Federal Communications Commission
North American Numbering Council

Nationwide Number Portability Issues Working Group

Report on Findings Related to ATIS Models on Nationwide Number Portability

May 2018

TABLE OF CONTENTS	**Page #**

EXECUTIVE SUMMARY

In continuance of the Federal Communications Commission's ("FCC") Wireline Competition Bureau's goal of advancing progress towards nationwide number portability ("NNP"), the North American Numbering Council's ("NANC") Nationwide Number Portability Issues Working Group ("NNP WG")[1] herein provides an overview, findings and recommended next steps concerning the ATIS NNP models[2] included in the 2016 ATIS NNP Technical Report and the FCC's 2017 Notice of Proposed Rulemaking/Notice of Inquiry.[3] The models discussed in this report provide methods that would enable consumers to port their numbers regardless of the consumer's geographic location. Per the 2016 ATIS NNP Technical Report, NNP could become universally available in an all-IP communications network and is just one of the benefits of the industry's efforts of transitioning to an all-IP network.[4]

FINDINGS

On a comparison basis among the ATIS NNP Models, the NNP WG finds the following to enable nationwide number portability:

- The GR-2982-CORE (GUBB) model, developed for use with the legacy TDM networks, is no longer a valid solution in the current IP network environment.
- The Commercial Agreements model is currently in use and service providers can continue to consider offering such arrangements. Although service providers interested in offering NNP can continue to use commercial agreements, such agreements may not be commercially feasible or desirable for all providers and thus may be insufficient to make NNP available to all consumers.
- The Non-Geographic Location Routing Number ("Non-Geographic LRN") model, has significant impediments for implementation, such as requiring new infrastructure and processes, changing the existing interconnection paradigm, and imposing costs on service providers that may not offer NNP themselves.
- The National Location Routing Number ("National LRN") model, with further technical evaluation, may provide limited potential in terms of an NNP model that could adapt to changing markets and technologies, as well as, benefit competition and consumers;
- The costs associated with any technical NNP solution, the regulatory barriers to implement and the identified consequences (e.g., impacts on tax collection and

[1] For complete list of membership for the Nationwide Number Portability Issues Working Group, s*ee*, *FCC Announces North American Numbering Council Issue-Specific Working Groups Membership*, rel. Feb. 18, 2018, http://www.nanc-chair.org/docs/mtg_docs/Feb_2_2018_FCC_NANC_Working_Groups.pdf ; *and* Appendix A, attached hereto.

[2] "ATIS Solution Models" is synonymous with the use of the term "models" and "solutions" throughout this document.

[3] Alliance for Telecomm. Indus. Sols., *ATIS Standard – ATIS-1000071, Technical Report on a Nationwide Number Portability Study* (2016) ("2016 ATIS NNP Technical Report"), http://www.atis.org/01_strat_init/nnp/docs/ATIS-1000071.pdf; *and*, Nationwide Number Portability, Numbering Policies for Modern Communications, Notice of Proposed Rulemaking and Notice of Inquiry, 32 FCC Rcd 8034 (2017), ("NNP Notice").

[4] *Id.*

tariffs), must continue to be considered to ensure NNP provides optimal benefit to consumers and competition.

- Some legacy fixed line switches may be unable to port NNP subscribers, as they will face challenges terminating inbound calls to numbers outside their NPA NXX. These switches also likely lack pANI 9-1-1 routing support. Thus, service providers interested in serving ported-in NNP subscribers will likely need to operate VoIP or mobile switching equipment or make commercial arrangements with a third party.

RECOMMENDED NEXT STEPS

In furtherance of the above findings, the NNP WG recommends the following next steps:

- The NANC should recommend to the FCC the establishment of a Second Notice of Inquiry to explore regulatory reforms to further enable and enhance the use of commercial agreements among providers for NNP.
- The NANC recommend to the FCC that ATIS survey service providers to assess their willingness to participate in testing of the National LRN model and report findings for further consideration by the NANC. This survey will be used to assess the feasibility of this testing covering a substantive portion of legacy switches.
- The NANC and the FCC continue to consider NNP's costs, regulatory barriers and identified consequences in all future efforts.

In support of these findings and recommendations, the NNP WG met weekly for extensive discussions on each of the models presented by the FCC's Wireline Competition Bureau. The NNP WG based its discussion on the 2016 ATIS NNP Technical Report, the ATIS/SIP Forum IP NNI Profile,[5] the pending 2018 ATIS Technical Report on Assessment of Nationwide Number Portability, [6] past reports on NNP (see, Appendix B - *Summary of Past NNP Evaluations*) and the current record in the FCC's docket on NNP.[7]

The NNP WG recommends the NANC transmit these findings, recommendations and the details concluded herein to the FCC's Wireline Competition Bureau.

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[5] ATIS-1000062, ATIS/SIP Forum IP NNI Profile, https://access.atis.org/apps/group_public/download.php/22841/ATIS-1000063-SIPForum_TWG-6.pdf; https://www.sipforum.org/download/joint-atissip-forum-technical-report-ip-interconnection-routing-atis-1000062-sipforum_twg-6/?wpdmdl=2780. *See also*, https://access.atis.org/apps/group_public/download.php/22840/ATIS-1000062-SIPForum_TWG-6.pdf.

[6] During the development of the NNP WG Report, the ATIS PTSC worked concurrently to conduct a further technical assessment of the potential NNP Models identified by the Bureau. A report, entitled *2018 ATIS Technical Report on Assessment of Nationwide Number Portability*, ATIS-100003, (http://www.atis.org/01_strat_init/nnp/docs/ATIS-1000083.pdf), is pending final approvals and will be published by ATIS in June 2018. The 2018 ATIS Technical Report reaches very similar conclusions regarding the NNP models., provides a good comparison of the Non-Geographic LRN and National LRN models, and suggests that Internet Interconnection is the preferred long-term approach for NNP. Accordingly, the NNP WG has unanimously agreed to incorporate the 2018 ATIS Technical Report, once final, into this Report.

[7] *See*, NNP Notice.

I. BACKGROUND

On October 26, 2017, the FCC released the NNP Notice of Proposed Rulemaking/Notice of Inquiry ("Notice"), which sought comment on "how best to move toward complete nationwide number portability to promote competition between all service providers, regardless of size or type of service."[8] Specifically, the FCC requested input from industry stakeholders regarding prior work of the NANC, ATIS and other organizations.[9]

In addition to issuing the NNP Notice, the FCC's Wireline Competition Bureau ("Bureau") sent a letter to the Chairman of the NANC, dated December 7, 2017, directing its NNP WG to:

- Determine whether any of the four models discussed in the NNP Notice are preferable in terms of feasibility, cost, and adaptability to changing markets and technologies;
- Specify in detail the potential costs, benefits and barriers to implementing these proposals;
- Identify any likely consequences of these proposals for routing, interconnection, or public safety;
- Recommend next steps to advance full nationwide number portability; and
- Make any other recommendations deemed necessary to achieve this goal.[10]

The Bureau further directed the NANC to approve a written report of its findings on those issues, and to transmit that report to the Bureau within four months of the date of the letter. On February 22, 2018, the Bureau subsequently extended the deadline for the NNP WG Report on NNP to be delivered to the NANC for review by May 18, 2018, with the further request for a status report on the progress of the report to the NANC on or before March 8, 2018. The NANC also issued a Progress Report on the status of all Working Groups to the Wireline Competition Bureau on April 9, 2018 and a status update to the NANC on April 18, 2018.

II. NNP OVERVIEW

As the NNP Notice stated, "currently consumers and businesses can keep their telephone numbers when changing service provider – wireline-to-wireline, wireless-to-wireless, and wireline-to-wireless and the reverse – when they move *locally."*[11] FCC local number portability ("LNP") policy and corresponding federal rules and industry standards are well established, and LNP continues to support significant intermodal competition for the benefit of consumers.

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[8] *Id*.¶ 3; With publication of the NNP Notice in the Federal Register, the FCC received initial comments in the matter on December 27, 2017 and reply comments on January 26, 2018.

[9] *See*, Letter from Steven K. Berry, President & CEO, Competitive Carrier Association, and Meredith Atwell Baker, President and CEO, CTIA – The Wireless Association, to Tom Wheeler, Chairman, FCC, (Sept. 25, 2015), ("Wireless Industry Letter"), http://www.nanc-chair.org/docs/mtg_docs/Sep_15_CTIA_Letter_to_FCC_092515.pdf.

[10] *See*, Letter from Kris Monteith, Chief, Wireline Competition Bureau, FCC, to North American Numbering Council Chair (December 7, 2017), ("Wireline Bureau Letter"), http://www.nanc-chair.org/docs/mtg_docs/Dec17_NANC_Referral_NNP.pdf.

[11] NNP Notice ¶ 2.

To those ends, today's LNP architecture relies upon the use of location routing numbers ("LRNs"), which identify the switch of a service provider.[12] The Number Portability Administration Center ("NPAC"), a system of databases, supports queries of dialed numbers to obtain LRNs which enable the proper routing of calls. The FCC currently limits the geographic scope of an LRN to a Local Access and Transport Area ("LATA"); and, thereby restricts the ability of consumers to port a telephone number to another service provider that is beyond the footprint of a LATA. There are over two hundred LATAs in the United States. In addition, the NPAC regional system of databases largely restricts ports between regions. Only in limited cases, historically in the wake of natural disasters, does the NPAC lift the porting limitation to temporarily support displaced individuals.[13]

The FCC has observed the limitations of the current LNP architecture, noting "[t]he ability to keep your telephone number when switching wireline or wireless service provider may depend on whether the service provider to whom you want to switch is a nationwide service provider. This limitation not only confuses and inconveniences consumers, it harms the ability of small or regional service providers to compete, undermining a core principle of number portability – competition."[14] However, the issue is not whether the recipient service provider is a "nationwide" service provider; the issue is whether the recipient service provider has a point of interconnection ("POI") in the LATA with which the consumer's number is associated.

The NNP WG took this into account and created a definition for NNP by combining the existing FCC definitions of number portability and location portability[15] in 47 CFR §52.21 to provide context for the recommendations contained in this report:

> *The term nationwide number portability means the ability of users of telecommunications services to retain existing telecommunications numbers without impairment of quality, reliability, or convenience when switching from one telecommunications carrier to another or when moving from one physical location to another.*[16]

[12] The LNP architecture also supports thousand-block number pooling, an important North American Numbering Plan ("NANP") number resource conservation measure. Thousand-block number pooling allows service providers to obtain numbering resources in increments of 1,000 versus an increment of 10,000, commonly known as a central office ("CO") code.

[13] Refer to http://www.nanc-chair.org/docs/nowg/Jan06_Hurricane_Impact_Report.doc; and, North American Numbering Council, Local Number Portability Administration Working Group, *White Paper on Non-Geographic Number Portability* (Aug. 30, 2016), http://www.nanc-chair.org/docs/mtg_docs/Sep16_LNPA_WG_White_Paper_Non-Geographic_Number_Portability_083016.docx.

[14] *See*, NNP Notice.

[15] See, 47 CFR §52.21 (m) and (k).

[16] The discussion of this document applies only to the United States and its territories.

Various organizations in collaboration with the FCC, including the industry, the NANC, and ATIS, have previously evaluated the opportunity to transition to a porting system that modifies or removes the current architectural limitations (i.e., LRNs and Points of Interconnection (POIs) within a LATA). A brief list of those past evaluations follows *(see also,* Appendix B, *Summary of Past NNP Evaluations).*

- Competitive Carriers Association ("CCA")/CTIA Letter to Chairman Wheeler dated September 2015;[17]
- The North American Numbering Council Future of Numbering ("FON") Working Group Report dated March 2016;[18]
- NTCA–The Rural Broadband Association ("NTCA") Letter to North American Numbering Council Chair dated March 2016; [19]
- The North American Numbering Council Report on Nationwide Number Portability dated May 2016;[20]
- The 2016 ATIS Technical Report on a Nationwide Number Portability Technical Report dated June 2016;[21]
- The North American Numbering Council Local Number Portability Administration ("LNPA") Working Group White Paper dated September 2016; [22] and
- The National Association of Regulatory Utility Commissioners ("NARUC") Resolution on NNP adopted February 14, 2018.[23]

[17] *Id.*

[18]N. Am. Numbering Council, *Future of Numbering Working Group Report to the NANC – Nationwide Number Portability*, (April 15, 2016) ("FON WG Report on NNP") http://www.nanc-chair.org/docs/fon/Apr16_FoN_NNP_Final_Report.pdf.

[19] Letter from Michael R. Romano and Brian J. Ford to Betty Ann Kane, Chair, NANC, March 16, 2016, https://www.ntca.org/sites/default/files/legacy/images/stories/Documents/Advocacy/ExParteLetters/03.16.16%20ntca%20letter%20to%20nanc%20re%20nnp.pdf.

[20] Report on Nationwide Number Portability by the North American Numbering Council (May 16, 2016) ("NANC Report on NNP"), http://www.nanc-chair.org/docs/mtg_docs/May16_NNP_Report.zip. This report incorporated the FON WG Report on NNP, among other NANC Working Group contributions on NNP.

[21] *Id.*

[22] Refer to http://www.nanc-chair.org/docs/nowg/Jan06_Hurricane_Impact_Report.doc; *and*, North American Numbering Council, Local Number Portability Administration Working Group, *White Paper on Non-Geographic Number Portability* (Aug. 30, 2016), http://www.nanc-chair.org/docs/mtg_docs/Sep16_LNPA_WG_White_Paper_Non-Geographic_Number_Portability_083016.docx.

[23] *See*, National Association of Regulatory Utility Commissioners, *Resolution on Nationwide Number Portability*, adopted February 14, 2018, ("NARUC Resolution"), https://pubs.naruc.org/pub/E0A7286D-F44E-49DE-0E87-E9E7CD3EF7CE.

III. OVERVIEW OF THE FCC'S WIRELINE COMPETITION BUREAU AND ATIS NNP IDENTIFIED SOLUTION MODELS

The FCC NNP Notice referenced four potential NNP solutions identified and evaluated in the 2016 ATIS NNP Technical Report. The NNP WG has adopted by reference the definitions of the evaluated solutions that are included in the 2016 ATIS NNP Technical Report. All of the identified solutions have been previously discussed and considered by other organizations and the findings and recommendations of those organizations have been transmitted to the NANC and the FCC.

In support of these recommendations, the FCC requested input on the identified solutions through both public comment via the NNP Notice[24] and the NNP WG. Where appropriate, the NNP WG has drawn on comments submitted in the record in response to the NNP Notice and contributions from the NANC NNP WG participants and other subject matter experts to further support the evaluations of the proposed solutions.

A. GR-2982-CORE (GUBB)

As a preliminary matter, the NNP WG dispensed with any substantive consideration of the GR-2982-CORE (GUBB) Model included in both the NNP Notice and the 2016 ATIS NNP Technical Report. The GUBB Model was developed over twenty years ago for use with legacy TDM networks, it was limited to the jurisdictionalization and routing paradigms of that time which are no longer valid in the current environment that incorporates VoIP, and it would require changes to the SS7 signaling parameters. The NNP WG determined that its efforts should be focused on solutions that were feasible in an IP technology environment, or existing technology if merely a configuration task, and consistent with the request in the Wireline Competition Bureau Letter to the NNP WG to focus on solutions which are adaptable to changing markets and technologies.[25]

B. COMMERCIAL AGREEMENTS

The use of commercial agreements by a provider is considered by both the wireless industry and by the assessment of national number portability options conducted by ATIS, as an interim solution.[26] Various organizations, notably LNPA WG, ATIS, CCA/CTIA and the NANC FON WG, have all previously identified and evaluated the use of commercial agreements to accommodate a service provider's ability to provide NNP for its end users.

The commercial agreement solution, as stated in the 2016 ATIS NNP Technical Report, includes the use of third-party facilities to provide a point of interconnection ("POI") in the donor LATA and to deliver traffic from that POI to the network of the recipient provider in a distant LATA[27]

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[24] *See*, NNP Notice.

[25] The NNP WG reviewed comments and reply comments in the NNP Notice which support the conclusion regarding the infeasibility of GUBB based on current and increase use of IP Technology.

[26] *See*, Letter from Steve Berry, President & CEO, Competitive Carrier Association, and Meredith Atwell Baker, President and CEO, CTIA, to Tom Wheeler, Chairman, FCC, (filed Sept. 25, 2015), ("Wireless Industry Letter"), http://www.nanc-chair.org/docs/mtg_docs/Sep_15_CTIA_Letter_to_FCC_092515.pdf.

[27] *See*, 2016 ATIS NNP Technical Report

(*See*, Figure 1 – Commercial Agreement NNP Call Flow, below). The commercial agreement solution ensures that service providers who are not porting in NNP customers do not face new burdens and costs with respect to routing and transit and transport of calls because other service providers implement NNP functionality. Further, the commercial agreements solution does not require modifying existing LNP practices and systems.

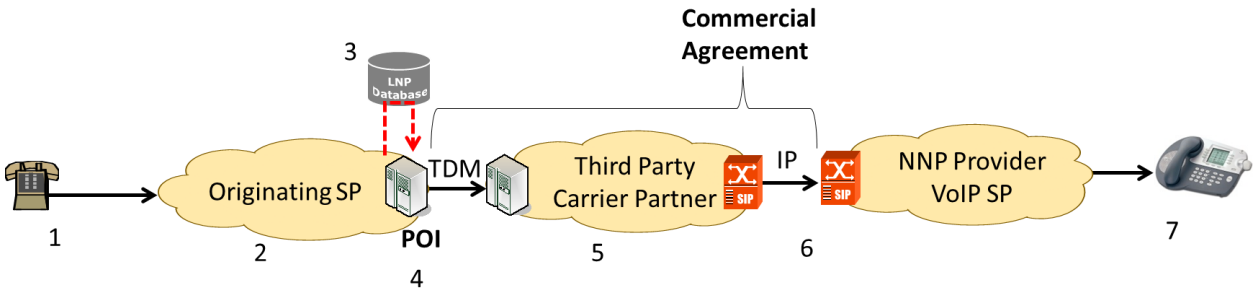

Figure 1 – Commercial Agreement NNP Call Flow

The customer originates the call (1). The originating service provider's network for the call first determines whether the called party number is potentially ported (2). If so, it queries the LNP database and obtains the LRN of the called party number (3). It then routes to the third-party service provider through point-of-interconnection based on the LRN (4). The third-party service provider partner typically interworks the call from TDM to IP and routes the call to the VoIP provider (5). The VoIP provider then routes the call to its NNP customer (6). The terminating customer receives the call (7).

Some interconnected VoIP providers have stated that obtaining commercial agreements in every LATA is burdensome and operationally inefficient, particularly since these providers typically make use of more efficient VoIP network technology and design. Accordingly, those providers seek to minimize the number of LATA-specific commercial agreements.

The NNP WG undertook a more detailed consideration of how service providers make use of commercial agreements, the challenges related to commercial agreements, the feasibility of commercial agreements today and with further technology advancements and recommended solutions to further advance the use of such agreements.

Specifically, it examined whether regulatory changes related to interconnection, portability processes, number administration, and routing databases would further advance and streamline the use of commercial agreements to offer NNP in a manner that will help minimize burdens on providers of all kinds.

1. Interconnection Challenges for Commercial Agreements

Non-national or non-facilities-based service providers that port numbers on a nationwide basis are generally limited to commercial agreements with service provider partners that provide IP connectivity on a nationwide basis to VoIP capable service providers that facilitate the exchange

of voice traffic with Incumbent Local Exchange Carriers ("ILECs"). More specifically, those service provider partners also would need to provide transport over long distances regardless of whether the connectivity is IP or TDM in nature. Given the limited number of nationwide service provider partners that offer the ability to exchange local traffic, there is little competitive pressure among those few service provider partners, resulting in fewer options in the terms and conditions of the agreements.

IP connectivity agreements directly with ILECs may be unavailable due to the lack of IP capability within some ILEC networks. In some commercial agreements, there may also be provisions that prevent the efficient and economic interconnection with other service providers, such as terms that stipulate that the non-national or non-facilities-based service provider may not pursue IP interconnection with originating networks, and that any traffic destined for that service provider must route through its service provider partner's network. In addition, some existing interconnection agreements ("ICAs") may contain language which restricts porting to within the rate center boundaries.

These factors may affect competitive options for non-national or non-facilities-based service providers to obtain desirable terms and conditions for direct IP connectivity and may necessitate reliance on third party provider commercial arrangements. Such agreements may be required for transport across long distances even if local interconnection issues are agreed on and resolved. Calls that connect directly to the LEC are likely to encounter fewer routing and reliability issues.

2. Routing via Commercial Agreements to Facilitate NNP

Although not a full barrier to implementation, the use of third parties to provide a POI in the donor LATA and to deliver traffic from that POI to the network of the recipient can increase the complexity of the routing, sometimes resulting in confusion to service providers when troubleshooting issues with multiple service providers involved. However, such confusion may be reduced by standardizing the processes that facilitate efficient troubleshooting. A lack of IP interconnection options also may preclude effective use of commercial agreements by certain kinds of providers and in certain areas, such as VoIP providers that need to find a third-party provider to convert calls from IP to TDM for purposes of interconnection and traffic exchange.

Dialing and routing of N11 calls could require changes by the originating service provider to reflect the geographic location of the call, rather than basing the translation on the NPA-NXX of the calling number. In addition, location-based routing services, such as 8YY toll-free calls, may be further complicated when callers have numbers that are outside the typical geographic area for their NPA-NXX.

Calls to 9-1-1 initiated by NNP TNs could use the existing pANI solutions deployed for wireless and VoIP service providers. Today, there are multiple vendors who provide a pANI-based solution via commercial agreements. Notably, current implementations for Wireless and VoIP providers (e.g., pANI) used to route 9-1-1 calls today can be and is used for NNP.

3. Cost Considerations related to Commercial Agreements

There are no NPAC costs required with commercial agreements since this model does not fail the existing NPAC validation that ensures that the LATA match of the LRN and porting

telephone number match. However, service providers choosing to offer NNP will likely incur expenses associated with the negotiation of interconnection with third parties to provide a POI in the donor LATA. Service providers choosing to offer NNP may also have to pay for upgrades to billing systems, number inventory systems, caring for "out of rate center" numbers, as well as 9-1-1 solutions. For example, service providers with traditional fixed-line connections to the local PSAP, will need to support pANIs or use third-party solutions.

Service providers interested in providing NNP via commercial agreements can and should do so in light of the recommendations provided in this Report. The use of commercial agreements expedites the timeframe for NNP to be available to consumers. The reconciliation of inter-carrier compensation can be addressed without the need for modification of current billing systems.

4. Benefits Related to Commercial Agreements

Service providers would benefit from minimizing the need for LATA-specific commercial agreements to advance NNP services. Further, service providers who are not porting in NNP customers should not face new burdens and costs with respect to routing and transit/transport of calls because of another provider's implementation of NNP functionality. Commercial agreements should prevent such burdens and costs from being imposed on other service providers. Commercial agreements can utilize both legacy and packet switch technology platforms, and existing portability practices and systems with no changes required.

C. NON-GEOGRAPHIC LOCATION ROUTING NUMBERS MODEL

The Non-Geographic LRN ("NGLRN") solution has three main components:

- A new non-geographic area code to provide NGLRNs;
- A new number administration function for NGLRN assignments;
- VoIP nodes, called Non-Geographic Gateways (NGGWs), that host NGLRNs and provide connectivity to service providers that port in NNP TNs.

To enable NNP for a geographic telephone number ("TN"), the TN is ported in its current NPAC region[28] to an NGLRN rather than to a traditional geographic LRN within the same LATA. When a service provider acquires an NGLRN from the new administration function, the service provider will link a SIP URI to that NGLRN, identifying the specific NGGW to be used for call processing on the VoIP network. Each NGGW delivers calls for one or more terminating networks.

When an LNP query is performed on the dialed TN, the NGLRN is returned. Calls on the TDM network will query their local NPAC database and route based on the area code to a VoIP network whether directly as a VoIP interconnect or indirectly as a TDM interconnect via a media

[28] There are seven regional NPACs that support seven unique regions. These regions are divided by the geography associated with the TN. For example, a New York TN is always ported in the Northeast regional NPAC, a Florida TN in the Southeast regional NPAC. To enable NNP for a New York TN it will be ported to an NGLRN in the Northeast regional NPAC. It does not matter if the New York customer is moving to Florida; the TN database record will remain in the NPAC region originally associated with the geography of the TN.

gateway that front-ends a VoIP network. The VoIP network will query the NGLRN to obtain the terminating NGGW address as a SIP URI.[29] Once on the NGGW, the call will be routed to the terminating network. This functionality allows the TDM network to coexist and interoperate with the VoIP network. (*See*, Figure 2 – NGLRN TDM to IP call flow, below).

Calls that originate on a VoIP network can retrieve the NGLRN from their local NPAC database and either receive the SIP URI in the same record or can trigger on the NGLRN area code to query a routing database with the full NGLRN to obtain the NGGW SIP URI. The call will be routed to the correct terminating NGGW using the SIP URI. (*See*, Figure 3 – NGLRN IP to IP call flow, below).

To summarize, NGLRN creates a VoIP network consisting of VoIP nodes, called NGGWs, which will terminate calls to NNP TNs. A new administration function for NGLRNs will associate the NGLRN to the address of the specific NGGW. NGGWs route calls to the terminating network. When the PSTN receives an NGLRN it must route the call to an IP network that can route the call to the NGGW so that the NGGW can route the call to the terminating network.

For text messaging in an LNP environment, the NPAC records locally cached contain SPIDs that are used rather than LRNs to allow routing to the correct recipient service provider. Until text messages migrate to IP, the NPAC will need to support NNP data records in addition to any new IP routing database records that might be introduced for NNP.

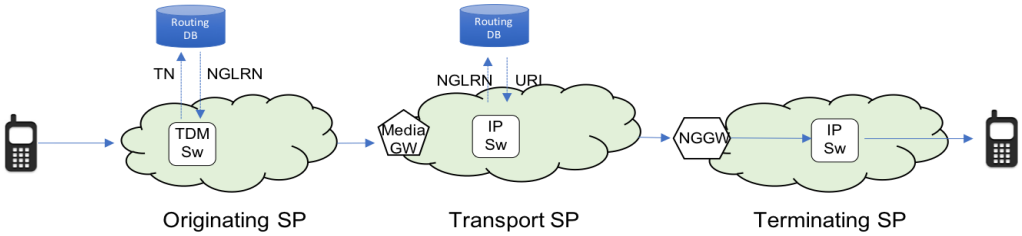

Figure 2 – NGLRN TDM to IP call flow

[29] Performing multiple queries for a single call is common in today's IP networks, it relies on queries for most aspects of call processing. This is not considered a burden on the network, but rather a basic part of IP call processing.

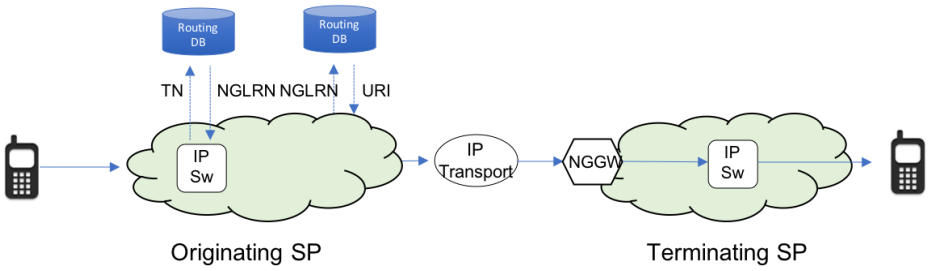

Figure 3 – NGLRN IP to IP call flow

The NNP WG discussed the use of the NGLRN model in both current and future network technology environments. Specifically, the NNP WG engaged in detailed discussions on how gateway architecture is a fundamental component of NGLRN design – and how interconnection and routing via this architecture would work. In addition, the NNP WG carefully considered overall feasibility of the technical solution and the necessary changes to the NPAC and establishment of a new number administration function to support the model. Lastly, WG discussions described important public safety and security issues with the NGLRN model.

1. Routing and Interconnection via the NGLRN Model

The NNP WG determined that the NGLRN model requires no new functionality in the SS7 infrastructure. Service providers would only need to ensure that the SS7 network can route calls to the new area code. Since new area codes are introduced every year, SS7 networks support such additions.

However, as noted above, the introduction of more ubiquitous and potentially new gateway technology will be required for the NGLRN model to ensure required service provider interconnection and call routing. To terminate calls to an NNP TN, both the originating and terminating service provider must be connected to the NGGW. The originating service provider can connect directly to the NGGW by IP or TDM for NGGWs supporting media gateway capabilities or through a transport provider that connects to the NGGW.

The NGGW is the interface between the originating network and the terminating network of an NNP TN and is the equivalent of the LATA tandem in the PSTN. NGGW providers should not be required by regulation to offer NNP service to other service providers (i.e., they can choose to only have their own NNP TNs accessible through their NGGW). To ensure cost-effective provision of NNP services, it is desirable that multiple competing NGGW providers emerge.

Service providers, both originating and terminating, may interconnect directly to NGGWs or through a transport provider that interconnects to NGGWs. Interconnection to the NGGW should adhere to the Joint ATIS/SIP Forum IP Network to Network Interface Profile protocol[30] when using VoIP rather than TDM technology.

An NGGW is a device that manages traffic between VoIP networks, and may be implemented by session border controller ("SBC"); SBCs are commonly used in VoIP networks. Unlike LATA

[30] ATIS/SIP Forum IP NNI Profile, https://access.atis.org/apps/group_public/download.php/22841/ATIS-1000063-SIPForum_TWG-6.pdf.

tandems, NGGWs do not have an association with a specific geography. The non-geographic nature of the NGGW allows for a small number of such gateways (and therefore points of interconnection) to enable interconnection across the nation. The costs of reaching the NGGWs for the different NNP services, borne by both originating and terminating service providers, need further analysis.

The NGGW could terminate calls to either an IP network or a TDM network for those switches capable of delivering the call to an access line assigned a foreign NPA-NXX. For a TDM network, there would also need to be an IP-to-TDM translation, and the originating service provider would need to ensure proper location information is provided in the event that an NNP TN originates a call to 9-1-1. Other N11 calls and location-based routing similarly would need to be addressed, as in the NLRN model.

In the NGLRN solution, routing on the PSTN relies on existing LNP functionality. Routing on the VoIP network relies on either extending the NPAC or on a new number administration function.

On the PSTN, calls to NNP numbers will perform an LNP query just as is done for calls today to any geographic TN. If the call is to an NNP TN, an NGLRN is returned. The area code will be an indicator that the call needs to be routed differently, i.e., it will be sent to an IP network for call processing. The IP network may be the service provider's own network, an existing transport provider that transports calls for the service provider (such as out of region calls), or a new service provider specifically contracted to handle NGLRN calls.

On the IP network, the number administration function will provide multiple identifiers associated with the NGLRN that could be used to route the call to the correct NGGW. Because there is no standard address for VoIP networks, different service providers have chosen to use different identifiers. For example, some service providers associate the central office ("CO") code with a service provider ID ("SPID"), and then associate the SPID with a SIP trunk group identified by a SIP URI. Typically, these identifiers today are placed in the number administration system for identification purposes, not call routing purposes. However, the flexibility of VoIP networks has allowed them to be used for routing as well. In addition to these identifiers, such as the service provider name, SPID, OCN, the NGLRN system will add a SIP URI identifying the NGGW, such as sip:2125551234@nggw.example.net.

2. Necessary Changes to the NPAC and Number Administration via the NGLRN Model

The NPAC LATA edit must be removed to allow the NGLRN model to route calls.[31] NGLRNs will need to be added to each of the regional NPACs, and there must be the ability to add the same NGLRN in multiple regions.

NNP TNs should be ported in the home region of the TN. For example, a New York TN should be ported in the Northeast region NPAC. This should be done to avoid NPAC development and maintain consistency of the regional NPACs. Service providers that want to serve NNP TNs will

[31] The NPAC LATA edit is a check that prevents a service provider from assigning an out of LATA LRN to a ported number or a pooled block.

need to interface with all seven NPAC regions. Further, service providers that want to transport calls to NGLRNs will also need to interface with all seven regions (or contract with an NGGW provider to do so). Finally, the NPAC data record has to be extended if the NGGW provider wants to use the NPAC to look up the NGLRN SIP URI.

From a number administration perspective, NGLRNs will be administered differently than existing geographic TNs. NGLRNs will be allocated as individual TNs, not within central office codes or blocks. A NGLRN will be necessary for each NGGW. If an NNP service provider has more than one NGGW, then each NGGW will need its own NGLRN. In addition to information identifying the service provider and NGGW, there will be a SIP URI for call routing on the IP network. The NGLRN model thus requires a new NGLRN allocation function to be developed and maintained.

3. Feasibility of the NGLRN Model

The NGLRN model can support routing calls in both legacy and IP technology environments with required changes, such as significant investment to service provider architecture and industry databases, as well as new transport and routing functionality to route calls to NGGWs.

TDM platform could originate calls to NNP TNs by configuring routing data for the new NGLRN area code, treating it like a new long-distance call destination.

While NGLRN allows service providers to migrate their customers from the TDM network to the IP network, it is unlikely that all landline circuit switch platforms can serve NNP TNs due to limitations within TDM switches to support terminating to access lines assigned an external area code and end office code.

4. Public Safety and Security Considerations via the NGLRN Model

A call originating from a TN that is not located in the geography associated with the TN has been a common occurrence for many years. This is predominantly associated with mobile and VoIP service. Both services use a pANI as a lookup key that provides accurate location information associated with the originating TN. NNP TNs should receive pANI service when calling 9-1-1. Under the NGLRN model, automatic callback should work like it does today for a ported TN. The PSAP's transport provider would need to be able to process calls to the new area code for NGLRNs.

From a security perspective, most aspects of the NGLRN solution are borrowed from existing processes and therefore are covered by existing security practices. For example, 9-1-1 calls originating from NNP TNs should utilize the pANI solution to provide accurate location information for the originating TN. While the NGGW is a unique aspect of the NGLRN solution, it is not a unique element in IP networks. NGGWs could be SBCs or media gateways, which are a common method for exchanging traffic. Service providers should utilize normal industry security practices and adhere to ATIS's IP NNI Profile.

5. Cost Considerations of the NGLRN Model

Developing, testing and implementing the NGLRN model could incur costs to the industry and consumers. The potential general costs associated with NGLRN include:

- porting systems (i.e., NPAC, SOA and LSMS);
- industry routing databases such BIRRDS/LERG;
- service provider network infrastructure;
- provider back office systems and processes such as billing and number inventory systems;
- transport costs (e.g., transporting calls from TDM networks to NGGWs to complete calls to NNP TNs);
- the new NGLRN administration function;
- connecting to all seven NPAC regions if a service provider wants to transport NNP calls or offer NNP to its customers;
- deploying NGGWs or contracting with an NGGW provider.

6. Observations of the NGLRN Model

The NNP WG observed that while the NGLRN model is feasible in both legacy and advanced technology environments, deployment of the technology may be challenging and time-consuming. It requires significant changes to service provider networks, as well as industry porting and number administration systems and processes.

D. NATIONAL LOCATION ROUTING NUMBER MODEL

The National Location Routing Number ("National LRN") model supports national number portability uses existing LRNs. The approach allows TNs to be ported beyond the current LATA boundaries, thereby allowing TNs to be made available to customers in any geographic location across the nation. This approach minimizes the changes required for routing calls to ported TNs by re-using the existing routing infrastructure.

This approach also could allow service providers with a nationwide footprint to associate customers who have physically moved outside the rate center or LATA associated with their NPA NXX to an LRN in the rate center or LATA in which they now reside. Thus, "permanent roamer" calls can be routed appropriately based on the nationwide use of LRN while assisting the service providers in determining the correct interstate/jurisdictional nature of the call based on the location of the LRN assigned.

A downside of this approach is that it could lead to access stimulation or traffic pumping if service providers associate ported TNs with LRNs that are commercially advantageous but not geographically appropriate to the customer's new physical location or primary place of use.

Existing LRN routing principles can effectively support NNP although there are some issues that need to be considered when taking LRNs outside the current construct of rate centers and LATAs.

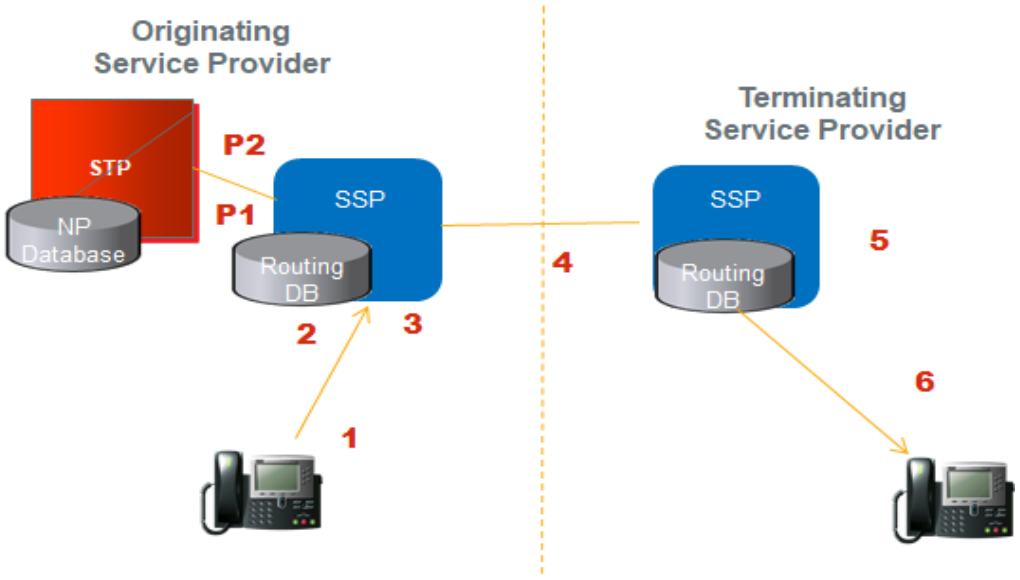

Figure 4 – Routing of an NNP call that used to be local

NNP call that used to be local in a default routing scenario, without porting or pooling:

Figure 4 illustrates how calls would be routed using local service provider routing databases and LRNs for both service provider and location portability. A call is originated (Step 1). In step 2, the originating Service Switching Point ("SSP") consults its routing tables to determine if the dialed number can be routed based on the TN. The originating switch determines the route to the terminating service provider based on the switch translations and routing tables as well as network and commercial conditions. The originating switch establishes a call path. The terminating service provider then translates the dialed number using local data in the terminating switch to find the circuit for the called subscriber and completes the call to the subscriber.

NNP call that used to be local in an exception routing scenario, with porting or pooling:

If the originating SSP determines that the number is potentially ported or in a pooled number block, it then queries the SCP or STP for an LRN. The LRN is based on porting and pooling data provisioned from the NPAC. The STP then returns an LRN to the SSP for the ported or pooled number block. The LRN either identifies the location of the switch based on service provider portability or for the switch where the subscriber is hosted based on location portability. An out-of-LATA LRN would need to be returned if the number was ported geographically outside of the LATA. The SSP uses the LRN to find an egress route to the terminating service provider based on local switch routing tables as well as network and commercial conditions. Next, the originating SSP establishes a call path to the terminating service provider. The terminating service provider translates the dialed number using local data in the terminating switch to find the circuit for the called subscriber and completes the call.

A similar model, i.e., enabling the query of an out-of-LATA LRN, was temporarily operationalized within an NPAC region in the wake of Hurricane Katrina and authorized in

subsequent national disasters.[32] During such emergencies, the NPAC edit that prevents a service provider from assigning an out-of-LATA LRN to a ported number or a pooled block is suspended temporarily. With the suspension of the regional NPAC database edit, a telephone number was ported to an LRN outside the LATA but within the NPAC regional footprint. (*See*, Appendix C - *Katrina LATA Edit Learnings Applied to NNP*).

In broader application via the National LRN model, which would suspend the NPAC edit in all regional NPAC database and system processes, a service provider would be able to assign an out-of-LATA LRN to a ported number from anywhere in the country.[33] Accordingly, the National LRN model requires that providers can have an LRN in multiple regional NPACs to ensure proper provider identification and routing.

The default scenario above assumes that the originating service provider performs a query on all calls. The NLRN solution can work in the current N-1 environment, but some calls will be inefficiently routed if the originating service provider does not perform the query and the N-1 provider needs to route the call back (known as "tromboning"). The impact depends on the number of calls that would be affected.

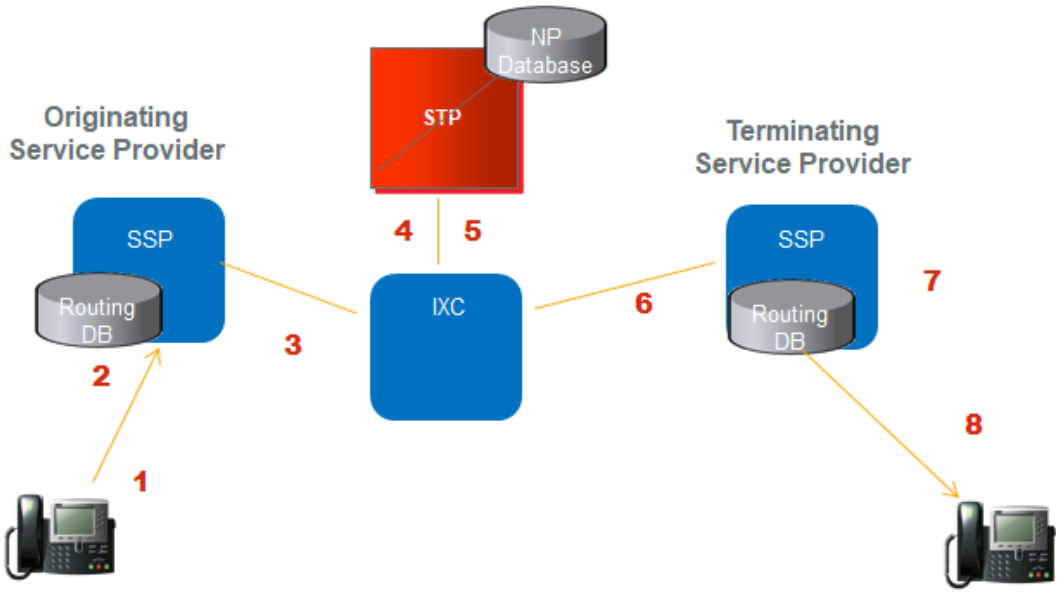

Figure 5 – Routing of NNP Inter-LATA Calls

[32] A report on this action taken and lessons learned from removing certain geographic limitations of LRNs in the aftermath of Hurricane Katrina was issued by the NANC LNPA Working Group in 2006 and subsequently sent to the FCC. (see http://www.nanc-chair.org/docs/nowg/Jan06_Hurricane_Impact_Report.doc). The report noted the temporary benefits to support consumers impacted in an emergency (i.e. individuals/entities displaced due to a catastrophic impact to telecommunications facilities) while detailing equipment limitations, regulatory requirements, number administration changes, back office impacts and consumer considerations that would require further consideration for future use in an emergency or as a model for NNP.

[33] This assumes the provider has facilities in the given location or commercial agreements to support access to facility(s) in the location.

1. A call is originated.
2. The Originating Switch performs digit analysis on the dialed digits to determine how to route the call. The switch determines that routing to the called TN requires routing to an IXC and does not perform the number portability query.
3. The Originating Switch signals the dialed number to the IXC switch using existing procedures.
4. The IXC switch performs digit analysis on the incoming digits to determine how to route the call. The switch determines that called TN is in a portable NPA-NXX and verifies that conditions have been met such that a query should be sent, such as this is the N-1 switch.
5. The NPDB sends a response containing the LRN of the Recipient Switch.
6. The IXC Switch receives the NPDB response and analyzes the data. The LRN is translated in the NP Routing Tables and a route out of the switch is determined.
7. The IXC Switch signals, the dialed number to the Recipient switch.
8. The terminating Service Provides completes the call to the subscriber.

In this case the N-1 carrier is involved, as would be the case for most long-distance calls. In an NNP environment, this could cause a "foreign" number ported into a LATA to be sent unnecessarily to an IXC and might generate unnecessary toll charges. However, the number of subscribers using this capability may be limited.

In this case, the originating switch likely considers that call to be local if the dialed number implies that. This mitigates the potential rating confusion for the consumer, however there may need to be a commercial arrangement or other requirement in place that the N-1 switch considers this a toll rated call.

Alternatively, an originating service provider query would prevent this rating inconsistency between the originating switch and the next hop. On the other hand, if a local number is ported out of the LATA, an originating service provider query would allow proper routing, but the resulting toll charges might be unanticipated by the caller.

1. Routing and Interconnection via the National LRN Model

The National LRN model posits that call processing and network routing, as currently designed by a provider, will likely remain the same for legacy switch or developing IP technology. However, as the 2016 ATIS NNP Technical Report noted, not all originating switch equipment may be able to query on calls to NPA-NXXs outside the LATA because much of that equipment is no longer supported by manufacturers or is at the "end of life" stage.[34] Further, it is expected that most legacy switch technology cannot accommodate the number of foreign NPA-NXX ports (i.e., 10-digit exceptions) due to known table limitations that route on NPA-NXX.

Originating service providers will need to assess technology and commercial arrangements to support the additional required functions for proper call completion outside their network footprint. Accordingly, any such technical challenges related to circuit or packet switch platforms will require collaboration and support by all parties involved.

[34] *See*, 2016 ATIS NNP Technical Report.

The proposal for the National LRN model acknowledges that there are both routing and non-routing impacts. However, this solution takes an approach of leveraging today's infrastructure since it utilizes existing call routing functionality, without the "costs" of additional administrative overhead. Impacts associated with this approach must be weighed against the number of subscribers who would make use of the capability.

From a dialing perspective, if a calling party dials 7 digits, the switch could assume an intra-NPA call and insert the NPA prior to processing the call. In that manner the "local" dialing rules could be maintained.

2. Feasibility of the National LRN Model

The National LRN solution is not affected by the migration to an all-IP environment. The implementation of IP should not change the administration of how TNs are currently assigned and allocated, nor how routing data, the NPAC, or pooled blocks, are currently provisioned and distributed for TDM networks. The major impact of IP networks is centered around defining the essential data elements required for routing in an IP environment, how that data would be exchanged between service providers, and how the network would use those data elements to complete calls end to end. Consequently, this solution satisfies those requirements and would be pertinent in an all-IP environment unless the industry determines through its consensus process that routing should be fundamentally different than it occurs today (e.g., not using LRNs), and then defines the requirements and specifications in an all-IP environment.

3. Industry Coordinated Testing

It may be worth determining whether outbound calls from originating switches to NNP subscribers must use IP or could be supported by existing service provider equipment by making translation and routing configuration changes. This may clarify if the rest of the industry who do not choose to port in NNP subscribers can support this initiative without a forklift change to their networks.

On the inbound side, similar testing may be warranted to determine if service providers wanting to port in NNP subscribers could do so and then terminate calls and messages to those subscribers. Tests may clarify whether this is feasible using legacy equipment or requires IP, and whether this would work for landline, wireless and VoIP services.

It should be noted, however, that even under the ideal situation that both outbound and inbound testing prove successful there is no way to determine in advance if this approach will scale across all service providers on a nationwide basis. Due to this uncertainty, service providers should be surveyed to assess their willingness to participate in testing of legacy network capabilities.

The Working Group recommends that an organized focused test could be undertaken from a selection of landline, wireless and VoIP service providers across network equipment types for legacy and IP, to send calls and messages to subscribers ported outside their LATA boundary. This test exercise will likely require the following steps:

- Designate a coordinator to manage the test.
- Identify the inventory of switching equipment vendors and products, route servers and their respective releases to be tested.
- Set up call signaling recording tools.

- Designate a set of test numbers in a few NPAs.
- Port those numbers, overriding any NPAC edit checks for those specific numbers.
- Participating service providers place test calls, manual or automated, and report the results to the coordinator.
- Assess any call delivery failures for fundamental issues that are beyond configuration tasks.
- Coordinator reports the findings to the NANC.

4. Cost Considerations related to National LRN

Developing, testing and implementing the National LRN model could incur costs to the industry and consumers. Previous discussions of this model have identified the following general cost categories, but there may be others:

- Porting systems (i.e., NPAC, SOA and LSMS)
- Industry routing databases (i.e., BIRRDS/LERG™)
- Provider network infrastructure
- Provider back office systems and processes such as billing, number inventory systems
- North American Number Plan ("NANP") administration
- State and/or federal regulatory proceedings (e.g., tariffs, calling plans, Extended Calling Area plans)
- Consumer outreach and education
- Public safety
- Transport costs for calls to telephone numbers that were once local but are now ported to locations across the country. This is of particular concern for service providers with small geographic footprints.

IV. REQUESTED EVALUATION OF ATIS NNP IDENTIFIED SOLUTION MODELS

The NNP WG examined the ATIS NNP identified solution models as detailed above. In addition, the NNP WG examined the overall benefits and barriers to implementing the models (except the GR-2982-CORE (GUBB) model), the costs of these models and other considerations. The following details are provided to support the request of the Wireline Competition Bureau to the NNP WG and to provide additional information to support the findings and recommended next steps in this Report.

1. Benefits to implementation

Generally, both providers and consumers may benefit from the implementation of NNP; however, any solution advanced must balance the costs with the likely benefits to ensure optimal use of limited resources. In that balance, it should be considered that NNP allows any service provider to have capabilities to allow customers to port their numbers beyond the local rate center, thus mirroring the capabilities of wireless permanent roaming and interconnected VoIP nomadic capabilities, creating a uniform service for customers.

A brief overview of NNP benefits:

- Ability of consumers to port number without geographic limits.
- Increased competition among small, regional and national providers to the benefit of consumers.
- Reduction of certain market entry restrictions for advanced technologies.
- Increased opportunity for development of innovative products and services.

While the above categories are general references to likely benefits, this list is not exhaustive. Previous evaluations of NNP, regardless of how implemented, also have noted these general categories and more.

2. Barriers to Implementation

As noted, additional technical evaluation must occur to fully understand any potential barriers to implementing NNP. Previous evaluations of NNP included the need for further consideration of the NPAC, number administration, state regulation, service providers back office systems (i.e., rating and billing), call routing, public safety, and dialing parity. The 2018 ATIS NNP Technical Report includes an impact analysis summary of the three remaining models and much of its information is included in the categories below.[35]

A brief overview of some of those categories is included:

- NPAC: Current NPAC system processes require the LRN and TN NPA-NXX components to be associated to the same LATA. Also, currently local systems connect to the regional NPAC Service Management System ("SMS") database based on numbers being broadcast to the region where the NPA-NXX is allocated. The commercial agreements model does not require any NPAC changes.

  With the non-geographic LRN model, the NPAC LATA edit must be removed to allow the routing of calls. In addition, the NGLRNs would need to be added to each of the regional NPACs, and there must be the ability to add the same NGLRN in multiple regions. A new data element must be added to the NPAC so as not to conflict with existing LRNs. Service providers that want to transport calls to NGLRNs will also need to interface with all seven regional NPACs (or contract with an NGGW provider to do so). The NPAC data record would have to be extended if the NGGW provider wants to use the NPAC to look up the NGLRN SIP URI.

  With the national LRN model, the NPAC LATA edit must be removed to allow the routing of calls and requires that service providers can have an LRN in multiple regional NPACs to ensure proper provider identification and routing. Further, local systems that perform their own LNP queries would need to connect to all regional NPACs that numbers may port from to receive the network routing information from the number portability data base used for call routing. However, retaining N-1 queries may mitigate the need for all service providers to connect to all NPAC regions.

[35] *See supra*, note 6.

For both the national LRN and non-geographic LRN models, the impacts to local systems, both Service Order Administration (SOA) and Local Service Management System (LSMS), would need to be assessed. Dependencies, assumptions, or design and implementation decisions likely exist regarding the relationships between NPAs, NXXs, LRNs, and geographic areas of service and single NPAC regions. System implementations may be based on the current porting rules restricting porting to only within a single LATA and/or NPAC region, and that association of an LRN with a single NPAC region, as well as rules that specify that a ported TN record can only exist in one NPAC region.

- Numbering Administration: There may be impacts on numbering administration as it relates to how numbering resources are managed via state oversight (e.g., NPA relief planning and implementation). State regulatory oversight aligns with NPA boundaries, as all NPAs have geographical boundaries that lie within a given state, and generally all rate center boundaries lie within a given state. Rare isolated cases may exist between states having a common border to address various dialing and servicing issues for small areas. The Commercial Agreements model and the National LRN model do not require any numbering administration changes. The Non-Geographic LRN model requires a new non-geographic NPA to be established from which NGLRNs would be assigned, and a new NGLRN allocation function to be developed and maintained.

- State Regulatory: In all three models, porting telephone numbers out-of-state raises questions of regulatory and service provider responsibilities, taxation, E9-1-1 funding, liabilities, and numbering resource oversight.

- Accounting/Billing: The Commercial Agreements model has no accounting or billing changes necessary. With the both national LRN and non-geographic LRN models, from a consumer point of view regarding call rating, there could be some confusion if local or toll plans are involved, as there would be calls to the same NPA-NXX that are sometimes local and sometimes toll. Some service providers' local calling scopes could require changes as a result of NNP.

- PSTN/IP Interworking: The Commercial Agreements and National LRN models have no PSTN/IP interworking changes needed. However, there is no industry-wide consensus on the preferred method to route calls in an IP environment or whether any such changes would impact existing industry regulations or processes. For the Non-Geographic LRN model, changes would be dependent upon interconnection options and obligations of providing PSTN/IP interworking function.

- Regulatory Related Services (Emergency and NS/EP): In all three models, NNP calls to 9-1-1 will likely require pANI services to route to the correct PSAP. This may not be feasible in some wireline TDM networks but could potentially be offered by third parties. No additional impacts are expected from NNP on NS/EP services.

- Dialing Parity/10-Digit Dialing: From a consumer perspective, dialing plan consistency (e.g., national 10-digit dialing) may be desirable. For example, variations exist across the country with how calls can or should be dialed, i.e., 1+10 digits, 10 digits, or 7 digits. These

are often related to intelligence in the dialed number relative to routing. For example, local calls originating and terminating within the same NPA, if only one NPA today serves the area, are usually dialed on a seven-digit basis. Areas where NPA overlays have occurred are dialed as 1+10 digits or most often only 10 digits depending on the dial plan approved by the state. NNP impacts of the three models on the varying dialing plans need to be assessed.

V. OTHER CONSIDERATIONS

On February 14, 2018, NARUC adopted a Resolution on Nationwide Number Portability. The Resolution referenced two studies of the issues related to NNP, specifically the ATIS "Technical Report on a Nationwide Number Portability Study," released June 20, 2016, and the "Report on NNP" prepared by the Future of Numbering ("FON") Working Group ("WG"), submitted to the FCC by the NANC on May 16, 2016. The Resolution "urges the FCC to carefully consider issues outlined in the NANC's May 16, 2016 "Report on NNP," so as to avoid known concerns; and that the FCC disclose for public comment: (1) the costs to consumers to implement NNP; (2) the cost recovery options for NNP implementation; (3) the timeline options for implementing NNP; and (4) the impact of NNP implementation on the IP transition."

The NARUC Resolution references the issues included in the FON WG "Report on NNP," which "found certain likely impacts in the following areas: Mandated Fees and Surcharges assessed upon Telecommunications Service based upon Physical Address; Mandated State and Local Sales Taxes; Intrastate Tariffed Telecommunications Services; Intrastate Toll Telecommunications Services; Tariffs and Rulemaking; State Coordination and Collaboration; 10-Digit Dialing; Customer Complaints; and Public Safety (9-1-1/NG-9-1-1)."[36]

Prior to reaching a decision to adopt NNP, using any of the technical solutions proposed in this Report, the FCC should thoroughly analyze how and if a proposed solution would impact such areas to ensure that there are no deleterious effects on the ability of state regulators and taxing authorities to carry out their duties under individual state statutes and regulations. For example, where current requirements are based on geographic location, additional procedures may need to be implemented to ensure that service providers, to the extent applicable, continue to correctly identify the physical location of their customers for the purposes of applying all applicable state taxes, fees and surcharges.

Public safety (E9-1-1 or NG 9-1-1) is a concern that must be considered in implementing NNP, because accurate originating location information of all E9-1-1 calls is vital to providing emergency services in a timely manner. If the use of National LRN or Non-Geographic LRN is adopted by the FCC, guidelines should be adopted to assure that calls to emergency services continue to have the accurate location of the call automatically sent to the Public Safety Answering Point.

[36] *See*, FON WG Report on NNP.