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REDACTED – FOR PUBLIC INSPECTION

July 25, 2014

Via Electronic Transmission

Marlene H. Dortch, Secretary
Federal Communications Commission
Office of the Secretary
445 12th Street, SW
Room TW-A325
Washington, DC 20554

Re: WC Docket No. 07-149
WC Docket No. 09-109
CC Docket No. 95-116

Dear Secretary Dortch:

Enclosed please find the REDACTED VERSION of Comments of the LNP Alliance with Exhibits for filing with the Commission in the above-referenced matters.

Sincerely,

James C. Falvey
Counsel to LNP Alliance

JCF/ljk

Encl.

REDACTED – FOR PUBLIC INSPECTION

BEFORE THE
FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, DC 20554

In the Matter of:	
Petition of Telcordia Technologies, Inc. to Reform Amendment 57 and to Order a Competitive Bidding Process for Number Portability Administration	WC Docket No. 07-149
Petition of Telcordia Technologies, Inc. to Reform or Strike Amendment 70, to Institute a Competitive Bidding for Number Portability Administration, and to End the LLC's Interim Role in Number Portability Administration Contract Management	WC Docket No. 09-109
Telephone Number Portability	CC Docket No. 95-116

COMMENTS OF THE LNP ALLIANCE

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Dated: July 25, 2014

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Telephone Number Portability	CC Docket No. 95-116

COMMENTS OF THE LNP ALLIANCE

The LNP Alliance ("LNP Alliance" or "Alliance") hereby submits these comments on behalf of its members in response to the Commission's request for comment on the recommendation of the North American Numbering Council ("NANC"), which endorsed the bid of Telcordia as the Local Number Portability Administrator ("LNPA").[1] The LNP Alliance is a consortium of small and medium ("S/M") providers that currently consists of Comspan Communications, Inc., Telnet Worldwide, Inc., the Northwest Telecommunications Association ("NWTA"), and the Michigan Internet and Telecommunications Alliance ("MITA"). The LNP Alliance is focused on ensuring that the LNPA selection process takes into account the concerns of its S/M provider members and other similarly situated providers.

[1] FCC Public Notice, Commission Extends Comment Deadlines For Public Notice Seeking Comment On The North American Numbering Council Recommendation Of A Vendor To Serve As Local Number Portability Administrator, DA 14-937, CC Docket No. 95-116, WC Docket No. 0-109 (rel. June 27, 2014).

I. INTRODUCTION AND SUMMARY

The LNP database is a critical component of competitive local exchange service provisioning in that it directly affects the customer's ability to select its provider of choice in order to obtain the customer's required personal or business communications services. While currently the porting of numbers between carriers and the routing of calls and messages is highly reliable, seamless and timely, it has not always been so. But once the Number Portability Administration Center ("NPAC") was established, an independent and neutral LNPA was selected, and the ancillary processes were agreed upon across the industry, competition began to grow because customers and carriers could trust the system. Now that the NANC is considering a change in providers for the next seven (7) years, not only is the selection of a neutral provider critical, but also ensuring that the transition to a new provider, if any, is implemented in such a way that the industry maintains the stability, accuracy, timeliness, and cost structure necessary to protect consumers and to ensure that there is no negative impact on competition. The Commission must also ensure that this LNPA transition is accomplished in a manner that accelerates, or at a minimum, does not further delay the transition to IP interconnection and the development of new and enhanced services.

The LNP Alliance is endorsing neither the Telcordia nor the Neustar bid at this time. Although both companies' bids have certain strengths, neither bid in its current form is adequate, particularly when considering the need to obtain the best value from the LNPA, the LNPA neutrality requirement, and the fact that the LNPA transition will take place at a critical time in the midst of the transition of the Public Switched Telephone Network ("PSTN") from TDM-based circuit switched technology to IP-based packet switched technology ("IP Transition"). The LNP Alliance has serious concerns about Telcordia's neutrality given the fact that its parent

company, Ericsson, is a telecommunications equipment manufacturer that is very closely aligned with the wireless telecommunications industry segment. Additionally, Telcordia is, by its own admission,[2] the nation's leading supplier of the systems that service providers use to communicate with the NPAC, both for receiving updates regarding numbering resource allocation in order to support, for example, carrier routing functions ("Local Service Management System ("LSMS"),[3] and to interact with the NPAC for the porting of telephone numbers from one carrier to another (also known as Service Order Administration ("SOA")[4]. If Telcordia were to become the U.S. LNPA while still dominating the market for provider-side systems used to communicate with the NPAC, the opportunities for various forms of nontransparent partiality on the part of the NPAC would be unlimited.

In light of these facts, proceeding to award the bid to Telcordia – a bid that violates the Commission's rules – would likely lead to an appeal by Neustar and future uncertainty if the Commission is found to have violated the rules governing neutrality. [BEGIN HIGHLY CONFIDENTIAL] [redacted] [END HIGHLY CONFIDENTIAL] If the Commission is inclined to award the bid based on the NANC's recommendation to Telcordia, the most conservative course would be for

[2] *See* Public (redacted) version of Telcordia RFP Section 15.1, Supplemental Documentation response section 3.1.1 which states, in part: "Telcordia is the leading Service Order Activation (SOA) provider with multiple deployments of its North American Number Portability Gateway in all NPAC regions. Approximately 90% of wireless number porting transactions goes through Telcordia systems. The Telcordia North American Number Portability Gateway is based on the ATIS OBF Wireless Intercarrier Communications Interface Specification that includes patented contributions from Telcordia, and this is the enabling technology for U.S. MNP to be the most efficient in the world. In fact because Telcordia systems handle the WICIS and the NPAC SOA transactions as well as the LSMS transactions and Toll-Free portability, Telcordia has likely processed more portability related transactions than NPAC itself."

[3] LSMS is the system owned by a service provider and which receives data broadcast from the NPAC/SMS. The LSMS provisions the service provider's downstream systems, such as its LNP call routing database. The LSMS is a mechanized system used primarily to receive data broadcasts from the NPAC/SMS.

[4] SOA: Service Order Administration. The mechanized device interfaces to the NPAC/SMS to create, modify, or delete NPAC/SMS records. For example, a record must be created when a consumer ports his number.

the Commission to require Ericsson to spin off Telcordia LNPA operations (while retaining its LSMS/SOA operations), even it meant delaying the bid process by a year or two beyond the July 2015 deadline.

The Commission must also give particular attention in the LNPA selection process to the fact that the telecommunications industry is in the middle of profound and potentially disruptive change. Though change is common in this industry, and accommodating incremental change will be required of any selected LNPA, the IP Transition comprises much more than that. This is not just the change in technology (TDM-based circuit switching to IP-based packet switching) mentioned above, but an evolutionary change in the services and service providers that will require access to LNPA services in order to offer retail communications services to the public, including S/M commercial customers which comprise the majority of a S/M service provider's customer base. For example while first steps in the IP Transition, such as provider-to-provider IP Interconnection for the exchange of voice traffic, can be accomplished with no change in NPAC services or procedures, other steps such as support for multi-media NG911 services or TN-based routing will require such alterations. The Commission must therefore evaluate the bids not only based on how effective each Respondent will be as the LNPA today, but also as each will define and perform LNPA tasks over the next seven years, including through the ongoing IP Transition, the impact of which will extend well beyond this seven-year contract. Of paramount importance is ensuring that the prevailing LNPA will not create artificial timelines or prerequisites that could delay the implementation of IP interconnection or other near-term aspects of the IP Transition.

The LNP Alliance is seriously concerned that the two disparate bids provided widely varying approaches in terms of "Required Enhancements and Future Considerations" in RFP

Section 7, making it difficult if not impossible to compare the bids in this critical area. In addition, there has been no mention in the RFP or the selection process of the efforts of the various groups working towards near-term consensus and standardization regarding numbering resource definition and allocation, and no mention of IP interconnection between service providers. These include the initiatives of the ATIS/SIP Forum IP-NNI Task Force, the ATIS Industry Numbering Committee, and the Internet Engineering Task Force now well underway.

Consumers and providers would benefit if the Commission were to extend the current Neustar contract for two years in order to garner sufficient operational data and industry consensus to provide clear direction to the Respondents on "required enhancements and future considerations," so that they can submit apples-to-apples bids in this critical area of concern. Both the neutrality and IP Transition issues require additional time in order for the Commission to make the policy decisions that are a necessary predicate to a smooth transition. This includes time to define the essential LNPA enhancement requirements to facilitate the IP Transition during the term of this Master Agreement and ensure a seamless LNPA transition.

The LNP Alliance raises additional technical and operational concerns below. The Commission should ensure that the LNPA is prepared to address known and unanticipated future enhancements, must ensure that the LNPA transition does not disrupt the integrity, security and operation of the nation's communications networks, and must ensure that the Master Agreement is sufficiently detailed to capture the benefits of the RFP process to date and ensures that providers harmed by inferior LNP services have adequate remedies.

II. THE COMMISSION MUST ENSURE THAT IT ADDRESSES THE NEUTRALITY ISSUE IN A MANNER CONSISTENT WITH THE COMMISSION'S RULES

A. Neutrality is a Critical Hallmark of the LNPA

There is a consensus that neutrality is a critical hallmark of the LNPA. Neutrality has been described as "central" among the selection criteria and a "crucial element of the RFPs."[5] The Commission has explained that neutral administration facilitates competition "by making numbering resources available to new service providers on an efficient basis," ensures that providers have open and efficient access to update customer records in support of their ability to transfer new customers, and ensures " the equal treatment of all carriers," and avoids "any appearance of impropriety or anti-competitive conduct."[6] Neutrality is particularly critical for S/M new entrant providers: without efficient, affordable, and neutral number portability it would be all but impossible for new entrants to build a customer base. The LNPA must act as the neutral arbiter of millions of transactions between a wide variety of categories of providers: wireline, wireless, ILEC, CLEC, RLEC and wholesale providers serving VoIP providers, without providing any preference for any one group over another.

B. The FCC's Rules Preclude Telecommunications Equipment Manufacturers and Their Affiliates from Serving as the LNPA

While both Telcordia and Neustar agree that neutrality is critical, there has been a running dispute over the exact requirements of the Commission's LNPA neutrality rules. The LNP Alliance believes that the Commission's rules do not permit a telecommunications equipment manufacturer or its affiliate to act as the LNPA. The Commission should ensure that

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[5] *North American Numbering Council, Local Number Portability Administrator Selection Working Group*, April 25, 1997, § 4.1.1 ("*Working Group Report*"), , available at: https://www.npac.com/content/download/10717/104218/NANC%20LNPA%20Selection%20 Working%20Group%204-25-97%20-DOC-272978A1%20(2).doc ("Working Group Report").

[6] *Telephone Number Portability*, First Report & Order and Further Notice of Proposed Rulemaking, FCC 96-286, 11 FCC Rcd. 8352, ¶ 91 (1996).

its LNPA selection falls clearly within the Commission's rules because an appeal overturning the selection decision would create unnecessary uncertainty for S/M providers and the industry as a whole. In addition, neutrality should not be a close call. The prevailing bidder must be beyond reproach in terms of neutrality. While it is Telcordia's neutrality that is the focus here, the LNP Alliance finds other aspects of Telcordia's bid to be attractive, and is recommending that the Commission require Telcordia to improve its commitment to neutrality, as opposed to rejecting the Telcordia bid on this basis at this time.

The recommendations of the NANC *Working Group Report* were explicitly "incorporated by reference" into 47 C.F.R. § 52.26(a).[7] The rules even state that certain provisions of the *Working Group Report* are ***not*** incorporated, making it clear that the Commission knew how to exclude particular provisions.[8] The *Working Group Report* recommendations, state that in "order to prevent a real conflict of interest, the . . . Administrator must be a neutral third party that has no financial or market interest in providing local exchange services within the United States." *Working Group Report*, § 4.2.2. As a prime example of key neutrality requirements, the *Working Group Report* states that the NPAC function "*will not* be awarded to . . . any entity with a direct material financial interest in manufacturing telecommunications network equipment . . . ." *Id.* (dual emphasis in original).[9] The *Working Group Report* also prohibits an award to "any entity affiliated in other than a deminimus [sic] way" with such an entity.[10] Although Telcordia has attempted to downplay this Commission rule as an "historical recitation,"[11] the language remains firmly rooted in the Commission's rules.

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[7] 47 C.F.R. §52.26(a).
[8] *Id.*
[9] Section 4.2.2 of the Working Group Report is incorporated into the LNPA Selection Process Recommendation 6.4.4. *Working Group Report*, §§ 6.4.4 and 6.4.5.
[10] *Id.*
[11] *Ex Parte* Letter from John Nakahata, Counsel for Telcordia Technologies, Inc., d/b/a/ iconectiv, to Marlene Dortch, Secretary, FCC at 2, CC Docket No. 95-116, WC Docket Nos. 07-149 & 09-109 (filed May 9, 2014).

Telcordia has attempted to argue that the *Working Group Report* is a detail relevant only to the 1997 selection process in the Mid-Atlantic Region.[12] Not only is the prohibition on telecom equipment manufacturer affiliates incorporated into the rules, but Telcordia never explains why that prohibition, which was highlighted as a strict prohibition in 1997, should no longer be a concern for the industry and the Commission today. Nothing has changed since 1997 that would suggest that a telecom equipment manufacturer's affiliate would not have a conflict of interest due to its parent company's financial interest in selling telecom equipment to particular telecom companies. Of course, manufacturers would be most likely to be influenced by their largest corporate accounts, which makes this a particularly important issue for S/M providers that need to preserve an equal role in the porting process, and with respect to future issues surrounding the porting process. There was every reason to preclude an award to an affiliate of an equipment manufacturer in 1997 and the LNP Alliance urges the Commission to continue to enforce this prohibition today.

C. At a Minimum, Companies Aligned with a Particular Industry Segment Are Not Eligible and Ericsson and Its Affiliates Are Aligned with the Wireless Industry

There is no debate that, at a minimum, the FCC's rules require that the LNPA be an "independent, non-governmental entity, not aligned with any particular telecommunications industry segment."[13] The RFP elaborates stating that such entity must be "impartial" and an entity "that can assure that access to the NPAC/SMS for all qualified Users is at all times

[12] *Id.*
[13] 47 C.F.R. 52.21(k).

evenhanded, impartial and nondiscriminatory."[14] The Respondents offer two extremes when it comes to nonalignment and neutrality.

Neustar, initially the Communications Industry Services ("CIS") division of Lockheed Martin, was divested from Lockheed in 1999 and became Neustar after Lockheed Martin acquired COMSAT, because the acquisition of a telecommunications company created neutrality concerns for CIS's number administration and NANP functions. Lockheed saw that the only responsible and legal solution to preserve the neutrality of Neustar was to spin off the operating unit.[15] Telcordia, by contrast, remains affiliated with Ericsson, a telecommunications equipment manufacturer with almost $35B in net sales in 2013.[16] Ericsson, as a manufacturer and supplier of services to the wireless telecommunications industry, is indisputably aligned with a telecommunications industry segment, the wireless industry. Although Ericsson is a household name in wireless manufacturing, we nonetheless provide a few examples of the manner in which Ericsson is aligned with the wireless industry. The Ericsson 2013 annual report provides:

> ***Our business depends upon the continued growth of mobile communications*** and the acceptance of new services. If growth slows or new services do not succeed, operators' investment in networks may slow or stop, harming our business. A substantial portion of our business depends on the continued growth of mobile communications in terms of both the number of subscriptions and usage per subscriber, which in turn drives the continued deployment and expansion of network systems by our customers.[17]

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[14] *Wireline Competition Bureau Seeks Comment on Procurement Documents for the Local Number Portability (LNP) Administration Contract, Pleading Cycle Established*, Public Notice, DA 12-1333, 27 FCC Rcd. 11,771, 11,781 (2012)("RFP").

[15] *See Neustar | Our History*, NEUSTAR.BIZ, http://www.neustar.biz/about-us/our-history#.U86CMaPD9ok (last visited July 23, 2014).

[16] *Facts & Figures - Ericsson*, ERICSSON.COM, http://www.ericsson.com/thecompany/company_facts/facts_figures (last visited July 23, 2014).

[17] *Living in a Networked Society - Ericsson 2013 Annual Report*, ERICSSON.COM, p. 123, http://www.ericsson.com/thecompany/investors/financial_reports/2013/annual13/sites/default/files/download/pdf/EN_-_Ericsson_AR2013.pdf (last visited July 23, 2014).

Ericsson and Sprint have reportedly entered into a $5B, seven-year agreement under which Ericsson has taken over the day-to-day management of Sprint's network, a deal in which 6,000 employees transferred from Sprint to Ericsson.[18] In addition, T-Mobile reportedly entered into a $4B transaction to purchase Ericsson equipment in 2012.[19]

Ericsson has also been outspoken in comments filed with the Commission on high-profile, controversial issues of pressing concern to the industry. For example, in recent net neutrality comments, Ericsson championed the development of the U.S. wireless industry under an unregulated regime with limited net neutrality protections for consumers: "The wireless industry in the U.S. has been almost completely unfettered by open Internet/Net Neutrality rules, and over the past five year in particular, has become the envy of the world in terms of price, speed, competition, and breadth of offerings."[20] Ericsson does not limit its comments to the wireless industry, arguing that it "does not support additional regulation of broadband Internet access."[21]

Ericsson also filed comments in enthusiastic support of the AT&T IP Transition trials, encouraging "the Commission to permit the trials to move forward expeditiously."[22] One would be hard-pressed to find similar FCC filings by Neustar on any issues that do not relate to number porting or administration. Assuming Ericsson

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[18] *Ex Parte* Letter from Aaron M. Panner, Counsel for Neustar, to Marlene H. Dortch, Secretary, FCC at 4, CC Docket No. 95-116, WC Docket Nos. 07-149 & 09-109 (filed Sept. 11, 2012)(citing Roger Cheng, *Sprint Signs Deal With Ericsson to Outsource Network Operations*, WALL ST. J., July 10, 2009, available at http://online.wsj.com/article/SB124715621714118569.html).

[19] *Id.* (citing *T-Mobile USA to use Ericsson, Nokia Siemens Gear*, REUTERS, May 7, 2012, available at http://www.reuters.com/article/2012/05/08/tmobileusa-ericsson-nokiasiemens-idUSL1E8G7NOY20120508).

[20] Comments of Ericsson, *In the Matter of Protecting and Promoting the Open Internet*, GN Docket No. 14-28 (July 17, 2014).

[21] *Id.* at 1.

[22] Ericsson Reply to Comments of AT&T Services, Inc. at 10, *In the Matter of AT&T's Proposal for Service-Based Technology Transitions Experiments*, GN Docket No. 13-5, GN Docket No. 12-353 (April 10, 2014).

continues to file comments on critical regulatory issues facing the industry, it will continue to broadcast to Telcordia employees the priorities that the parent company values and the direction that the parent company believes the industry should be heading through such filings.[23]

In short, Ericsson and its affiliate Telcordia are clearly aligned with and financially dependent upon the wireless industry and not sufficiently neutral to meet the requirements in the RFP and the Commission's rules for neutrality. Telcordia cannot meet the RFP's requirement that it provide "evenhanded, impartial and nondiscriminatory" access to the NPAC/SMS,[24] because it is affiliated with a telecommunications equipment manufacturer,[25] and is clearly aligned with the wireless industry in a manner that violates Sections 52.26(a) and 52.21(k) of the Commission's rules.[26]

[BEGIN HIGHLY CONFIDENTIAL]

[redacted]

[23] Ericsson has every right to file such comments and to influence the regulatory debates affecting the future of the wireless industry. It clearly has a vested interest in doing so to promote policies that will create continued growth in Ericsson's products and services. But the company that files comments and pursues specific policies should not be the parent company of the LNPA under any circumstances.

[24] RFP, 27 FCC Rcd. at 11,781.

[25] *See Working Group Report*, § 4.2.2.

[26] 47 C.F.R. §52.21(k).

[redacted]

[redacted]

[END HIGHLY CONFIDENTIAL]

III. THE LNPA SELECTION PROCESS MAY BE SKEWED BECAUSE IT DID NOT ACCOUNT FOR THE REQUIREMENTS OF THE IP TRANSITION

A. Respondents Bids May Not be Comparable Because the RFP Does Not Provide Detailed Requirements for the LNPA Role After the IP Transition

[BEGIN HIGHLY CONFIDENTIAL]

[END HIGHLY CONFIDENTIAL] With limited requirements to establish exactly what architecture would apply to the composition and possible commingling of data between NPAC repositories and, for example, external registries, as well as NPAC processes, procedures, service level requirements, data elements, formats and protocols in the wake of the IP Transition, it seems very likely that the two Respondents made very different assumptions about what services they would be providing in the post-IP Transition future as the LNPA. A recent Telcordia White Paper, discussed further below, indicates that this may very well have been the case. Yet there is not enough direction given in the RFP for the NANC and the Commission to understand fully what each party was actually pricing out.[42]

In fact, the RFP only asks a single question regarding the IP Transition. In Section 7.2.5, the RFP asks:

> PSTN to IP Transition
>
> REQ 1: The next-generation NPAC/SMS architecture must be flexible in order to support the transition of the Public Switched Telephone Network (PSTN) to an all-Internet Protocol (IP) network. In addition, the LNPA must work expeditiously with the industry to implement any required changes.
> **Does the Respondent's proposed NPAC/SMS platform have the flexibility to incorporate this future consideration should it become required?**[43]

Of course, both Respondents made their best efforts to provide a constructive, general response to this general question. The RFP does not request the parties to present and cost out their IP LNP architecture, and neither party has done that. What the RFP should have done is

[42] In theory, companies should have identified this issue when they had an opportunity to comment on the RFP. But given the complexity of the issues and the unanticipated interrelationships between the LNPA bid process and the IP Transition, the fact is that no carriers, consumer advocates, or other parties identified these issues at the time the RFP was put out for comment. Now that we have brought these issues to light, it is incumbent upon the Commission to address them and not to continue down a path that could jeopardize the competitiveness of future markets.

[43] RFP, 27 FCC Rcd. at 11,780 (bold in original).

affirmatively establish industry-consensus LNP IP Transition requirements based on the ongoing work of industry groups focused on this issue, and asked the Respondents to bid on those specific requirements. The industry is on the cusp of establishing such requirements and it would be irresponsible and potentially very harmful to bid and award the LNPA contract without incorporating these requirements. Only the first few years of the current LNPA contract will relate to services in a TDM-centric environment; the better part of the contract is likely to relate to services provided in a post-IP Transition architecture that is not described in the RFP.

Because the RFP provides insufficient detail as to the methods and procedures relative to the PSTN transition and the role of the LNPA in that transition, it does not specify that the respondent provide cost information relative to any particular set of tasks or performance criteria or requirements. Therefore, each respondent is left to its own thoughts as to what comprises such a transition, rendering a comparative analysis of the two bids in this area impossible. Again, it is highly probable that the PSTN transition to IP will largely be completed well before the end of the term of this Master Agreement.

There are currently three distinct industry working groups heading toward consensus and standardization regarding various issues of numbering resource definition and allocation, as well as carrier interconnection in support of the IP Transition: the ATIS/SIP Forum IP-NNI Task Force, the ATIS Industry Numbering Committee ("INC"), and the Internet Engineering Task Force. Final reports, recommendations and standards in many areas will be published within the year. To provide some idea of the standards and issues being considered by these committees, the LNP Alliance attaches hereto as Exhibit B a letter from ATIS on behalf of the INC to Henning Schulzrinne, Commission Chief Technology Officer, detailing their view of the

functions, features, capabilities and security of transition-related systems.[44] Yet the RFP fails to make any mention of these efforts, the standards that will very shortly result from these efforts, or the manner in which these standards must be incorporated into LNPA architecture and operations. This is partly because these efforts, robust at present, were in their infancy at the time the RFP was written.

As noted, the single general question elicited equally general good faith responses, but failed to shed any light on exactly what architecture and functionality each Respondent was pricing out. [BEGIN HIGHLY CONFIDENTIAL] [redacted]

[redacted]

[44] *See* Letter from Thomas Goode, ATIS General Counsel, to Henning Schulzrinne, FCC Chief Technology Officer (Mar. 31, 2014), attached hereto as Exhibit B.

[redacted]

[END HIGHLY CONFIDENTIAL] The Commission needs to put the horse back in front of the cart and permit the industry task forces and the Commission to establish clear requirements for the future role of the LNPA during and post-IP Transition. The LNP Alliance therefore recommends that the Commission extend the Neustar contract by two years, let the industry define and develop solutions to transition issues, reach a consensus as to requirements, revise the RFP, and permit the parties and any other interested vendors to respond to the revised RFP at that time. Conveniently, the two-year extension also makes sense in the neutrality context to provide sufficient time for Ericsson to address its neutrality issues.

B. There Could Be Additional Adverse Consequences to Proceeding With the LNPA Selection Process Without First Identifying Post-IP Transition Requirements

In addition to skewing the selection process and creating "apples to oranges" bids, there are a number of additional adverse consequences to proceeding without first establishing transitional and post-IP Transition requirements. The following is a brief description and explanation of each of those potential consequences:

1. The currently-unspecified costs relative to known future enhancement requirements will not be fair, reasonable and nondiscriminatory

Because future enhancement considerations were not specifically articulated or categorized in the RFP, there is no assurance that the LNPA charge for each enhancement will be fair, reasonable, and nondiscriminatory. This is a particular concern for S/M providers who are the most likely to be discriminated against if pricing is not regulated. Volume and term pricing, for example, would prove favorable to large carriers but would discriminate against S/M carriers. In light of the ambiguity regarding these enhancements, the LNPA could also charge for such services under either the Direct or Statement of Work ("SOW") pricing models. In such a pricing regime, the FCC's Allocation Model is not used and the LNPA is relatively free to charge for those services in a manner of its own choosing. Such an environment will invariably lead to partiality and unfair pricing practices, to the detriment of S/M providers.

[BEGIN HIGHLY CONFIDENTIAL] [redacted]

[END HIGHLY CONFIDENTIAL]

2. Lack of Detail Pertaining to Known and Future Enhancements Could Adversely Affect the Integrity, Security, and Operation of the Nation's Telecommunications Networks

Theoretically, any transition to a new vendor may disrupt the integrity, security and/or operation of the nation's telecommunications networks. However, the transition to a new LNPA at the very moment when the industry is in the middle of profound and evolutionary change is an extraordinary circumstance. While the Transition and Implementation Plan provided by Telcordia is comprehensive, the plan does not acknowledge and is not inclusive of detail concerning procedures for simultaneously adopting required "future enhancements." The IP Transition will continue to take place simultaneous with the new LNPA Transition and Implementation Plan, unless the LNPA plan somehow delays or disrupts it. The Telcordia Implementation Plan does not contemplate this eventuality nor consider the interplay of the two transitions when conducted concurrently, as it is expected they will.

There may therefore be a risk that the change process itself may cause added exposure in terms of the integrity, security and operation of the nation's telecommunications networks. If Telcordia is chosen as the new LNPA, it should recast its plan to accommodate known IP Transition initiatives now underway so as not to impede or conflict with them.

IV. THE LNPA SELECTION PROCESS SHOULD NOT BE USED AS AN EXCUSE TO DELAY THE IP TRANSITION

The LNP Alliance is acutely concerned that the transition to a new LNPA could disrupt or delay the IP Transition, an unforeseen and unintended consequence that deserves significant scrutiny by the Commission and the industry. While this might benefit certain providers which would welcome such delays, it would be detrimental to consumers eager to access next generation IP-based services and to competition from S/M providers that offer such services. For example, depending upon the impact of a requested future enhancement on the profitability

of the LNPA, the LNPA may leverage its position as the sole provider of essential LNP to curb or delay the development of those enhancements. The RFP should define remedies that can be included in the Master Agreement to address such possibilities.

Both Respondents have provided information related to the tasks and timeframes that they project are necessary to achieve various "future enhancements" specified within the RFP. Both have addressed the subject of the IP Transition, inclusive of IP interconnection, and both have addressed the timing of IP interconnection. Both Respondents estimate that it will take as many as three years to complete the project. But the Respondents are addressing the issue of IP Transition ***in totality***, where endpoint discovery[47] is necessary in order to maximize service flexibility in terms of breadth and quality. And endpoint discovery is not the logical first step in the PSTN transition as it is, by far, the most complicated. Further, it is premature, since most customer endpoints are not IP-based at this time.

IP interconnection to facilitate intercarrier VoIP traffic exchange is the logical first step in the IP Transition. The transition will then move from the core to the customer edge of service provider networks. It follows therefore that, as we know, carriers are interconnecting via IP for the support of VoIP traffic exchange at this very moment, using nothing more than the current functionality of the NPAC/SMS. By way of example, the LNP Alliance provides, attached hereto as Exhibit E, a recent Verizon contribution to the ATIS/SIP Forum NNI Task Force which describes a routing method currently in use and being adopted by some service providers to

[47] "Endpoint discovery" is a term used, in this context, to determine the nature and capabilities of the device employed by an end user in a communication session. For example, endpoint discovery may find that a user is placing a telephone call with a device capable of supporting high-definition voice and video. This information may influence session request of the originating provider in order to tell the terminating provider that this session may include the need to support those features. The terminating carrier will also use endpoint discovery to determine whether or not the device used by the called party also supports the features before honoring the originating provider's request.

exchange VoIP traffic via IP interconnection.[48] IP interconnection is increasingly common because carriers can accomplish it without regard to the technology used by the originating or terminating endpoint (*i.e.*, TDM-based or IP-based).

The LNP Alliance draws the Commission's attention to this aspect of the LNPA RFP Responses because we are concerned that the FCC may be approached by those carriers who have resisted IP interconnection to delay mandated negotiation of IP interconnection agreements until the NPAC/SMS can complete its broader, long-term complete IP Transition. If that were to occur, the industry would lose years of financial and economic efficiencies that real-world IP interconnection between service providers has already proven possible. This would be an ironic, unfortunate, and certainly an unintended result of the LNPA selection process.

The FCC, therefore, should not permit the future enhancement schedule of the winning vendor to delay or disrupt current IP interconnection initiatives between carriers for the purpose of VoIP traffic exchange. In fact, the FCC should immediately acknowledge the technical feasibility of IP interconnection and move quickly to mandate it between requesting service providers for the exchange of all managed VoIP traffic without regard to the technology used by either the originating or terminating endpoint.

V. THE MASTER AGREEMENT PLAYS A CRITICAL ROLE IN PROTECTING THE GAINS OF THE RFP PROCESS AND ENSURING ADEQUATE REMEDIES

A draft Master Agreement (or "Agreement") is not included in the RFP for review. The Commission should ensure that the Master Agreement receives adequate scrutiny, including public comment, to ensure that it preserves the gains of the RFP process and provides adequate

[48] *Text for Section 4 of Interconnection Routing Outline (IPNNI-2014-64XX)*, Verizon Contribution to ATIS/SIP Forum NNI Task Force (July 24, 2014), attached hereto as Exhibit E.

remedies for carriers harmed or discriminated against in the LNPA transition or under the new Agreement.

It is the understanding of the LNP Alliance that the Master Agreement is expected to be an agreement between the NAPM and the selected LNPA. Although NAPM would have a right to enforce the terms of the Agreement, the Commission should ensure that the Agreement permits carriers damaged or discriminated against by the selected LNPA to bring claims for breach of the Master Agreement. This will ensure that the LNPA is responsive to the concerns of carriers, including S/M providers who would not have as strong a voice in dealings with the LNPA.

The Master Agreement should also ensure that the detail contained in the RFP and associated documents, as well as the selected LNPA's responses, are incorporated into the Master Agreement. This will preserve and protect the commitments that the NAPM and the NANC have gained during this phase of the process, when they retain significant leverage over the bidding Respondents. Once a winning bid is selected and awarded, that leverage evaporates, and it is therefore critical that the Master Agreement contain the requisite detail.

In addition to the Respondent commitments in response to the RFP, it is possible that the selected respondent will not be capable of providing a function that is currently unknown but is later determined to be essential to future service delivery. The Master Agreement should permit and facilitate the ability of the selected LNPA to hire a sub-contractor in order to fulfill such a need in the most economic and operationally efficient way possible. In addition, the Master Agreement should give the NAPM the right to mandate the selection of a subcontractor under defined circumstances where the service is necessary to promote competition or permit the widespread delivery of new or innovative services. In a similar vein, the Master Agreement

should ensure that the NAPM and the Commission have flexibility to address any issues that could cause delays in the IP Transition.

Finally, the S/M providers that comprise the LNP Alliance are concerned that the LNP selection process and the new Master Agreement may trigger renewed petitions to shift the current FCC cost allocation model for shared number portability costs to favor larger service providers.[49] Although there have been repeated efforts to create such a shift in the past, the Commission has wisely retained the current model which fairly allocates the costs of number portability across all providers—large, medium, and small—on a nondiscriminatory basis. There is nothing in the LNPA selection process or the adoption of a new Master Agreement that should cause the Commission to revisit this issue at this time. However, because most of the costs to support the IP Transition remain undefined and uncategorized, the risk that these not yet apportioned costs will be allocated in a discriminatory fashion gives great cause for concern.

VI. CONCLUSION

The NANC recommendation is not the end of the LNPA selection process but the beginning of an important phase in which the Commission must review whether the Respondents meet the LNPA neutrality requirements and globally review the LNPA selection process to ensure that it is consistent with the interests of consumers and competitors, including S/M providers. The LNP Alliance began its review with an open mind to both the Telcordia and Neustar responses, both of which have notable advantages and disadvantages. The Alliance cannot endorse either bid at this time.

Based on our analysis of the complete RFP responses, we urge the Commission to extend the existing Neustar contract for two years in order: 1) to permit Telcordia to address serious neutrality concerns associated with its affiliate relationship with Ericsson; and 2) to permit

[49] *See* 47 C.F.R. § 42.32.

industry task forces on the cusp of identifying the requirements of the LNPA in a post-IP Transition environment to complete their work, and 3) to provide the Commission time to incorporate those critical requirements into a revised RFP. The Commission should also ensure that the LNPA transition is not used as an excuse to delay the IP Transition, and that the Master Agreement is drafted to lock in the benefits of the NANC and NAPM's work to date and to guarantee adequate remedies to S/M providers harmed by the LNPA transition or other actions of the new LNPA.

Respectfully Submitted,

/s/ James C. Falvey

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Exhibit A

iconectiv experience performance results

News Release

FOR IMMEDIATE RELEASE

iconectiv Adds Industry Veterans to Board

Clift and Lynch bring extensive experience in leading global communications businesses

PISCATAWAY, NJ – July 24, 2013 – iconectiv, a leader in trusted, neutral, third party telecommunications interconnection solutions, announced today the appointments of two industry veterans, William "Bill" Clift and Richard "Dick" Lynch, to a newly authorized advisory board.

iconectiv's board has been authorized to act in its sole discretion to support iconectiv's objective to deliver neutral, mission-critical, interconnection services around the globe. These two appointments mark the initial stages of staffing an independent iconectiv board. Mr. Clift and Mr. Lynch, bring a wealth of combined telecommunications industry and carrier knowledge and a deep understanding of how technology is converging across the communications landscape. Mr. Clift is the former Chief Technical Officer at Cingular (now AT&T Mobility) and Mr. Lynch is the former EVP & Chief Technology Officer at Verizon Wireless.

"*We are pleased to have Bill and Dick join this iconectiv board,*" said Richard Jacowleff, President and CEO of iconectiv. "*Bill's extensive background at BellSouth, BellSouth Wireless and AT&T Mobility and his leadership in the communications field make him an excellent addition to the team. Dick brings a wealth of experience from his time at Verizon Wireless and Verizon Communications and will lend his expertise to key priorities across the company including our continued commitment to offering competitive, neutral telecom administration services. Both of these board members will bring considerable insight to the company as iconectiv continues to help advance the transition to a global IP communications marketplace.*"

William Clift

Mr. Clift has over 36 years of experience in the telecommunications industry. In his 29 years at BellSouth, Bill held various positions in Network Operations and Strategic Planning and served as Regional Vice President for Business Operations in Indiana and President of one of BellSouth Wireless' divisions. When Cingular Wireless was formed as a joint venture between BellSouth and the then SBC, Bill was appointed as the Chief Technical Officer for the company. He held this position until his retirement in 2004. Since that time, Bill has held the position of North American division President for WFI and CEO and President of Optimi, a creator of wireless engineering software products. Bill has served on the Boards of Mitec Telecom, Optimi, Oz Communications and Innopath and on the Wireless Advisory Board for Vantage Point Venture Partners. He currently serves on the Board of Directors for Sionic and on the Advisory Board for Star Voice.

Richard Lynch

Mr. Lynch was the EVP & Chief Technology Officer for Verizon Communications between 2007 and 2011 and EVP & CTO of Verizon Wireless and its predecessors since 1990. Mr. Lynch is a Fellow of The Institute of Electrical and Electronic Engineers (IEEE) and has been awarded patents in the field of wireless communications. He has sat on the boards of numerous industry organizations including the GSM Association (GSMA), the CDMA Development Group (CDG), and as a member of the Federal Communications Commission Technical Advisory Committee (TAC) and Communications Security Reliability and Interoperability Council (CSRIC). For his leadership in the early years of wireless data, Lynch was honored with the President's Award by the Cellular Telecommunications and Internet Association (CTIA). He has also been inducted into the Wireless History Foundation's Hall of Fame. Lynch currently serves on the boards of TranSwitch Corporation where he is chairman, Ruckus Wireless and Blackberry. Mr. Lynch currently is president of FB Associates, LLC, which provides advisory and consulting services at the intersection of technology, marketing, and business operations.

For more information about iconectiv, visit: www.iconectiv.com.

About iconectiv

Telcordia Technologies, Inc., doing business as iconectiv, a wholly owned subsidiary of Ericsson, develops market leading solutions that enable operators to interconnect networks, devices, and applications critical to evolving the global telecommunications marketplace: iconectiv's powerful, trusted, neutral solutions for the telecommunications industry includes number portability clearinghouses, mobile messaging services, anti-theft mobile device registries, spectrum management databases and other interconnection information services. iconectiv's solutions are used by more than 1,000 operators, regulators and content providers and are currently used to provide services to over 1 billion end users. For more information, visit: www.iconectiv.com

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PISCATAWAY, N.J., Aug. 21, 2013 /PRNewswire/ -- iconectiv, a leader in trusted, neutral, third party telecommunications interconnection solutions, announced today the appointments of Mark Greenquist and Peter Heuman to its advisory board. With a majority of independent members, the board is now complete.

(Logo: http://photos.prnewswire.com/prnh/20130506/PH98498LOGO-a)

Mr. Greenquist, formerly President and CEO of Telcordia, and Mr. Heuman, currently serving as the Deputy Head of Business Unit Support Solutions, Ericsson AB, both bring valuable experience operating and managing companies in the telecommunications industry; and are well versed in iconectiv's business.

The majority of the board is now comprised of independent members, including the previously appointed Bill Clift, the former CTO of Cingular (now AT&T Mobility) and Dick Lynch, the former EVP and CTO of Verizon. Collectively, iconectiv's board brings extensive experience working with carriers, building senior relationships and successfully operating and building telecommunications businesses.

"*We are pleased to have Mark and Peter join the iconectiv board*," said Richard Jacowleff, President and CEO of iconectiv. "*Mark is in a position to provide outstanding guidance as he was Telcordia Technologies' former CEO and was involved in much of our current business. Peter is a dynamic leader bringing experience from both the service provider market from his time with Tele2 as well as telecom infrastructure expertise from Ericsson, one of the industry's most successful companies.*"

Mark Greenquist

Mr. Greenquist has more than 20 years of telecommunications industry experience. Previously, he was President and Chief Executive Officer of Telcordia Technologies where he oversaw the daily operations of the company and successfully orchestrated its acquisition to Ericsson. While at Telcordia, he was appointed to the President's National Security Telecommunications Advisory

Committee (NSTAC) which he served on for three years. Prior to Telcordia, he served as CFO at both Symbol Technologies, a global leader in enterprise mobility solutions, and Agere Systems, a global leader in semiconductors and software solutions for storage, mobility and networking markets. Mr. Greenquist developed his international business expertise at General Motors' European operations, working as the treasurer of Saab Automobile and CFO and managing director of GM Poland. He also served as Vice President of Finance and CFO for General Motors, Europe, based in Zurich, Switzerland. Mr. Greenquist holds a Bachelor's degree in Economics from Dartmouth College in New Hampshire, and an MBA from Columbia University Graduate School of Business in New York.

Peter Heuman

Mr. Heuman has more than 11 years of experience in the telecommunications and media industry. He currently serves as Deputy Head of Business Unit Support Solutions, Ericsson AB. Prior to his current role, he was Head of Operations for Business Unit Support Solutions, Ericsson AB. Before joining Ericsson, Mr. Heuman held operational and sales & marketing executive positions at Tele2, a fixed, mobile, internet and IP-TV solutions telecom operator. Prior to Tele2, he was Chief Executive Officer for Scandinavian media industry-leading Done Management & Systems AB. He holds an MSc, Information Technology & Industrial Management from Chalmers University of Technology in Sweden.

For more information about iconectiv, visit: www.iconectiv.com.

About iconectiv
Telcordia Technologies, Inc., doing business as iconectiv, a wholly owned subsidiary of Ericsson, develops market leading solutions that enable operators to interconnect networks, devices, and applications critical to evolving the global telecommunications marketplace. iconectiv's powerful, trusted, neutral solutions for the telecommunications industry includes number portability clearinghouses, mobile messaging services, anti-theft mobile device registries, spectrum management databases and other interconnection information services. iconectiv's solutions are used by more than 1,000 operators, regulators and content providers and are currently used to provide services to over 1 billion end users. For more information, visit: www.iconectiv.com

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SOURCE iconectiv

RELATED LINKS
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Exhibit B

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ATIS Board Officers

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Susan M. Miller
ATIS

March 31, 2014

Via Email
Henning Schulzrinne
Chief Technology Officer
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Re: *Ex Parte*, WC Docket No. 13-97

Dear Dr. Schulzrinne:

On behalf of its Industry Numbering Committee (INC), the Alliance for Telecommunications Solutions (ATIS) would like to express its appreciation for the Commission's efforts in hosting the numbering testbed workshop on March 25, 2014.

ATIS INC agrees with the Commission that the transition of the PSTN raises both challenges and opportunities for the assignment of telephone numbers and for the features, capabilities, and security of numbering-related databases. ATIS further agrees that correctly addressing transition-related numbering issues will be essential to preserving core values of competition and consumer protection.

ATIS INC has been working on high-level functional requirements for the numbering testbed. The requirements, outlined below, are being shared to ensure the industry's alignment with Commission expectations. ATIS INC notes that, although functional elements may be tested individually, the testbed environment as a whole must have the ability to:

1. Maintain an assignment pool of applicable numbering resources;
2. Facilitate the assignment of a numbering resource (*e.g.*, e.164 number) in a secure and efficient manner from an administrator(s) within a specified amount of time;
3. Transfer a numbering resource between administrators within a specified amount of time in a secure and efficient manner (assuming multiple administrators);
4. Identify the service(s) and/or destination(s) associated with a resource in a secure and efficient manner;
5. Transfer (*e.g.*, port) a numbering resource and/or service and/or destination(s) between service providers within a specified amount of time;

6. Modify a numbering resource, service(s) associated with a resource, and/or destination(s) in a secure and efficient manner;
7. Return a numbering resource and/or disconnect a service and/or destination(s) in a secure and efficient manner;
8. Notify appropriate entities of any of the above activities in a secure and efficient manner;
9. Track and manage the numbering resource in a secure and efficient manner to assist with the management of conflict resolution as well as service history;
10. Communicate with emergency services (*e.g.*, 911, region emergency SMS messages) and other common services (*e.g.*, 211, n11) for the numbering resources and/or services (*e.g.*, text, voice) and/or destinations (*e.g.*, devices, endpoints); and
11. Appropriately address security issues.

ATIS INC has not attempted to identify the stakeholders that will perform the functions outlined above.

Thank you for providing us the opportunity to address these important industry issues. A copy of this letter is being submitted on the record of the above-referenced docket. If you have any questions or concerns regarding the material provided, please feel free to contact me.

Sincerely,

Thomas Goode
ATIS General Counsel

cc: Robert Cannon, Senior Counsel, Office of Strategic Planning and Policy Analysis

Exhibit C

IP Inter-Carrier Routing

Capabilities to Support IP Services Interconnection

The Need for IP Interconnection

Service providers have been transitioning their individual networks to IP for many years. The industry has now come to a critical point where key decisions and capabilities are required to support IP based interconnection, and thereby enable growth of wide-scale and end-to-end IP services. The industry has been exploring ENUM based telephone number registries for a number of years and although not deployed, these experiences will be useful as the industry begins to conceptualize the future IP 10-digit line level database. A number of initiatives have recently been created to take the transition to all-IP networks to the next step.

It should be noted that ENUM has found a niche to determine a unique Service Provider ID (SPID) for routing SMS (short message service) and MMS (multimedia message service) over IP, but ENUM is not yet used in the US for the exchange of routing data between service providers to support real-time IP services on a nationwide scale.

Key market drivers are the ongoing deployment of LTE, and the need to provide interoperability, roaming, and IP based interconnection for the new Voice over LTE (VoLTE) and High Definition (HD) voice services that are being launched worldwide.

The GSM Association (GSMA) and the i3forum recently launched an IP interconnection initiative to drive the deployment of VoLTE and new high quality IP communication services through commercial pilots with leading mobile and fixed providers including Deutsche Telecom, Vodafone, Orange, and Telefonica.

In the US, the FCC is driving towards the sunset of the PSTN and has launched a set of service based experiments and data collection initiatives aimed at evaluating the impacts on consumers and businesses of replacing the existing copper-based telephone network with IP based alternatives for broadband, video, data, and voice services. The challenge is to support secure, reliable, and innovative communications services while ensuring public safety, widespread and affordable access, competition, and consumer protection.

Part of this challenge is to enable open access to IP services from a large number of providers to encourage innovation, competition, and a wide array of choice for consumers and businesses.

Enabling IP Interconnection

Although converged communication in an IP environment has long been a prevailing catchphrase in the telecommunications industry, there have been many roadblocks to achieving seamless interoperability between service providers that the industry is now starting to address.

In addition to the GSMA, i3forum, and FCC initiatives mentioned above, ATIS, the North American organizational partner for 3GPP, and the SIP Forum announced a joint task force in

January 2014 to fully specify an IP communications Network-to-Network Interface (NNI) between North American service providers. The goal is to ensure all service interconnection between providers can occur at the IP level end-to-end, including wide-scale IP-based voice services and other ubiquitous advanced real-time communications such as high-definition voice, point-to-point video calling, and multimedia text across wireless, wireline and cable providers.

Although telecommunications users are identified in different ways for different services (e.g., telephone number, email address, internet domain name, location routing number), telephone numbers remain a ubiquitous mechanism for subscribers to find each other. ENUM (E.164 Number mapping) enables participating service providers to map subscribers' phone numbers to a variety of IP attributes and services. A registry service that enables this mapping is an important element of IP intercarrier routing.

Any registry service that provides these mappings also needs to provide three essential capabilities:

- **Policy** - allows trusted interconnect partners to share certain interconnect and routing information with each other to obtain interconnect and routing data. This can be accomplished during the provisioning process.
- **Rules** – provide the ability to aggregate the telephone numbers into a grouping, e.g., OCN, NPA-NXX, LRN, etc., or assign different attributes to a telephone number. This functionality occurs within the registry and the results of the "rules" are either provided in the download to each operator or by per session query.
- **Peering** - allows for multiple registry providers to synchronize with each other and offer the same authoritative data to their respective customers. Enabling competition amongst registries will ensure a more resilient and innovative service with market based pricing

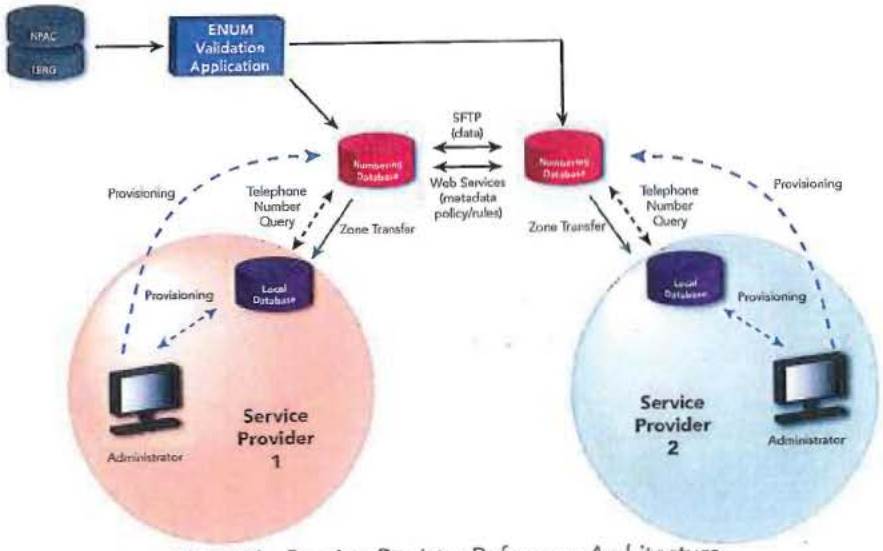

Figure 1 - Peering Registry Reference Architecture

Figure 1 is a reference architecture of the registry that depicts the mechanism by which information is provisioned, distributed, and how multiple registries can co-exist.

IP Interconnection Registry Policy

The US industry is driving towards IP interconnection on a nationwide basis. Unlike the legacy PSTN where the originating network determines the route, IP interconnection may have different characteristics compared to TDM. For example, service providers will be responsible for getting traffic to and from aggregation points where it will be exchanged with other carriers. This would require that an IP Interconnection Registry not only support the interconnection points but also understand, acknowledge and honor the commercial interconnection agreements between service providers.

In an all-IP environment the Service Provider that provisions the data will also likely define one or more selective lists of Data Recipients so that data is not given to unauthorized parties. Therefore, service providers determine the content of the Name Authority Pointer (NAPTR) records returned in response to ENUM queries, including the Uniform Resource Identifier (URI) information that specifies how IP sessions should be routed. Similarly, the Business Logic provisioned by the Service Providers determines the contact information in Session Initiation Protocol (SIP) messages returned to SIP Proxies so that calls can be routed using SIP signaling.

Another example of policy would allow for different Name Server records; depending on the originating & terminating service provider combination, the registry could be configured with policy for source based resolution using a "Recipient Group" feature. For example, some authorized Service Providers of Record might input Name Server information for the same TN that in one case refers to the Tier 2 Name Server of a transit operator or Internetwork Packet Exchange (IPX) and in another case refers to their own terminating Tier 2 Name Server when they are peering or interconnecting directly with the originating service provider. While more powerful in the Tier 2 Name Server platform, this feature has potential application at the registry level and could be used for either per session queries as well as to customize the data download to local cache.

IP Interconnection Registry Rules

The number of records stored in an IP Interconnection Registry could be tens or hundreds of millions based on the need to assign different characteristics per TN. A single change can ripple through the data and touch a vast number of records. As Service Providers provision their Destination Codes, such as Telephone Numbers (TNs), Local Routing Numbers (LRNs), 1K NPA (Numbering Plan Area)-NXX-X number pool blocks, or 10K NPA-NXX exchange codes, these records would identify a routing pattern. A rule that aggregates a number of TNs into a block such as NPA-NXX or NPA-NXX_X can dramatically reduce the number of records that need to be provisioned because it enables higher-level groupings that provide a compressed record set.

For example, an NS or NAPTR record value could be assigned to each Operating Company Number (OCN) rather than to each telephone number or, to each unique Service Provider ID (SPID) and/or NPA/NXX or Location Routing Number (LRN). This could also differ by TN and be at the discretion of the number holder.

As the migration to IP occurs, a single telephone number may be associated with several services, e.g., HD voice, Instant Messaging (IM), and IP telephony. Consequently, when a telephone number is dialed, the service provider needs to know how to route the call. In the example of HD voice (using G722 or G722.2 codecs), if an end user calls from a HD device and

the call is terminated on a HD device, the quality of the call should not be downgraded to traditional voice (G711). The issue is that not all border gateways/session border controllers are HD-capable and not all service providers are HD-capable and consequently this becomes a question of capital investment. The originating service provider should have the ability to route the call to an HD-capable gateway all the way at the far end. However, if the terminating network cannot complete the HD session, then there is no reason to use the more expensive HD codecs. Therefore, the network needs to associate that destination number with some "HD capable" flag.

Not all subscribers have the same services. Therefore, the calling network needs to determine whether the called party has the requested service prior to setting up the call. A solution would be to publish the service information for end users in a registry. A purpose-built registry can accommodate various service attributes at a TN level as well as at coarser levels based on rules established by the Service Provider. The use of rules allows the industry to provision services against higher levels of abstraction which optimize the number of records in the registry and especially in a local (cache) database. Every record and every digit used to identify the record(s) could drive increased costs across the industry.

The registry could optionally be used by service providers to capture and exchange NAPTR records instead of just NS records thereby combining Tier 2 functionality in the Tier 1 Registry. This would limit the number of external cross network queries. This could be optional according to terminating service provider discretion and would be transparent to the originating service provider. This would enable ENUM implementation without the complexity of cross network queries.

IP Interconnection Registry Interworking

Another issue to address is the examination of the often-heard statement that there can be "no more than one National ENUM Registry" because of synchronization issues.

The situation with operating multiple ENUM Registries is different than that of operating a distribution infrastructure, such as the Domain Name Server DNS (A.ROOT-SERVERS.NET through M.ROOT-SERVERS.NET), since these Registries are assumed to be independently managed by competing organizations, each of which allow changes to be made to data. Unlike the DNS system, there is not a single source of valid data. It is important to be clear that each of the competing Registries is intended to contain the same data. The issue, then, is to create an architecture that allows propagation of changes with high speed and high precision, to achieve sufficient synchronization capability such that the information within each registry is identical over a sufficiently rapid time scale.

One obstacle to achieving synchronization is the quantity of data involved. The number of records stored in a registry could be tens or hundreds of millions. Clearly, the time taken to distribute a large number of changed records puts a lower bound on the time scale over which the Registries can be considered to be synchronized. However, it is often not necessary to distribute the changed records explicitly. The simple change which impacted the vast number of records can be described by an equally simple rules statement, which can then be compactly and quickly distributed. It is necessary only that:

- Each registry includes a policy language and rule set that operates on the data's metadata, unambiguously and completely describing the changes
- Each registry uses the same policy language in conjunction with the established rules to describe changes sent and to interpret changes received

Figure 1 is a reference architecture of the proposed solution, consisting of multiple peered Registries combined with either cached data in each Service Provider's environment or allowing a query per session.

This figure shows the overall solution, in which the Service Providers provision data in their registry of choice. In addition, the Registries also receive Industry Data from the Number Portability Administration Center (NPAC) and Local Exchange Routing Guide (LERG). The Registries stay in sync by means of two mechanisms: File Transfer Protocol (FTP) and Web Services.

The FTP-based component relies on a file naming convention and an agreed-upon directory structure which is consistent over all participants. The file names contain an identifier for the intended recipient and a timestamp. In addition, the files are named either ALL or INCR. The INCR (Incremental) files contain only changes to data made during the last hour, whereas the ALL files are a dump of the entire database, written every 24 hours. Each file contains a Transaction ID which acts as an index to the stream of changes. Files are written by the sending registry to the FTP site and pulled by the receiving registry as desired.

In addition there is a Web Services component which provides near-real-time response. Each registry commits to exposing changes on the Web Services interface within a matter of seconds, and other Registries poll the interface as often as desired, typically every 15 seconds. Each Web Services query specifies a Transaction ID, so that the server knows the starting point from which changes are required for that specific query. Each response to a Web Services query specifies a "next" Transaction ID which will be used in a subsequent query. Thus there is assurance that every change is transmitted in a stream of linked queries and responses.

It is assumed that the Web Services client will continually poll the server, but if for some reason the client goes silent for some time, the stream is not broken. All that happens is that the next query after a long hiatus will receive a long response.

The Web Services mechanism is well-suited to transmitting relatively small messages on a rapid schedule, such as the rules declaration messages referred to above. The FTP mechanism is well suited to transmitting large numbers of explicit changes by "brute force" if required. This is primarily intended to be a mechanism used during startup or recovery, but a convention might be that ALL explicit data is transferred via Secure FTP (SFTP) (regardless of quantity) and the Web Services mechanism is ONLY used for rules declarations.

Of course some changes are more compactly described by sending the actual data, rather than forcing it into a contrived rules-based description. Thus a convention would be needed to distinguish actual changed data from rules statements which describe changes if Web Services are used to carry both.

In addition, the possibility of collisions must be considered, in which two independent changes are made in different Registries within the synchronization timescale. Each registry must be prepared to roll back changes if it receives instructions from another registry which impact a

datum which has just been changed locally.

As the migration to a service rich IP environment occurs, multiple ENUM registries can co-exist and it is important to enable peering capability. As an example, this overall architecture already exists within the TV White Spaces industry. The Whitespaces Database Administrators (WSDBA) group has defined an architecture and an Interoperability Specification (http://apps.fcc.gov/ecfs/document/view?id=7520963472) which allows a number of WSDBAs (several of which are certified by the FCC and actively interoperating) to accept registration information and distribute it quickly and accurately, thereby remaining synchronized.

Summary

As more and more telecommunications services are designed for, or migrate to, IP (e.g., VoIP, VoLTE, high definition voice, messaging, and M2M communications), an authoritative means for identifying telecommunications users and services reachable via IP will become a prerequisite to operate at scale. A platform for provisioning and exchanging this interconnection information between telecommunications providers is needed.

Although telecommunications users are identified in different ways for different services (e.g., telephone number, email address, internet domain name, location routing number), telephone numbers remain a ubiquitous mechanism for subscribers to find each other. ENUM has been used in telecommunications for many years but now needs to evolve to meet the particular needs of inter-carrier routing. As the breadth of available services increases, a standards-based mechanism will be needed for mapping a telephone number into IP addresses designating service-specific interconnection points. This capability will be required as part of any large-scale, service-rich IP interconnection architecture. A trusted, centrally-managed IP interconnection registry for inter-carrier routing of IP enabled services should provide three essential functions; policy during the provisioning process, rules based on routing granularity, and the ability to support multiple competing IP interconnection registries. These practical enhancements to today's ENUM solutions will enable the industry to manage inter-carrier routing on a nationwide scale and ultimately sunset the PSTN.

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MC-COR-WP-041
May 2014

Exhibit D

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experience
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results

Address and Interconnection –
From a PSTN to an IP World

Adam C Newman
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4/24/12

Presented for:

ATIS INC

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- Telcordia Technologies, Inc., a wholly owned subsidiary of Ericsson, doing business as **iconectiv**, develops market leading solutions that enable operators to interconnect networks, devices, and applications critical to evolving the global telecommunications marketplace.
- Global Trusted Administrator of mission-critical industry directories, technology and services that enable operators, content providers and subscribers to find, route, connect and interact for high-value voice and data services.

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Directory services currently processing transactions for more than **1.5 billion** subscribers globally.

Manage the information for **400,000 equipment types**, **10 million** locations, and **billions** of connections

80% of fixed access lines, **100%** of toll-free traffic, and **90+%** of wireless number portability in the US.

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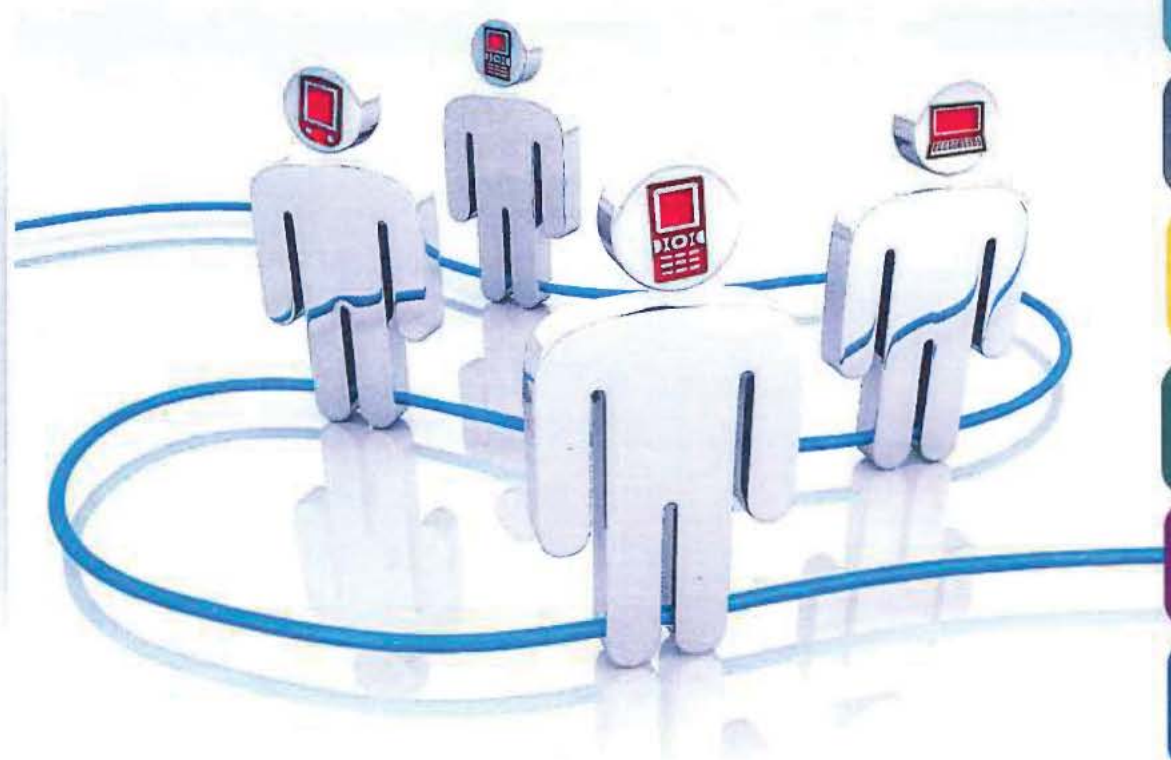
Products and Services



- Number Portability
- Common Language
- Mobile Data
- Message Hub
- Routing Administration
- Spectrum Management
- Device Registry
- Training and Consulting

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Interconnection and the Numbers/Network Addresses:

PSTN

- Telephone Number (TN)
- LERG Switch Homing Arrangement (SHA) & Switch Functions (SOF)
  - Local and Access Tandem
  - OS Tandem
  - 911 Tandem
- Trunk Group ID (TG ID)

PSTN → SS7

- TN
- Service Provider ID (SPID) & Location Routing Number (LRN)
- LERG SHA & SOF & TG ID
- Global Title Address (GTA):
  - Point Codes
  - International Mobile Station Identifier (wireless)

SS7 → IP

- TN
- Port Correction (SPID)/LRN
- LERG SHA & SOF & TG ID
- GTA
- SS7-IP Gateway and Trunk Gateway
- Border Gateway and/or SIP address

IP → IP?

- TN or other user identifier (SIP name, email, IM id) but TN is ubiquitous
- Route to appropriate server for appropriate service
  - SIP/Voice, IM, Email, MMS
  - 911, OS
  - Priority Network Access

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TNs Have Inherent Advantages

- TNs Are:
  - Ubiquitous
  - Unique
  - Understood
  - Routable Globally Across International Boundaries
  - Service Provider Portable (IP and DNS addresses aren't)
  - Available
  - Accessible
  - Adaptable

  - Likely here to stay!

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Registries to Manage Interconnection Data

- Several DBs today that manage data for interconnection:
  - LERG Routing Guide
  - NPAC
  - CLONES
  - NECA Tariff No. 4
  - LIDB
  - SMS/800 Toll Free
  - ENUM federations

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Registries to Manage Interconnection Data

- Registry(ies) will be needed for Transition:
  - Dynamically link PSTN DBs routes to trusted IP routes for basic, premium and ancillary services and to allow interworking between IP enabled SPs and TDM SPs
  - Registries will need to enable interworking between TDM and IP based networks
  - Can extend today's DB's to contain information for interworking during transition
  - ENUM protocol enables relation between TN and ENUM Services
  - ENUM is the i3 forum recommended query protocol

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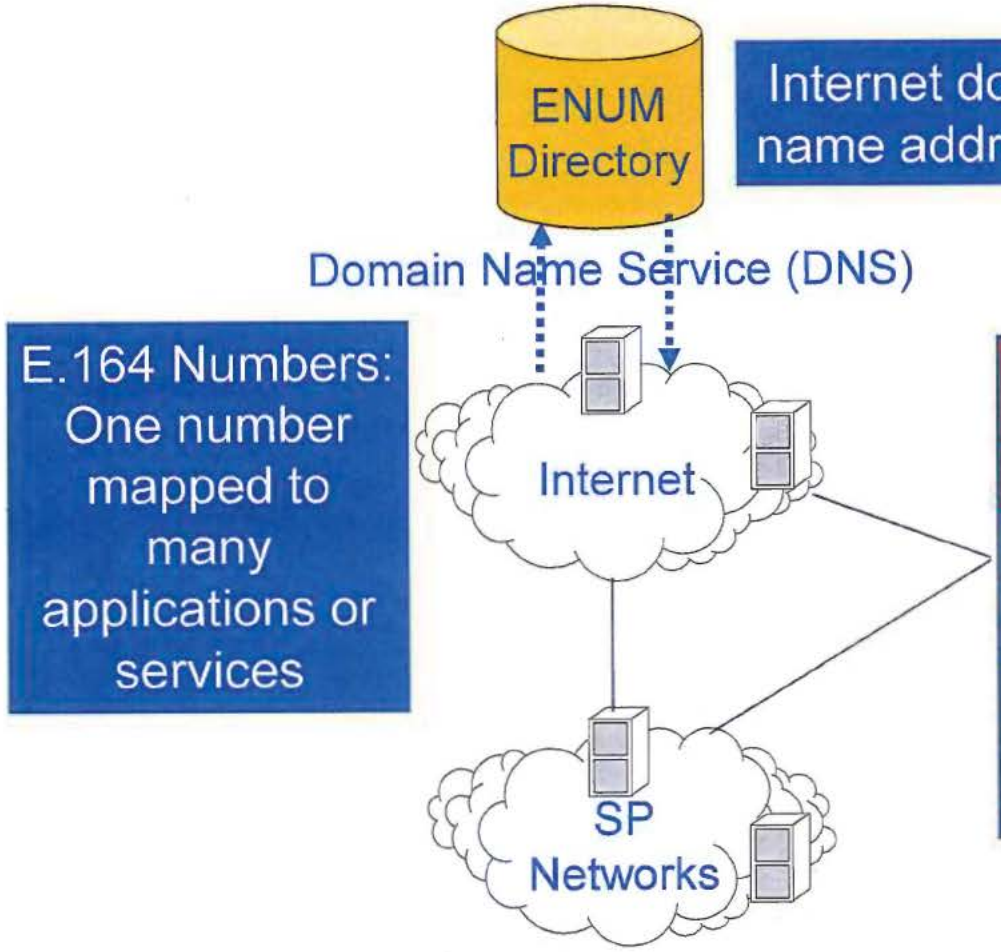
IETF ENUM Protocol to Map e.164 Telephone Numbers to IP uniform resource locators (urls) with defined ENUM services to enable registries



Tier 2 Pointer Record 5.2.4.6.9.9.6.2.3.7.1.e164enum.net	
Protocol	**Service Address**
SIP	sip:anewman@telcordia.nj3.vz.net
SMTP	smtp:anewman@telcordia.com
TEL	tel:+17326996425
FAX	fax:+17323366999
SMS	tel:+17325896783

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Advantages to a DNS Registry?

- DNS query-response protocol is as standard and inexpensive as it's possible to get. e.g.
  - Every Internet-capable computer has the standard DNS protocol built-in.
- DNS queries can be used "recursively" to start at a fixed point and navigate through a set of delegations to find Resource Record information for any valid domain name
- So, if we can do these things:
  - Express a Telephone Number as a domain name (the ENUM Name), and
  - Define a delegation path (series of NS Record, pointing sequentially to a set of DNS servers), and
  - Store the required information at the end of that path as a Resource Record (in this case, a NAPTR record)
- then, the Originating SP has a well-understood, inexpensive way to get the information in real-time.

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I3 Forum on Registry Information to be stored in IP routing directory

- The data model objects should include:
  - Public Identity: TN or TN range
  - Service Provider Identity
    - SPID is suggested
    - Alternatively, service provider identity might be derived from the domain in the host portion of a SIP URI encapsulated in a NAPTR record or the number portability parameter rn (routing number)
    - For shared databases, Source Identity: Carrier or federation ID to show the data source, this could be a carrier identification or a carrier federation/consortium ID.
  - End user service objects: far-end user characteristics and/or applications supported. For ENUM a set of the *enumservice* registrations triggering different URI schemes has been defined (http://www.iana.org/assignments/enum-services)

I3 Forum White Paper "Techniques for Carriers' Advanced Routing and Addressing Schemes" (Release 2.0) May 2011

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Registries to Manage Interconnection Data Tomorrow

- Registry(ies) still necessary in all IP world tomorrow:
  - Efficiently manage data for the trusted IP routes for basic, premium and ancillary services
  - Provide security mechanisms to prevent spoofing
  - Enable appropriates services to devices
  - Prevent device theft and fraud
  - Enable geographic location information for service, technical and regulatory purposes.

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Some Practical Issues for Discussion

- TNs required for the foreseeable future as ubiquitous addressing mechanism
  - IP based SPs can not currently be directly assigned TNs
- IP registries (ENUM enabled) not currently a substitute for NP, Toll-Free, LIDB and other PSTN based service infrastructure
  - Such services still required in all IP universe
  - ENUM does aid in discovery (specified discovery mechanism for IMS)
  - If trusted registry for a TN is discoverable, path to replacement available
- Multiple registries, multiple routes
  - NPAC, Telcordia ENUM Registry, Cable Labs Registry, etc. may provide different routes
  - All routes may be valid
  - Some routes may not be available based on business arrangements between SPs
- Multiple Technologies not all will Interwork/Interconnect
  - SIP is stable, implementations are varied
  - IMS
  - IP-IP Voice & Video via private implementations e.g., Skype.

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Some Regulatory and Other Issues

- Geography and TNs
  - This is both a service and a regulatory issue
  - LATAs are anachronistic
  - If the idea of local calling areas go so can rate centers
    - Requires a regulatory change to number assignment on some other basis, NPA, switch?
  - Jurisdiction of traffic (inter/intrastate) is determined by location
  - Originating and terminating location information has rate (consumer and wholesale) and tax implications
  - Even if TNs do not maintain geographic significance, geography must be know.
  - It's just data, a future registry can maintain some form common geographic location identification for a TN range that may or may not be directly tied to the number range from an assignment perspective.

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What's it all mean?

- Numbers are here to stay and need to be managed into the future
- Direct Assignment of Numbers to IP providers
- Management of new assignment criteria as requirements change
- Working to make sure data associated with a number assignment meets the needs of future SP registries
- Developing and maintaining standards and guidelines enabling registries and accommodating the combination of the geographic desensitization of TNs with the need to still understand the geography for origination and termination.

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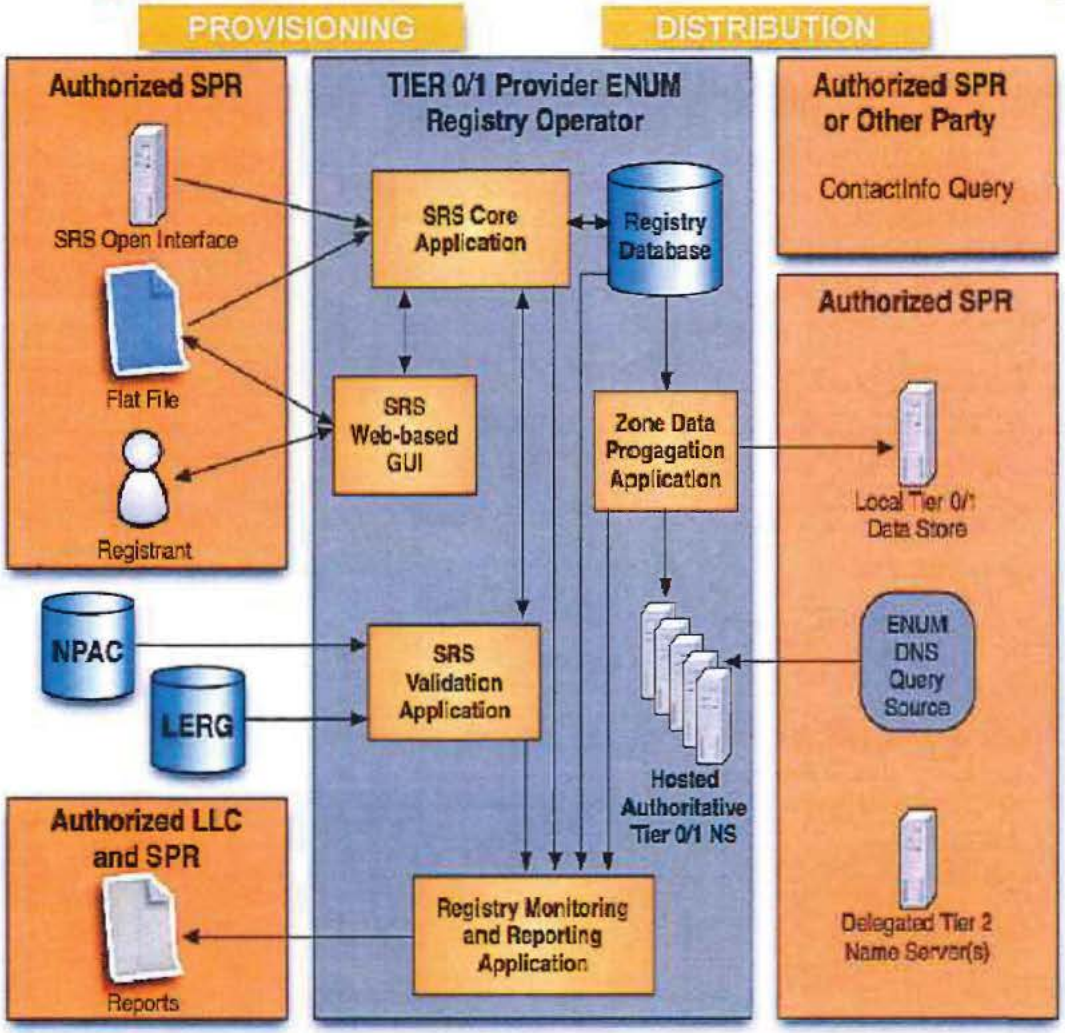
Telcordia ENUM Registry



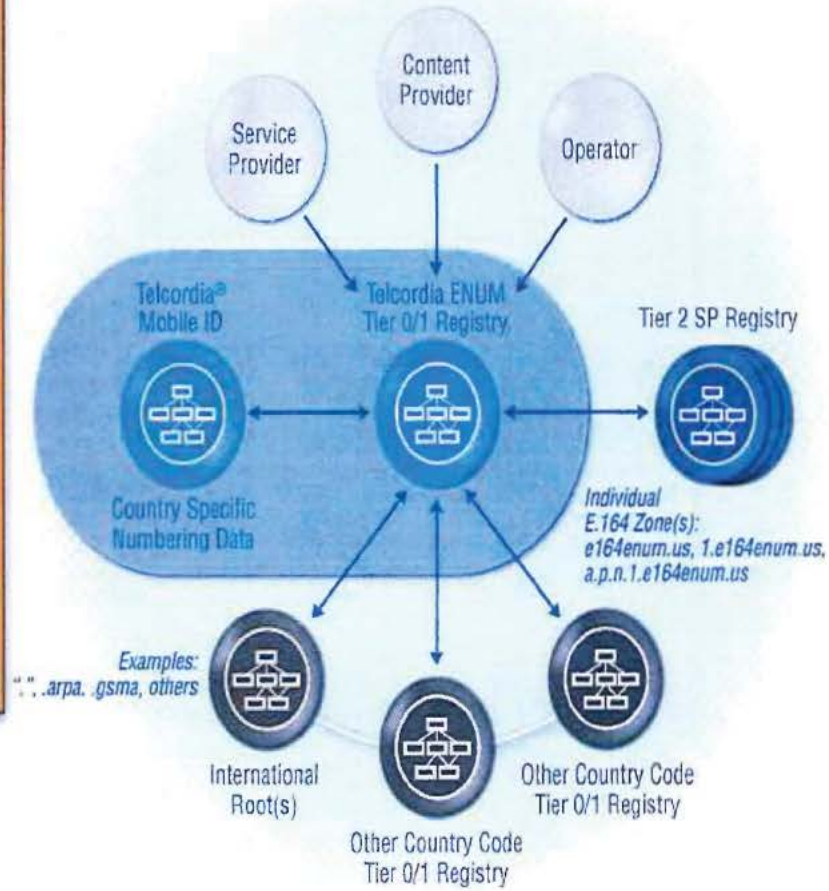


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Exhibit E

ATIS/SIP Forum NNI Task Force
July 24, 2014

Contribution

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

SOURCE*: Verizon

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.

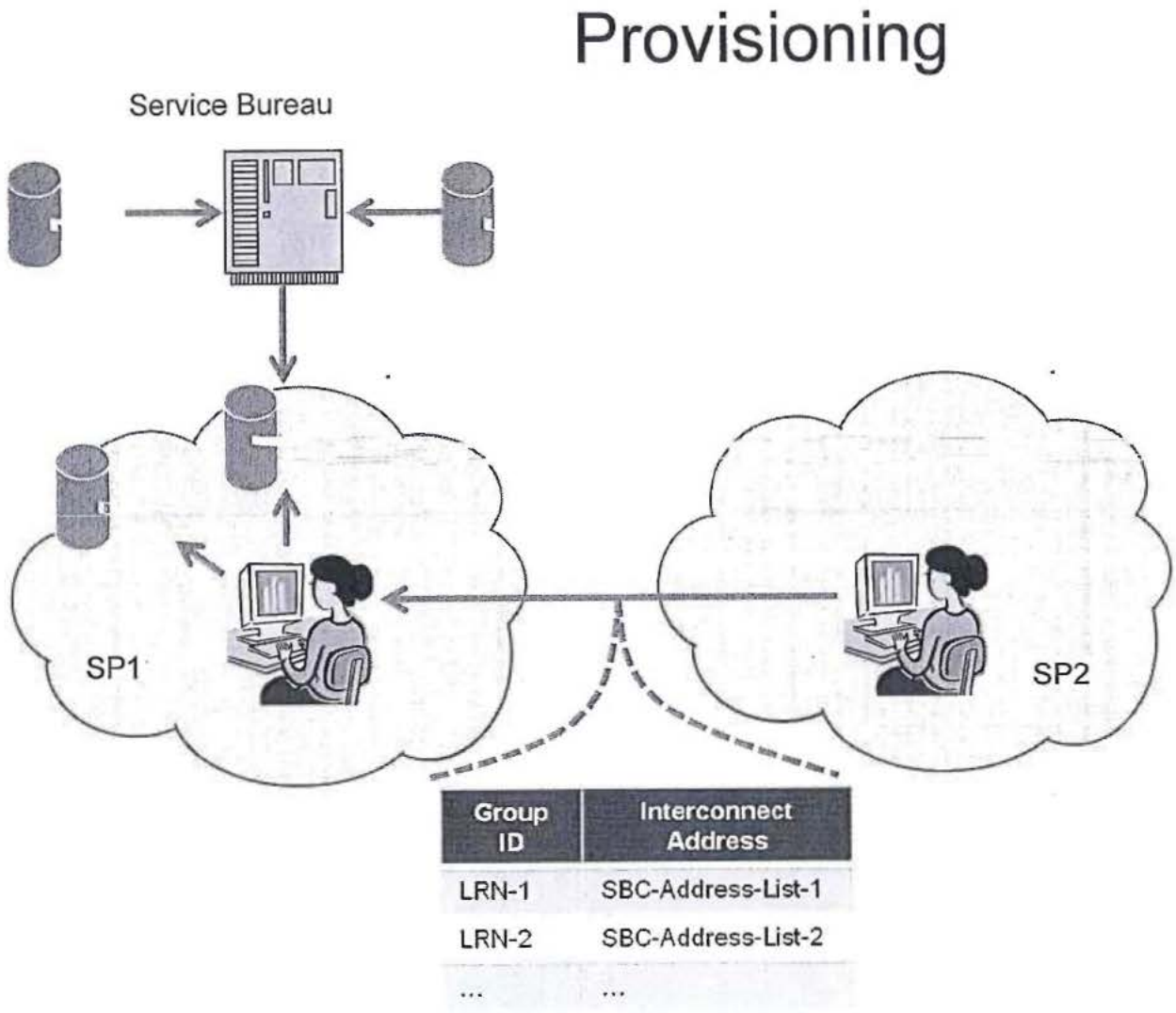

Figure 1

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] 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.

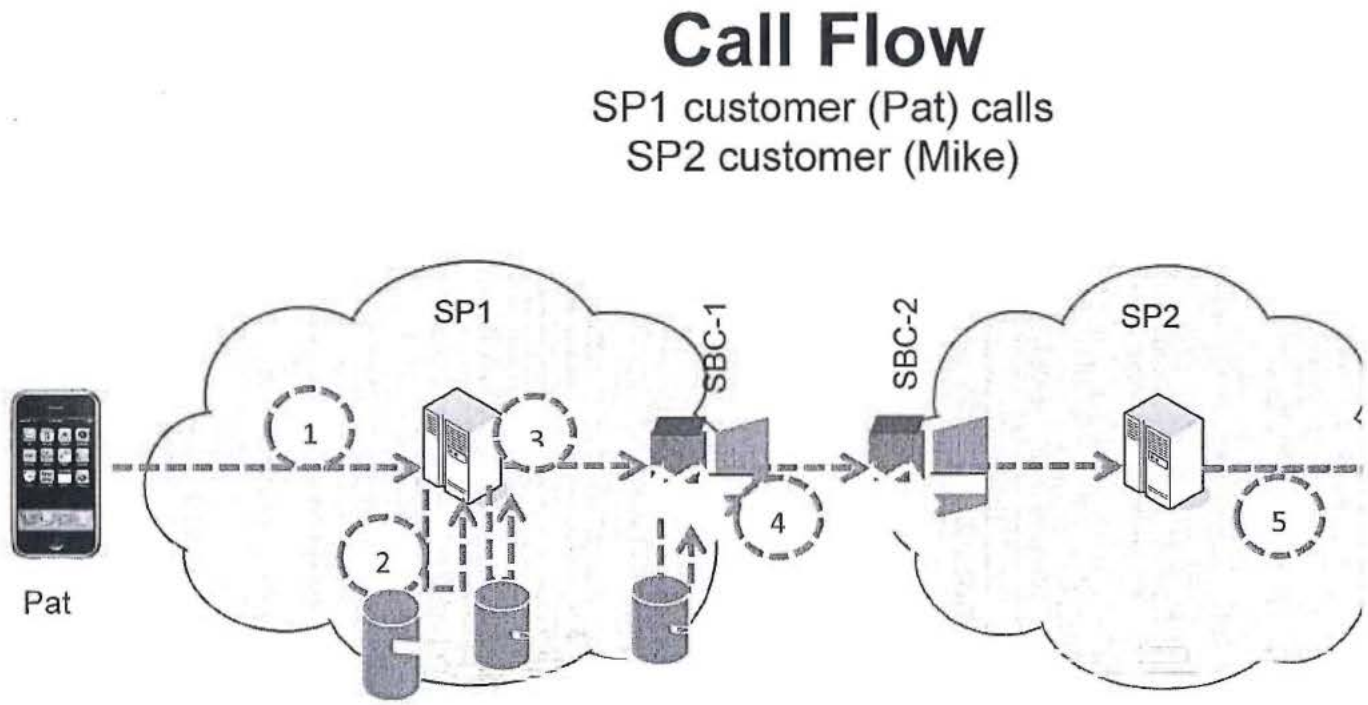

Figure 2

[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.