and domain names provided by SP2.

Figure 1

# 4.3.2 - Call Flow

An example of the Call Flow is shown below in Figure 2:

1. Pat (non-roaming subscriber of SP1) makes a session request (e.g., places a call) to Mike (subscriber of SP2). SP1’s network provides originating services based on Pat’s subscription.
2. SP1’s application server queries its routing service in real time using the called number to determine how to forward the request. The routing service first portability corrects the called number, and then determines that it is not subscribed to SP1. It then checks to see whether a group identifier is associated with the telephone number and covered by an IP interconnection agreement. If so, the SP1 routing service supplies[[1]](#footnote-1) the application server with the ingress point through which SP2 has requested that session requests directed to members of this group enter its network.
3. The application server identifies SBC-2 and (if applicable) SBC-1 in SIP ROUTE headers, and forwards the resulting session request onward. SP1’s L3 processing resolves the host portion of the topmost ROUTE header (using DNS) to the IP address of SBC-1.
4. SBC-1 removes the topmost ROUTE header (which identifies itself) and forwards the session request based on the next one (which identifies SBC-2). To do so it resolves (using DNS) the host portion of that header, yielding the IP address of SBC-2.
5. SBC-2 removes the topmost ROUTE header (which identifies itself) and admits the message to SP2’s network, forwarding it to an application server, and eventually to Mike. How SP2 performs these functions is SP specific.

Figure 2

1. How this is accomplished is implementation specific. Messages from an application server to a routing service is typically an ENUM query, but in some networks a SIP message is sent to a proxy collocated with the ENUM service, which sends back a 302 “redirect” response. [↑](#footnote-ref-1)