DRAFT

WIRELESS NUMBER PORTABILITY
Technical, Operational and Implementation Requirements

Phase II

Version 1.5

Created by the Wireless Number Portability Subcommittee
For the
North American Numbering Council

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1.0 EXECUTIVE SUMMARY

The Wireless Number Portability Subcommittee (WNPSC) has prepared the *Wireless Number Portability Technical, Operational, and Implementation Requirements Report*, dated July 11, 2000, in order to provide the guidelines and a timeline for Commercial Mobile Radio Service (CMRS) carriers to fully implement Local Number Portability (LNP).

In the Telephone Number Portability First Report and Order, CC Docket 95-116 released July 2, 1996, the Federal Communications Commission (FCC) established rules mandating number portability for both LECs and CMRS providers. After two extensions, a separate timetable was established for CMRS providers, requiring them toimplement service provider number portability by November 24, 2002, including support of nationwide roaming

In the Telephone Number Portability Second Report and Order, FCC 97-289, released August 18, 1997, the FCC adopted NANC's recommendations as presented in the Architecture Task Force Report (footnote, to paragraph 71). In this order, the FCC used the NANC approved LNPAWG recommendations from the Architecture Task Force and Technical and Operational Task Force reports as the basis for their decisions regarding many number portability implementation, technical standards, and operational issues. This order acknowledged that the LNPAWG focused primarily on the wireline industry segment and did not consider issues related to CMRS providers. As a result, the NANC did not make recommendations regarding the implementation of number portability by CMRS providers. However, the FCC directed NANC to develop and make recommendations that would allow CMRS providers to fully participate in LNP.(paragraph 14).

In the Telephone Number Portability Second Report and Order, the FCC recognized that it would be necessary to modify and update number portability standards and procedures to provision wireless number portability. The FCC directed the NANC to develop the guidelines and procedures necessary to provide for CMRS provider participation in LNP, including recommendations which support proper call routing and roaming. For that purpose, the WNPSC was formed under the LNPAWG to address wireless only LNP implementation issues. The WNPSC was created by NANC on February 16, 1999.. The NANC instructed the WNPSC to report directly to the NANC regarding wireless number portability implementation issues.

The WNPSC developed this report to document wireless industry agreements on the requirements and procedures needed to support LNP. The report is based upon the implementation milestones and associated time frames necessary for the wireless industry to implement LNP by the mandated deadline of November 24, 2002. In a manner similar to that of the wireline industry segment under the LNPAWG recommendations, the WNPSC requests NANC approval of this report as a guideline for the wireless industry segment implementation of LNP. This would fulfill the directive given the NANC in the Second Report and Order. Moreover, to ensure efficient and timely implementation of wireless LNP, it would be beneficial

to the wireless industry segment if the FCC adopted the report and the wireless industry LNP implementation guidelines.

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This document focuses on the technical, operational and implementation requirements necessary for wireless number portability compliance, which includes the support of nationwide roaming. The major areas discussed are *Functional Specifications, System Development, Testing, and Implementation*.

- Section 2provides a regulatory background.
- Section 3provides an overview of the major impacts on porting and non-porting service providers.
- Section 4 provides a matrix of the implementation milestones .
- Section 5 contains the Functional Specifications, including Switching and Signalling Network, Operational Support Systems (OSS), Number Administration and Service Order Administration (SOA) .
- Section 6 contains System Development requirements for the Inter-carrier Communications Process (ICP), Switching and Signalling Network, OSS and SOA.
- Section 7 outlines Testing requirements for internal testing, Number Portability Administration Center (NPAC) certification and turn-up testing, and Inter-carrier testing.
- Section 8 contains an outline of Implementation considerations.
- Section 9 is the glossary.

2.0 BACKGROUND

2.1 Regulatory

On July 2, 1996, the FCC Common Carrier Bureau (CCB) released its First Report and Order in the Number Portability Docket (CC Docket No. 95-116, FCC 96-286). This order required all cellular, broadband Personal Communications Service (PCS), and covered Specialized Mobile Radio (SMR) providers to have the capability of delivering calls from their networks to ported numbers anywhere in the U.S. by December 31, 1998. This is referred to as Phase 1 of Wireless Number Portability. In addition, these CMRS providers were ordered to offer service provider (SP) portability, including the ability to support roaming, throughout their networks by June 30, 1999. Implementation of SP number portability is referred to as Phase 2 of Wireless Number Portability.

On August 14, 1997 the Commission released a Second Report and Order addressing various long-term number portability implementation issues. Among the actions taken in the 2nd Report & Order, the North American Numbering Council (NANC) was directed to develop standards and procedures regarding the provision of number portability by CMRS providers.

Previous activities of the Local Number Portability Working Group (LNPAWG) and associated Task Forces focused primarily on the wireline segment of the industry. The implementation of number portability by wireline carriers was addressed by the LNPAWG in the following documents:

- The *Architecture and Administration Plan for Local Number Portability; and (footnote stating where this can be found)*
- The *LNPA Technical & Operational Requirements Task Force Report, dated April 25, 1997 (footnote stating where this can be found)*

The LNPAWG also addressed wireless and wireline integration issues in two subsequent reports entitled:

- *Local Number Portability Administration Working Group Report on Wireless Wireline Integration, dated May 8, 1998(Refer to Appendix C)*

- *Local Number Portability Administration Working Group 2nd Report on Wireless Wireline Integration, dated February 5, 1999(Refer to Appendix C)*

Subsequent to the First and Second Reports and Orders, two extensions were granted for the implementation of Phase 2 Wireless Number Portability. The first extension was granted per a Memorandum Opinion and Order released September 1, 1998 (DA 98-1763), by the Wireless Telecommunications Bureau. This order extended the deadline from June 30, 1999 to March 31, 2000 to provide additional time for the wireless industry to develop standards to ensure efficient deployment of wireless number portability. In this order, it was clarified that CMRS providers offer number portability in the top 100 MSAs (Metropolitan Service Areas), as well as the ability to support nationwide roaming. The second extension was granted by the CCB in a Memorandum Opinion and Order released February 9, 1999 (FCC 99-19). The CCB granted a Cellular Telephone Industry Association (CTIA) petition to forbear from imposing SP Local Number Portability (LNP) until the completion of the five-year build out period for broadband PCS. This extended the deadline until November 24, 2002.

Since the implementation deadline for Phase 1 LNP has already transpired, this report will not address Phase 1 requirements. The focus of this report shall be on Phase 2 LNP implementation milestones and associated requirements and guidelines.

3.0 WIRELESS NUMBER PORTABILITY – PHASE II OVERVIEW

Phase 2 of LNP is much broader in scope than Phase 1 and impacts all wireless SPs in the United States and any international roamers on their networks. Those wireless SPs operating within the top 100 MSAs are impacted to a much greater extent than those operating outside the top 100 MSAs. The wireless SPs operating outside the top 100 MSAs only have Non-Porting responsibilities. The wireless SPs operating inside the top 100 MSAs have both Porting and

Non-Porting responsibilities. These differences are discussed in the following sections. The first section *(section 3.1)* titled *Resellers* is intended to provide an introduction to the treatment of resellers in the remainder of the document. The second section *(section 3.2)* titled *Non-Porting Service Providers* refer to those activities and issues related to providing service to customers (both homers and roamers) who have ported numbers, and not the functionality of porting numbers. The third section *(section 3.3)* titled *Porting Service Providers* discuss the activities required to incorporate LNP functionality. The fourth section *(section 3.4)* titled *Major Impacts* focus on the LNP changes that have the most significant impact to wireless SPs.

3.1 Resellers

The impact of LNP on wireless resellers is dependent upon the individual relationship between the facility based SP and the reseller. In general terms, these relationships fall into one of two categories – either the facility-based SP maintains complete end-user information for the reseller, or the reseller maintains their own end-user information.

I think the next 3 paragraphs should be deleted because it refers to internal business methods and is confusing. I also think resellers should be the third section, after Non-Porting and Porting. Anna.
In the first case, the facility-based SP supplies either a manual or automated method for the reseller to access and update end-user information, which is maintained in the facility-based SP's databases and systems. The facility-based SP maintains all end-user information and provides billing functions for the reseller.

In the second case, the facility-based SP only supplies the reseller with number resources. In an LNP environment, this will include MDN and Mobile Station Identifier (MSID). The reseller maintains all end-user information in their databases and systems. The facility-based SP passes all end user usage information to the reseller. The reseller is responsible for providing billing functions.

The facility-based SPs may provide MDNs and MSIDs to a reseller in one of two ways:

1. as individual numbers on an as-needed basis
2. or in blocks of numbers

For porting telephone numbers between a new and old wireless reseller, b the pre-port process, i.e. the exchange of the Wireless Port Request (WPR) or Local Service Request (LSR) data and confirmation, will be the reseller's responsibility. Once the confirmation is received, both the Old Service Provider (OSP) (donor) and New Service Provider (NSP) (recipient) should notify their facility based network SPs to initiate the port process, i.e. the communication with the NPAC. (Refer to Appendix A, for wireless to wireless process flows and description.)

3.2 Non-Porting Service Providers

There are several activities which all wireless SPs must complete in order to support LNP and nationwide roaming regardless of whether or not number portability is provided within any one of the top 100 MSAs.

Switches and associated hardware and software must be upgraded to accommodate the separation of the MDN and MSID. Even if a wireless company does not have to provide LNP to its own customers, it must provide service for roamers with ported numbers. In this case, the Visitor Location Register (VLR) must be able to accommodate both an MDN and an MSID – Mobile Identification Number (MIN) or International Mobile Station Identifier (IMSI). In addition, the switch Call Detail Record (CDR) must be able to record both MDN and MSID to facilitate correct out-collect processing.

In all cases, where true Automatic Number Identification (ANI) is to be provided, all wireless SPs must ensure that they are passing true ANI based on the MDN – not the MSID. Passing incorrect ANI will have negative consequences on such functions as Inter-Exchange Carrier (IXC) billing and providing call-back numbers for emergency services. Passing incorrect ANI, as in the case of other services such as calling party number, would result in the wrong number displayed on the wireless handset, inconveniencing the customer.

SEE HI-LITE All of this usage of DN and TN here and elsewhere is very confusing to me and I thought I understood this stuff - kinda. Could we use just one term, I am concerned that others may be unduly confused as myself???? PLEASE BG *Anna votes for MDN.*
All wireless SPs must also ensure that Message Processing Systems (MPS) have been updated to read the modified switch call detail records, containing both MDNs and MSIDs. The MSID is critical in determining the Home Location Register (HLR) of a roamer. After the mandated implementation date of wireless LNP, the MDN can no longer be used to determine the HLR of a r oamer. The MDN could be ported in from another wireless or wireline SP. CIBERNET has declared that the information contained in the NPA/NXX Line Range Table refers to MINs and not MDNs. Therefore, it is the MSID (MIN) that must be used in a porting environment to determine the HLR of roamers. CIBERNET reference footnote:See MSID in Section 10 – Data Dictionary; CIBER Record Methods and Procedures --- JG

It is recommended that the wireless SPs should bill home – JG customers based on the combination of the MSID and the MDN. The MSIDs are re-useable, but not portable and remain with the company to which they are originally assigned.The MDN identifies the party responsible for payment of charges. As a result, all wireless SPs need to modify their systems to format the newer CIBER X2 records and populate both the MDN and MSID. Do all use CIBER records or don't we just need to make sure that the interface works? BG

All wireless SPs need to ensure that when a call is received by Customer Care from a customer – either homer or roamer –the correct number, the MDN, is displayed on the Customer Care representative's screen. It is the MSID that is used by the phone and switch to communicate with each other, but the MDN is used to communicate with the customer. It is important to remember that the same 10-digit number that represents a MSID (is this

completely true? I thought that the ESN, the MSID and the MDN would make a phone / customer unique. The ESN identifies the eqpt and MSID is programmed in according to the SP ------ good point -- actually the MDN and MSID need to be displayed on the Customer Care screen – CC needs the MDN in case they need to call the customer back, and they need the MSID to determine who the current service provider is for the roamer -- JG) may also represent a MDN, A MSID cannot be distinguished from an MDN and, when dialed as a TN, may actually complete, but not to the intended person. The systems used by Customer Care must properly identify the correct MDN to facilitate call-back if necessary. In addition, the MSID may also be useful so the customer's home facility-based SP may be identified. *WNPSC needs to rewrite this paragraph with Jim's help. Anna.*

Finally, wireless SPs operating outside of the top 100 MSAs, may receive a request to provide LNP in a specific switch. These SPs have a maximum of six months (180 days) to become fully LNP compliant. FCC Bona Fide request reference: Paragraph 137 of the First Memorandum Opinion and Order on Reconsideration adopted on March 6, 1997, CC Docket No. 95-116 with the Wireless implementation date extended by Memorandum Opinion and Order adopted on February 8, 1999. --- JG) The amount of work required to become fully compliant is significant and should not be treated lightly.

3.3 Porting

For those wireless SPs who are mandated to provide porting functionality, all of the issues and modifications addressed in section *3.2 Non-Porting* must be completed in addition to the major changes discussed in this section. It is assumed that all wireless SPs operating in the top 100 MSAs will ensure that NPDB queries are performed on appropriate out-bound calls. For that reason, there is no further discussion of Phase I requirements in this document.

3.3.1 Number Inventories

Changes must be made to maintain two number inventories – one for MDNs and one for MSIDs. Management of these two individual inventories will be required. Requests for additional number resources will need to be made based on one set of industry guidelines for MDNs and another set of guidelines for MSIDs. Additional information can be found in *section 3.4.1 MIN/MDN Separation.*

3.3.2 Reference Tool

A new reference tool is needed to determine which NPA NXXs are within the same portability region.Each company must decide which NPA-NXXs can be ported-in from a donor company. It would be very difficult for a sales representative to determine, without a reference tool, whether or not their company has a license to serve a particular NPA-NXX.

3.3.3 Business Days and Business Hours and Porting Intervals

What are we going to use here, we are asking the LLCs to include Saturday, can we make a generic statement. "Service Providers may port at any time based on the current NPAC availability schedule and business arrangements between each other." This changes and hopefully will continue to evolve for the better. BG
Differences between the wireless and wireline industry exist with regard to porting intervals and associated Normal Hours of Operation and NPAC timers. These are documented in the NANC LNPAWG 2nd Report on Wireless Wireline Integration, dated June 30, 1999, in Section 4.2.2 Table 2: Normal Hours of Operation and Table 3: NANC 201 Timers.

For wireless to wireless ports, the porting interval for the pre-port Wireless Port Request is 30 minutes, i.e. the exchange of information between SPs. For all other ports, this pre-port process, also described as the Local Service Request/Firm Order Commitment (LSR/FOC), is 24 hours. For wireless porting activity, i.e. the exchange of porting messages with the NPAC, the porting interval for wireless to wireless is 2 hours. The associated NPAC short timer default is one business hour each for the T1 and T2 timers. Thus, the total wireless to wireless port interval is 2-1/2 hours. Note that this is applicable to simple ports only. Complex ports require additional pre-ordering coordination and associated port due dates and times based upon negotiated business arrangements. For the NPAC port activity, the porting interval for wireless (donor) to wireline (recipient) follow the wireline intervals and associated NPAC long timers. The NPAC long timers are 9 business hours each for the T1 and T2 timers. For the porting interval for wireline (donor) to wireless (recipient), the porting interval is subject to negotiation based upon the Alternatives presented in the 2nd Report on Wireless Wireline Integration.

For wireline, the Normal Hours of Operation are Monday through Friday, 7AM to 7PM Central Time. For wireless, the Normal Hours of Operation are Monday through Saturday, for a 12 hour duration starting at 8AM or 9AM for a local time zone to be determined by NPAC region. NPAC timers only run during Hours of Operation, although SPs may still process ports in the NPAC outside the hours of operation absent the T1 and T2 timers. Likewise, SPs may process ports outside the Hours of Operation, but SPs are not required to respond outside Hours of Operation. The WNPSC has agreed to request NPAC support for Saturday Hours of Operation and is investigating the proportion of customer activation which occurs after 7PM Central Time. Currently, the NPAC only has real time support for the wireline Hours of Operation.

3.3.4 Service Order/Provisioning

Significant changes will be required to Service Order Processing and Provisioning. A customer may need just a new DN when requesting a telephone number change, just a new MSID when porting in an existing telephone number, or both when a customer

establishes service without porting a their telephone number. In the case where a customer ports in a telephone number, that number must be added to an inventory of assigned home numbers. Also, new information, currently not collected, must be obtained from the subscriber in order to complete the Inter-carrier Communications Process *(refer to section 3.3.5)* and to provide complete communication with the NPAC *(refer to section 3.3.6)*.

All edits and tests on NPA-NXXs to determine whether or not they are home numbers must now include the NPA-NXX of the new, ported DN. Another change is to accommodate "snap-back" *(refer to section 5.4.4)* which includes both the ability to receive back DNs that have been ported out and also to release disconnected, ported DNs back to the current code/block holder.

3.3.5 Inter-carrier Communications

In order to validate customer information in a porting scenario, the NSP must communicate specific information to the OSP (current). The OSP, in turn, responds to the NSP to either confirm or deny the subscriber and port information. The data is slightly different depending on whether the OSP is a wireless or wireline SP, as is the method of data transport. *(Can the transport be the same? Anna)(Refer to Section 3.4.*2 for a detailed discussion of the ICP.)

3.3.6 SOA (Service Order Administration)

Each wireless SP that is providing porting functionality must be able to communicate with the appropriate regional NPAC(s). The communication process is facilitated by use of either a high-tech interface (SOA) or a Low-Tech Interface (LTI) to the NPAC. It is up to each SP to determine their individual interface. If the SOA is chosen, the SP has the option of either building their own SOA, contracting with a service bureau that provides access to a SOA, or purchasing a SOA from an established vendor. *Refer to section 3.4.3* for additional information on SOA.

3.4 Major Impacts

The following sub-sections discuss three LNP topics that cause the greatest impact to wireless SPs. Separation of the MSID and MDN was chosen as the method to retain the ability to identify the home SP of a wireless customer while still enabling the MDN to be portable. This is discussed in *section 3.4.1*. Two new communications processes are required for LNP. Communication between the OSP and NSP is required to validate customer information and the port request. This is referred to as the ICP for wireless to wireless ports. This is discussed in *section 3.4.2*. Communication with the regional NPACs is required to actually process the port activation.This is covered in *section 3.4.3*.

3.4.1 MIN/MDN Separation

The MIN is the identifier that was first used by Advanced Mobile Phone Service (AMPS) cellular systems, and since adopted by most TIA cellular and PCS standards that contain an "AMPS" compatibility mode (e.g. IS-91 "AMPS", IS-88 "NAMPS", IS-54 and IS-136 "D-AMPS" and IS-95 "CDMA"). [1]

Prior to the separation of MIN and MDN, AMPS, CDMA, TDMA SPs performed registration, call processing, provisioning, customer care and billing based upon a single number---the MIN. Traditionally, the MIN has also been used by SPs within the North American Numbering Plan (NANP) serving area as the 10-digit MDN.

In a LNP environment, mobile subscribers will require two types of numbers: a MDN and a MSID. The MDN will be the dialable NANP telephone number and will be portable in a SP portability environment. The MSID will be non-portable and non-dialable. The MSID can be formatted in a 15 digit IMSI or a 10-digit MIN format.

In a pre-LNP environment, existing AMPS, TDMA and CDMA subscribers will most have the same number for both the MIN and MDN. When a subscriber ports, the MDN and MIN become separate and distinct. The ported subscriber's MDN will remain unchanged and port with the subscriber. The ported subscriber will surrender the MIN to the donor network and receive a new MIN or MSID from the recipient network. The donor network can reuse the relinquished MIN for another subscriber. It is probable that the same number may be used for a MDN in one network and a MIN in another network.

Conservation and control of MIN Block Identifiers (MBIs) within the NANP area will avoid conflicts with existing NANP area MBI assignments and mitigate international MIN conflicts. *(refer to section 5.4.1 for more information)*

3.4.2 Inter-carrier Communication Process (ICP)

In general, the steps involved in the ICP are similar regardless of the port direction (wireless to wireless, wireline to wireless, or wireless to wireline). When a customer requests the wireless NSP to port an existing DN, the NSP must send certain information, the Wireless Port Request (WPR) or Local Service Request (LSR), to the OSP. After the NSP sends the required information to the OSP, the OSP verifies that the customer and DN information is correct and that the port can be completed at the requested date and time. The OSP responds to the NSP with an accept or deny. If the WPR or LSR is denied, the request is delivered back to the NSP with the appropriate reason codes or remarks. The NSP makes changes as necessary and returns the information to the OSP. The process continues until the OSP verifies that all information is correct, and the port can be completed at the requested date and time. The OSP then returns a satisfactory confirmation to the NSP, and the process is completed.

[1] MIN Block Identifier Assignment Guidelines and Procedures, Draft version 1.8, Feb., 1999

There are several reasons for this communication process. To a great extent, the customer is protected from fraud, since initially the information that is exchanged between SPs is known only by the customer and the OSP . This process requires the NSP to verify the identity of the OSP. This identification is required of the NSP before communications with the NPAC to ensure that the port information is correct. The ICP also provides notification of the port request to the OSP.

In order to process a port request, it will be necessary to collect new porting data from the customer and populate new fields on the service order. The ICP will generate the mechanized data structure, i.e. forms, to be passed between the two SPs. The data is slightly different depending on whether the OSP is a wireless or wireline SP, as is the method of data transport.

3.4.2.1 Wireless to Wireline Communications

The ICP between wireline and wireless carriers is defined by the LNPAWG. *(in the Wireless Wireline Integration Report, dated 6/98, the 2nd Report on Wireless Wireline Integration dated June 1999, and the Third Wireless Wireline Integration Report, due Third Quarter of 2000, in Appendix C)*. Each of these three reports contains different information pertinent to wireless wireline LNP integration.

3.4.2.2 Wireless to Wireless Communications

The wireless to wireless communications process is defined in *the CTIA Numbering Advisory Group Wireless Inter-carrier Communications Report, Version 2.0.* This report documents the wireless consensus recommendation to standardize the data structure, elements, and communications protocols wireless SPs will use to exchange customer and port information (WPR). *Refer to Appendix A for more information.*

3.4.3 SOA

As stated in *Section 3.3.6*, communication with the NPAC is critical to number portability and the maintenance of the regional NPDB. Communication is facilitated either by a SOA system or a manual process, LTI.

The LTI provides very basic access to the NPAC's web-based GUI system. Information for porting "events" is keyed manually. There is no mechanized interface between order entry and the NPAC. Most, if not all, communication with the NPAC is initiated manually. In addition, there are limited reporting and data retention capabilities. The LTI is was developed for SPs expecting a low volume of porting activity.

In contrast, the SOA provides a mechanized interface between the SP's Operational Support Systems (OSS) and the NPAC. *(Refer to 3.3.6 for SOA options.)* It is possible for a SOA to interface with a SP's order entry system, number inventory system(s), and accounts database. In addition, the SOA can include the functionality of a database for retention of information sent to and received from, the NPAC, as well as generate reports. It is also possible to have the SOA automatically respond to notifications from the NPAC. SOA applications are used by SPs expecting medium to high porting activity.

4.0 IMPLEMENTATION MILESTONES

A timeline showing the completion dates for the various LNP milestones for wireless SPs has been developed and is included in *Appendix I*. A matrix of the wireless LNP milestones is shown below. The Sections and associated Milestone Description refer to the corresponding sections of this report for easy reader reference.

Sections	Milestone Description	Start Date	End Date
5	Functional Specifications	01/00	05/00
6	System Development	05/00	02/01
7	Testing	02/01	06/02
8	Implementation Considerations	06/02	09/02

Implementation should begin ASAP this implies that you don't have to start until 6/02???

5.0 FUNCTIONAL SPECIFICATIONS

5.1 Wireless to Wireless Inter-carrier Communication

In January 1998, a CTIA sponsored workshop on ICP recommended adopting a phased approach to WNP ICP. Given the short compliance timeline, the first phase was to begin June 30th, 1999 using a modified version of the wireline Local Service Request (LSR) an OBF form and process. It was suggested that the second phase eliminate the wireline LSR method from the wireless number portability processes for ICP. The workshop recommended that the second phase consider an enhancement to the NPAC or an alternative method. This would enable wireless carriers to exchange information about porting subscribers through a third party communication, rather than using direct carrier to carrier communications.

The *CTIA Report on Wireless Number Portability* was issued to the industry in August of 1998. In that report, the Local Service Request was defined as a method of communication between SPs. The highlighted portion of figure 1 represents the ICP step, using the LSR, within the overall porting process as it was defined in the original CTIA report.

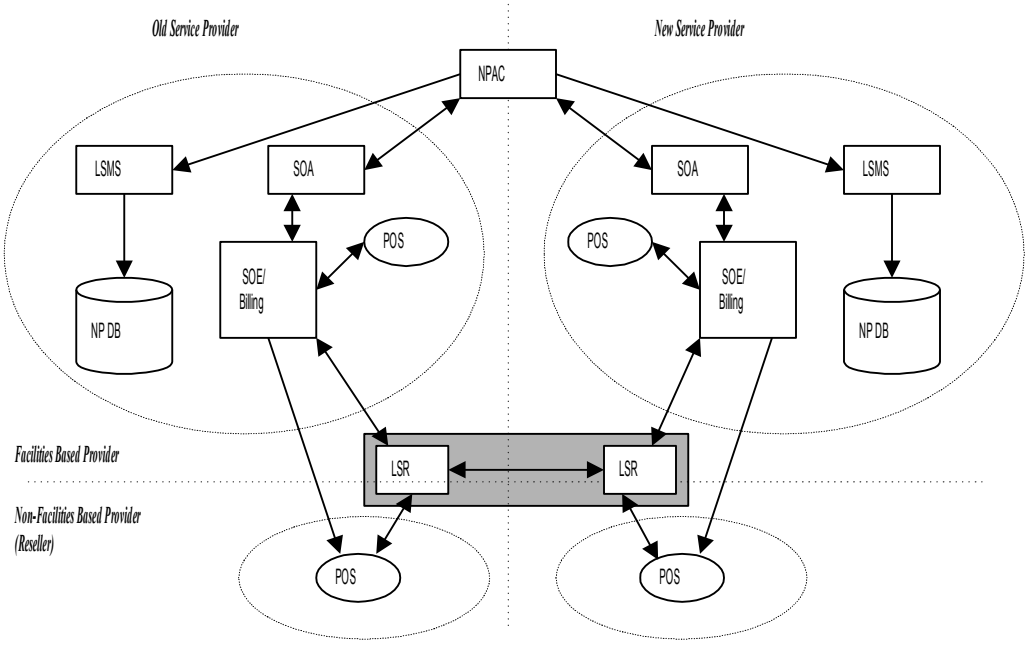


Figure 1- Porting Flow

The LSR consists of fields of information that are contained in "forms". These forms are used to coordinate the porting of a subscriber. The LSR process specifies what information is exchanged, however no functional system specifications were defined for the system that facilitated the LSR communication. A variety of methods may be used for transferring the information including fax, e-mail transfer, Internet access or Electronic Data Interchange (EDI). To support the unique requirements of the CMRS providers' business model, the wireless industry supported a 2 and 1/2 hour porting interval. The ICP process was allotted 30 minutes of the 2 and 1/2 hour interval. The North American Numbering Council supported this wireless to wireless porting interval in a recommendation to the FCC per the LNPAWG 2nd Report on Wireless Wireline Integration.

Wireline porting, which uses the LSR forms as its *pre-porting* process, has been in place since fourth quarter 1997. This process takes 24 hours for completion. Recent statistics indicate that wireline porting volumes are over 700,000 per month[2]. Current CMRS churn rates are reported at 2.3% per month or 28% per year.[3] If there was a 1:1 relationship between churn and porting requests, (factoring in growth projections), the volume of porting could reach 40 million individual ports annually. This is not to suggest a 1:1 relationship will exist. Thus, it is anticipated that the wireless industry will substantial increase porting volumes. (WHAT HAPPENED TO THE RECOMMENDATION THAT THE WIRELINE CARRIERS REDUCE THEIR SUPPPOSED 24 HR PORTING INTERVAL TO SOME UNKNOWN TIME? `They did try to reduct it ---- it is now down to 3 days!!! -- JG`)

[2] http://www.npac.com/docs/sv_cnt.txt

[3] CTIA's Wireless Industry Indices: Semi-Annual Data Survey Results A Comprehensive Report from CTIA, January 1985-June 1999 An Analysis of the US Wireless Industry (January 2000 Publication Date) at Section 2.3, Table 18, p. 42

On February 8, 1999, the FCC granted the CMRS industry an extension regarding their LNP obligations until November 24, 2002. The additional time granted to CMRS providers makes possible the launch of wireless number portability with an ICP process that adequately supports the industry's needs.

In June 1999, the CTIA Number Advisory Working Group ICP Task Force was formed to evaluate porting alternatives for wireless carriers. The result of the ICP Task Force effort establishes the high level requirements to achieve mechanized standard formatting and exchange of customer information. A CTIA industry forum held February 24 and 25, 2000 reached consensus to support the *CTIA Numbering Advisory Working Group Report on Wireless Inter-carrier Communications, version 2.0*. On June 15, 2000, the CTIA Board approved the report. (Refer to Appendix A)

5.2 Network

The industry has implemented LNP using the LRN method. LRNs are 10 digit numbers that are assigned to a network switching element for routing calls in the network. The first six digits of the LRN will be assigned to at least one of the NPA NXXs of the switching element. The wireless architecture to support the LRN method is shown in the Figure X below[4]. This generic model depicts only those network elements impacted by LNP. Other features and services must be addressed by each wireless SP based upon their specific network configuration.

The NPDB, referenced in Figure X as NPSCP, is accessed by the Mobile Switching Center (MSC) to provide the LRN value for the ported Mobile Directory Number (MDN) in order to correctly route the call. The NPDB contains the applicable number portability information transmitted from NPAC Service Management System (SMS) to the SP's Local Service Management System (LSMS). Each SP will either own or have access to a NPDB/LSMS that will contain the mapping between the MDN and the LRN.

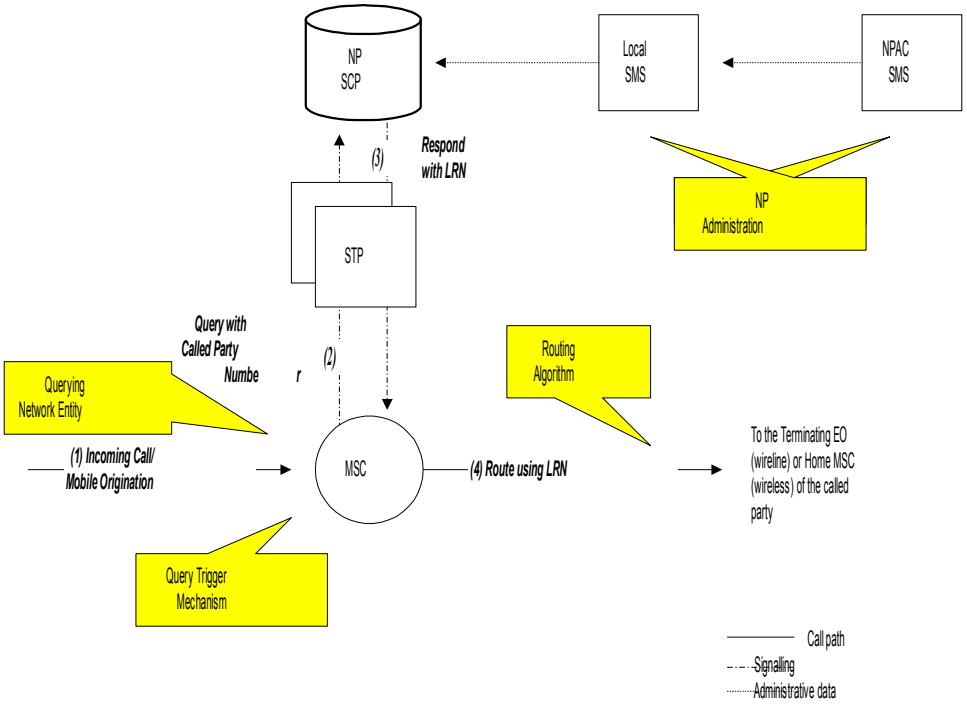
In a pre-LNP environment, there was no separation between GTT based upon the MDN versus the MIN. As a consequence, SPs used GTT for MDN based network capabilities and services. With the MIN/MDN separation, there are significant GTT impacts for MDN based capabilities that only provide the first six digits of the MDN in the called party number address. In an LNP environment, six digit translation no longer provides the granularity required for inter-network routing.

The LRN GTT is the six digit GTT based upon the portable NPA NXX and is used to direct the LNP query to the NPDB to obtain the LRN routing information. The LRN GTTs SCCP Called Party Address (CdPA) contains the first six digits of the portable MDN. New translation types were assigned for all query formats which enable TCAP processing to interpret the message correctly. To support SS7 intersystem messaging for services (CLASS, LIDB, ISVM, and CNAM), this NP GTT function must be available somewhere within the

[4] CTIA Report on Wireless Number Portability, figure 0-2, page 25, July 7, 1998

service providers network. The NP GTT function must be able to perform non-final GTTs (six digits), and may also perform final GTTs (ten digit), depending on the network configuration planned by the service provider. The NP GTT function also need to be performed on SS7 messages received from other networks that are to be routed on a GTT basis where the NPA NXX within the GT represents a portable NPA NXX.

The NPDB also provides the LSMS with ported GTT data to support services such as Short Message Service (SMS). The NPAC will provide the data to provision interim GTT for routing interoperability between different SPs' networks. Additionally, the NPDB may contain the Point Code (PC) and Subsystem Number (SSN) for signaling CLASS, LIDB, CNAM, ISVM, and SMS delivery services to ported MDNs.



Additional information on network configurations, network and signaling impacts are contained in *the CTIA Report on Wireless Number Portability Version 2.0 dated July 7, 1998*. The TIA and T1 standards define the WNP NPDB query and termination of calls to wireline ported numbers, associates ported numbers with the LRN, and interfaces with the LSMS to obtain the MDN to LRN mapping. In addition, these standards address MINs not ported,

handling of incoming calls routed using LRN, cause code 26 (misrouted call to a ported number), and call completion to a ported number.

Several LNP standards exist including T1S1.6, TR 45.2 and T1P1.5. T1S1.6 has published three Technical Requirements (TR) documents, dated April of 1999: *TR No. 1, Number Portability Operator Services Switching Systems; TR No. 2, Number Portability Switching Systems; TR No. 3, NPDB and Global Title Translation.* Under TR 45.2, here are the following standards: *TIA/EIA/IS 756, WNP Phase I; TIA/EIA/IS-756-A, WNP Phase II*; *PN-4410 on Automatic Code Gapping; and PN-4411, WNP Phase III enhancements*. Under T1P1.5, here are the following ANSI standards: *T1.708, PCS 1900 SP Number Portability; and T1.711, Number Portability for PCS 1900 Short Message Service and Other Services*. These standards are available from www.global.ihs.com and http://www.t1.org/t1p1/pl-grid.htm/ (URL Doesn't work) http://www.t1.org/t1p1/_P1-GRID.HTM This one does. BG

5.3 Operational Support System (OSS)

5.3.1 Service Order Entry (SOE)

For the purposes of this report, SOE includes gathering and entering customer data for provisioning and completing all relevant port information, as well as communicating to adjunct systems.

For "non-porting" SPs and respective resellers, there will be no changes to service order processing, and, therefore, no requirements will be needed.

For "porting" SPs and respective resellers, `the service order entry and processing areas of the OSS are impacted the greatest. -- JG` Two number databases will be required, one for MDNs and one for MSIDs. All new customers will be assigned an MSID. Some new customers will be assigned an MDN and some will not. (What criteria is used to determine who is assigned and who isn't? Reference the MBI specs. `It cannot be assumed that all new customers will port their numbers – only those who are not porting their numbers will a new MDN. In either case, it cannot be assumed that even if the customer needs a new MDN, that there will be the equivalent MSID available for that customer -- JG`) For telephone number changes, only the DN needs to change and not the MSID. (What? I think I need some clarifying discussion on DN/TN and MSIDs) `It is not necessary to reprogram a phone with a new MDN (aka DN, aka TN) for a telephone number change. The separation of the MDN and MSID will really simplify telephone number changes. That's not to say that you couldn't reprogram the customer's phone with a new MSID, but it certainly is not necessary -- JG`
This Hi-Lite is confusing to me we are talking about porting not number changes????
I recommend a group rewrite of the above paragraph, Anna.

In addition, SPs and resellers will need to be able to accommodate "non-dedicated" NPA-NXXs. In the past, entire NPA-NXXs codes have been assigned to either wireline or wireless SPs. With LNP, wireless SPs need to be able to accept traditionally wireline NPA-NXXs as wireless. This will require the immediate entry of a "foreign" DN into the telephone number inventory of a wireless SP and/or reseller. These systems will also need to accommodate the loss of DNs from inventory for those cases where customers port out to other SPs.

Finally, the "snap-back" functionality needs to be accommodated to add a DN back into inventory or delete a number from their inventory.[5]

For NPA-NXX based services, such as Pre-pay, specific blocks of MSIDs may need to be identified and dedicated. Dedicated NPA-NXXs will need to be assigned to those customers who desire, or are assigned to, the specific service. Internal processing will need to be modified to use the MSID, and not MDN, to identify customers of these services.

A new process (ICP) will need to be developed to facilitate communications with the NSP or OSP in a port scenario. (Refer to Appendix A)
A new interface will also need to be developed to exchange information with the SOA for the facilitation of the port process (NPAC).

It is possible that current SOA vendors will integrate the ICP process into their SOA software or add it to the same platform so only one interface is needed for both functions.

For those adjunct systems that require separate provisioning, requirements will need to be written to accommodate the separation of the MDN and MSID. Like the wireless SPs, the adjunct systems will need to accommodate DNs from "traditional" wireline NPA-NXXs.

5.3.2 Message Processing

In the context of this document, Message Processing includes editing and reformatting Call Detail Records (CDRs) into internal billing records. These functions are performed on switch records, CIBER records, reseller records, and CDRs from adjunct systems such as SMS and Prepay. Message Processing also includes guiding, rating (local, long distance, and miscellaneous toll charges) and rerating, outcollect processing, and calculation of airtime for each call.

Changes will be required to Message Processing Systems to correctly identify roamers. Currently, wireless SPs are typically assigned full codes (Central Office Codes) to use for DNs. These are published by CIBERNET and in Technical Data Sheets exchanged between roaming. With LNP, a ported DN may have originally been a wireline number

[5] Guidelines for the Aging and Administration of Disconnected Telephone Numbers, Section 4.0, Aging and Snapback Administration Process for Ported Telephone Numbers

or assigned to another wireless SP. Processing will need to be modified to use the MSID instead of MDN from the CDRs. In all cases, the MSIDs will uniquely identify wireless SPs.

Providers of adjunct systems may need to modify processing in order to record additional data. The modification may be necessary for the wireless SP to correctly identify the MDN and MSID of the call origination and, in some cases, the call termination.

With the split of the MDN and MSID, it is possible that facility based wireless SPs may want to provide resellers with specific blocks of MSIDs, to be able to readily identify the reseller. For those resellers who provide their own Message Processing, they will also need to modify systems to accommodate the MIN (MSID)/MDN split.

Changes will be required for "service-specific" rating such as mobile-to-mobile calls. It will no longer be possible to determine, based on MDN, if a terminating number is wireline or wireless. It will be necessary to check for the presence of an LRN to help determine how a specific call was routed, but even then, the LRN will identify the switch to which the call was routed – not the specific SP. In addition, some switch CDRs may not have all of the information needed to determine the SP of the originating and/or terminating numbers. (Jim will provide list of new available fields due to LNP)

As a result of the Local Number Portability architecture, additional information is recorded on switch call detail records. Some information, such as the MIN is required to bill calls correctly, and other information, such as the LRN, is required to determine how a call will be, or was, routed.

Following is a list of new data elements available for switch call detail records:

MSID	- this includes both 10-digit MIN and 15-digit IMSI and is recorded as a separate field to accommodate the separation of the MIN and MDN.
JIP	- this is the Jurisdiction Information Parameter and is used, on incoming calls, to identify the switch on which a call originates.
LRN	- the Location Routing Number identifies the switch in which a number is homed.
LRN Source	- the LRN Source indicator identifies whether the LRN came from an NP-DB query or from the incoming ISUP message.
NP-DB Query Status	- the various values for Query Status indicate

whether or not a NP-DB query was performed, and, if so, whether or not the query was performed successfully (could be used to identify default routed calls).

I suggest using the following table to indicate (reflect) existing and possible new data fields in the new CDR record for Wireless Number Portability. Definitions could be placed in the Glossary for those wishing to know more. The visual impact of the sheer number of new fields and size speaks for itself. These may or may not be inclusive to all vendors and that should be expressed, it is the best information I have based on three separate switch vendors. BG

Field Name	Type	Len (In Bytes)
Mobile Directory Number	Alphanumeric	31
Term_Number Portability Query Status	Integer	4
Term_Location Routing Number	Alphanumeric	31
Term_IRN Source	Integer	4
Term_Jurisdiction Information Parm	Alphanumeric	7
Term_Called MSID	Alphanumeric	15
Term_Billing MSID	Alphanumeric	15
Orig_Number Portability Query Status	Integer	4
Orig_Location Routing Number	Alphanumeric	31
Orig__IRN Source	Integer	4
Orig_Jurisdiction Information Parm	Alphanumeric	7
Orig_Called MSID	Alphanumeric	15
Orig_Billing MSID	Alphanumeric	15

Message processing systems must be modified to read and process these new fields as they are presented in the switch call detail records. It is up to each company to define their own rules for handling this new information. JG

Out-collect processing needs to be modified to accommodate the CIBER X2 records. These records accommodate the population of LNP data such as MSID and LRN.

5.3.3 Billing

For the purposes of this document, billing functionality includes the monthly accumulation of airtime usage, identification of allowance or package minutes and deduction of those minutes from the monthly usage, identification of pooled and/or tiered minutes, pricing of air-time usage, bill calculation, and bill formatting.

There are few, if any, required billing changes to support LNP. The one important change is that wireless SPs may want to include the customer's MSID along with the MDN on the bill to eliminate any question about who is responsible for the charges. Optionally,

SPs may wish to include LRNs and/or MSIDs where appropriate on the call detail lines of the bill.

5.4 Numbering Administration

5.4.1 MBI Administration

In order to avoid duplicate utilization of MINs in multiple SPs' networks, MIN assignment must be managed. Conservation and control of MBIs (MIN Block Identifiers) within the NANP area will avoid conflicts within the NANP area and mitigate international MIN conflicts. To accommodate MBI management, CTIA is addressing MBI Assignment Guidelines and Procedures and selection of an MBI Administrator.

5.4.2 LRN Assignment

The industry has implemented LNP using the LRN method. A LRN is a 10-digit number, in the format of NPA-NXX-XXXX, that uniquely identifies a switch or Point Of Interconnection (POI). The NPA-NXX portion of the LRN is used to route calls to telephone numbers or DNs that have been ported to another SP's switch. The LRN is retrieved from the Service Control Point (SCP), or database, during call processing and is used for call set-up in place of the called number. When a query is performed on an NPA-NXX that has been designated as portable, if the DN is ported the response from the database will be the LRN of the new switch. If the DN is not ported, a null will be returned, and the Forward Call Indicator (FCI) set.

A local SP must ensure that LRNs assigned for routing of ported numbers are identified and populated in the Local Exchange Routing Guide (LERG). This should be done coincident with the notification of the code opening as described below. The NPAC updates internal SP and network information and informs all SPs of the newly established LRN via the NPAC SMS to Local SMS and SOA to NPAC SMS interfaces. This is posted on the npac.com web site..

For purposes of number administration, *LRN Assignment Guidelines* have been developed by the Industry Numbering Committee (INC). Refer to Appendix E. Some of the assignment criteria are included here. However, it is recommended that all SPs become familiar with the INC document. A unique LRN may be assigned to every LNP switch or POI, with at least one LRN assignment required per LATA within the switch coverage area. LRNs assigned for a switch should not be a working customer number. LRNs may change due to switch replacements, code or LERG reassignments, or NPA splits. An NXX will not be assigned to a SP for the sole purpose of establishing an LRN unless that SP's switch or POI does not yet have an LRN for the LATA where they intend to provide service.

For further information, *reference INC document 98-0713-021, issued 7/13/1998*. And *ATIS document TRQ No. 02, issued 4/99; Number Portability Switching Systems*.

5.4.3 Opening NPA NXXs for Porting

A local SP will need to make sure NPA-NXXs that need to be opened for porting are marked as portable in the LERG. The code opening process must occur before processing any subscriber requests for porting numbers in portable NPA-NXXs. The process steps are as follows:

- Individual SPs identify the NPA-NXXs targeted for porting and forward a request to the LERG assignee (code holder) of the NPA-NXXs. Notification must occur by the 15th of the month for portability information to be included in the next LERG update.

- The code holder must respond to the SPs within five business days, indicating whether the NPA-NXX can be processed. The code holder then notifies the LERG to open the NPA-NXXs, 45 days before the date when porting needs to be effective (if the request cannot be processed, the holder must note the reasons in the response).

- The LERG publishes notification of the NPA-NXX with the effective date, i.e. the date that the NPA-NXX is available for LNP in the NPAC customer networks. LERG updates are published by the fifth business day of the month. Emergency updates can be sent out daily also.

- SPs and N-1 carriers update GTT information in their individual networks for all appropriate services. GTT updating must occur within 45 business days of LERG publication.

Code holders notify the NPAC of NPA-NXXs to be opened for porting. This should occur within 45 days of the LERG publication. The SP must specify to NPAC personnel via fax or email in advance, preferably 2 weeks, any NPA-NXXs they are making available for porting and the porting effective dates. If a SP chooses, they can input their NPA-NXX information directly to the NPAC SMS via the NPAC SMS to Local SMS interface, or SOA to NPAC SMS interface or use a Low-Tech GUI.

The NPAC updates internal SP and network information and informs all SPs about the availability of the NPA-NXXs for porting via the NPAC SMS to LOCAL SMS and SOA to NPAC SMS interfaces. This is posted on the npac.com web site.

- Upon receipt of the first subscription version for porting the first ported number in a newly opened NPA-NXX, the NPAC broadcasts a message to all LSMSs and SOAs.

Upon receipt of the message, SPs should open routing tables and set triggers in donor switches, LNP-capable tandems and LNP-capable offices in all networks.

Requests for additional LNP capability in switches outside the top 100 MSAs can be made at anytime. After11/24/2002 LNP capability must then be provided by the incumbent within the following time frames after the receipt of the Bona Fide Request (BFR):

- equipped remote switches within 30 days
- hardware capable switches within 60 days
- capable switches requiring hardware within 180 days
- non-capable switches within 180 days

Refer to Appendix F, Inter-SP LNP Operations Flows and Processes for Code Opening.

5.4.4 Disconnection of Ported Telephone Numbers

The administrative process for aging and disconnection of telephone numbers was developed based upon existing LNP operation flows. The aging of reserved ported telephone numbers and re-establishment of service on disconnected ported numbers after the aging interval are specified in *Section 4.0, Aging and Snapback Administration Process for Ported Telephone Numbers, per the INC Guidelines for the Aging and Administration of Disconnected Telephone Numbers, INC 99-1108-024.*

5.4.5 NPA NXX Split Procedures

To perform switch provisioning associated with NPA splits in the LNP environment the NPAC, LSMS, SOA and Database systems must be updated to reflect new split information and to enable correct routing information both during and after the Permissive Dialing Period (PDP).

The major challenge with LNP split processing is that there is no communications from the NPAC to cause NPA updates to occur over the interfaces to either the locally owned SOA or LSMS or NP databases. Each SP should work with their individual vendors to understand how splits are implemented in each element and create local Methods & Procedures (M&Ps) for internal teams to follow.

Generally, SPs have the following responsibilities:

- Opening new (split) codes in the LERG, 45 days in advance
- Identifying a new LRN in the LERG , if applicable
- Opening the new split codes in the NPAC
- Creating a new LRN in the NPAC, if applicable
- Notify NPAC (fax, telephone etc) with specific new codes
- Update Subscription Versions (SV) creates with new LRN (if applicable)

- Schedule, provision splits in your own LSMS, SOA and databases. Mechanism for this is vendor specific.
- Update GTT data for ported number (if applicable)
- Update default GTT data for ported exchanges involved
- Updating switch, back office, signaling systems, and service platforms
- Deleting old LRNs and NPA-NXXs after the PDP

The NPAC responsibilities include:

- Accept split notifications from SPs
- Scheduling splits within the NPAC SMA
- Accept subscription version (SV) creates from SPs with both the old and new NPA-NXX, but broadcast to downstream systems only with the new
- Update Methods and Procedures as appropriate
- Manage errors during processing and correct (if possible) error conditions encountered

Associated reference materials include the NPAC M&P document, *NPAC Functional Requirement Specification (FRS) (refer to* http://www.npac.com/*) and the ATIS document TRQ No. 03, issued 4/99: Number Portability Database and Global Title Translations*.

5.5 Functional Requirements Specifics Service Order Activation (SOA)

The SOA is the interface between each SP's SOE system and the NPAC database and is the point where a new subscription is sent to the NPAC. Carriers participating in number portability are required to use a SOA system or LTI to interact with the NPAC.

5.5.1 SOA to NPAC SMS Interface

The SOA to NPAC SMS interface, which allows communication between a SP's Operating Support Systems (OSS) and the NPAC SMS, supports the creation and update of subscription information, network data and SP information and audits. While core interface functionality is required based on industry specifications, individual SOA products may include additional features for internal use.

5.5.2 Number Portability Transactions

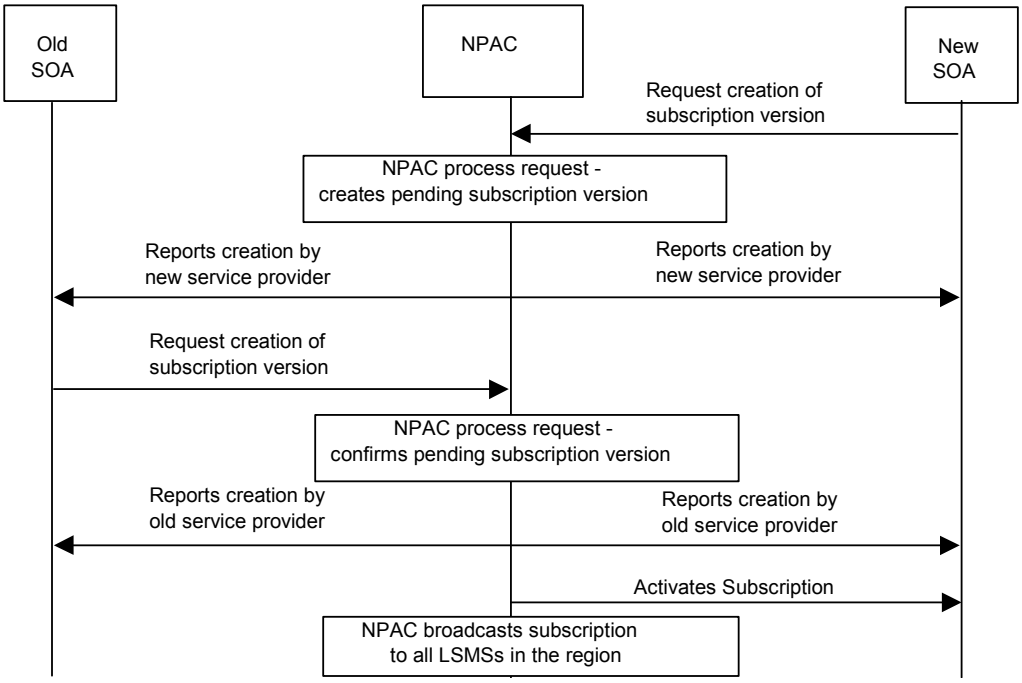
The following transactions occur to support LNP functionality:

- SOA requests for subscription administration to the NPAC SMS and responses from the NPAC SMS to the SOA. This includes the capability to: create, cancel, modify and disconnect a SV Create, place SV Create into and out of conflict as well as retrieve and activate SV Create versions.

- Audit requests from the SOA to the NPAC SMS and responses from the NPAC SMS to the SOA. This provides the ability to audit NPAC SV Create versions, and correct inaccuracies
- Notifications from the NPAC SMS to the SOA including: SV Create version data for creations, deletions or changes; the need for concurrence or authorization for number porting; conflict-resolution; cancellation; outage information; customer disconnect dates; and the first use of an NPA-NXX.
- Network data from the NPAC SMS to SOA. Network data (NPA-NXX, Service Provider Identification (SPID), and LRN) is automatically downloaded from the NPAC.
- SP data administration (profile data and network data) from the SOA to the NPAC SMS. SPs can use, read, and update their information on the NPAC SMS.

5.5.4 NANC Functional Requirements Specifications and SMS Interoperable Interface Specifications

The SOA implements the interface required by each facility based SP for communicating information, regarding a ported subscriber to or from the NPAC, as specified in the NANC Functional Requirements Specifications and Interoperable Interface Specifications documents. *The depiction of this system is shown in Figure Y below..*



5.5.4 Other SOA Functions

While the precise behavior of the NPAC to SOA interface and messaging is provided in the Functional Requirements Specifications and Interoperable Interface Specifications, there are a variety of other functions that can be derived from that behavior.These include:

Service Disconnect -- The disconnect message updates and removes the ported TN from LNP databases and allows those ported numbers to be returned to the original code holder for future reassignment, i.e. snapback.

Service Repair -- Once a problem is detected by either a SP or a customer the system audit capability allows the SP to perform some trouble administration and data correction.

Report Request - SPs have the ability to request data/reports from the NPAC.

6.0 SYSTEM DEVELOPMENT

Is all of the following information regarding ICP related to development?? It seems to me that much of this I scopied from the ICP document does not need to be reiterated here. What do y'all think??? --- JG I think this is a good idea most people won't read the ICP document. BG *I agree with BG and think it should be included, Anna.*

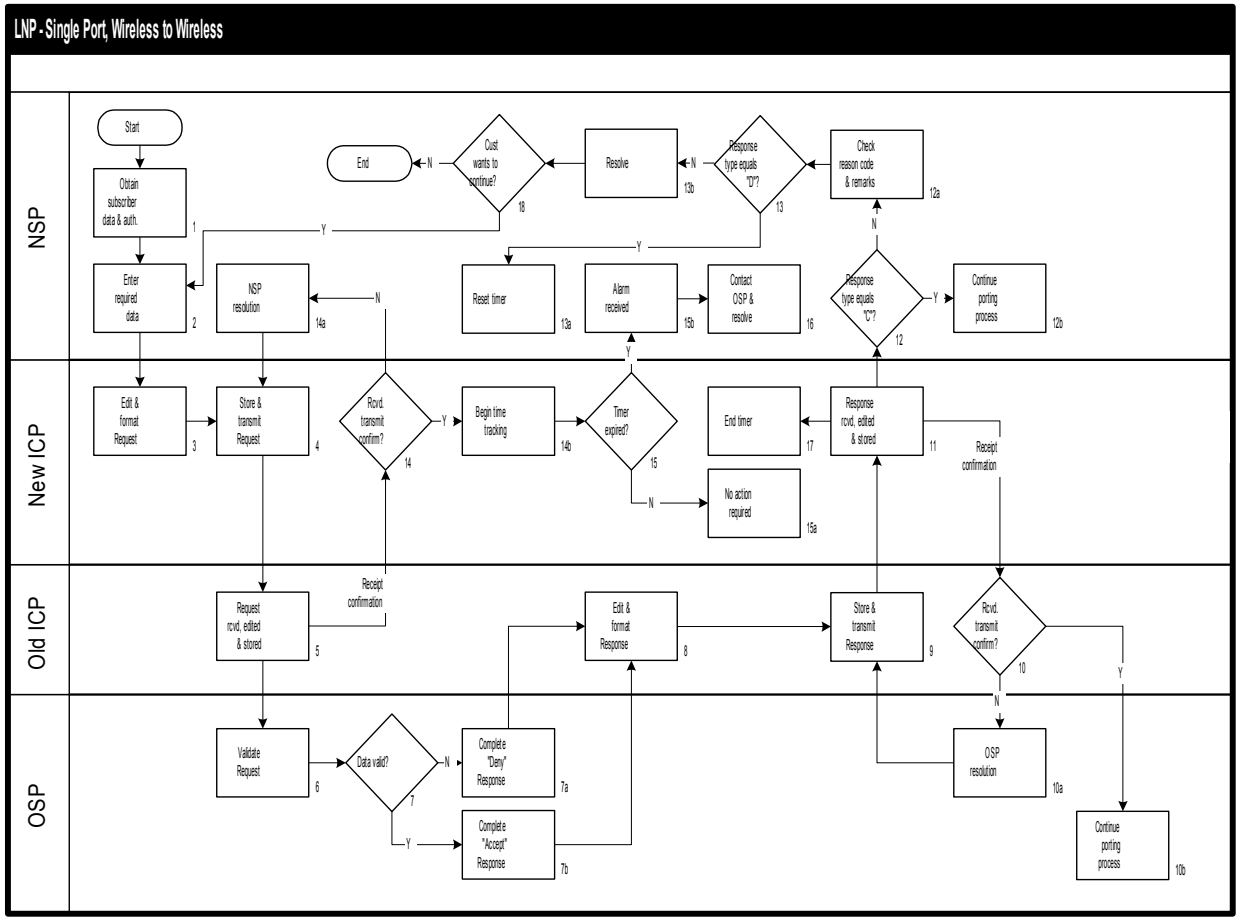
6.1 Inter-carrier Communications Process (ICP)

The ICP is defined as the open interface between the NSP and the OSP for wireless to wireless ports. While the ICP clearly defines fields, record layouts, edits and communication procedures, the implementation of the process within proprietary systems may be unique. This allows SPs to build their own ICP solution or purchase one from a third party vendor. OSP validation can be automated or manual. In addition, while mandatory subscriber information is standard for all SPs, an OSP can chose which of the mandatory fields to use for validation. For example, one OSP can use the Ported Number and User Name for validating a port Request, while another OSP may choose to include Bill Address within their validation routines. SPs may choose different data entry points, such as POS, SOE or a third party system.

The ICP is divided between functions that relate to the NSP and those that relate to the OSP. The *figure in section 6.1.1* should help the reader in understanding where the event is occurring within the NSP and OSP processes. There are two basic types of wireless ports. The first is a single port, which is defined as a customer requesting to port one number. The second is a multi-line port, which is defined as a customer requesting to port more than one line. In some cases, the OSP may be able to respond to a multi-line port within the 30-minute guideline. In other cases, the complexity of the port may require additional time and coordination between the OSP and the NSP.

6.1.1 Single Port Wireless to Wireless

The following section defines the process for a wireless to wireless single port including the OSP options of either confirming or denying the port request. A narrative follows the process flow chart.



The process begins when a customer requests to port their telephone number to a new SP. The NSP should gather the appropriate subscriber information to populate the Request. This includes obtaining an Authorization from the subscriber to initiate the porting process as required by company policy *(Box 1)*. NSP should refer to the Data Elements for mandatory subscriber information.

The information gathered should be entered into the proper system, either an integrated POS or SOE system or directly into the NICP *(Box 2)*. The data is edited and formatted according to the rules defined by the ICP *(Box 3)*. If the edits fail, an error message will be returned to the point of data entry. The formatted record is then stored and forwarded to the proper OSP based on a table of Company Code routing information *(Box 4)*.

The OSP receives and stores the Request. The Request is passed to the OSP's Billing and Customer Care (B&CC) system *(Box 5)*. When the OICP receives a Request, a Confirmation of Receipt is issued back to the NICP *(Box 14)*. When NICP receives the

Confirmation, the Timer is started *(Box 14B)*. If a receipt is not received within a defined time period, the NSP initiates a resolution process *(Box 14A)*.

The OSP validates the subscriber information contained on the Request based on proprietary processes *(Box 6)*. A decision is made to either Deny or Accept the Request *(Box* 7). If the Request is invalid, the OSP populates the proper fields to indicate a Denial Response to the NSP *(Box 7A)*. If the Request is valid, the OSP populates the proper values for indicating an Accept Response *(Box 7B)*. The data required to issue a Response can be entered through proprietary systems or directly into the OICP.

The OICP Edits and Formats the data *(Box 8)* according to the Data Dictionary. If the edits fail, an error message will be returned to the point of data entry. The formatted record is stored and forwarded to the proper NSP based on a table of Company Code routing information *(Box 9)*.

The NSP receives and stores the Response *(Box 11)*. The Response is passed to the NSP B&CC system. When the NICP receives a Response, a Confirmation of Receipt *(Box 10)* is issued back to the OICP. The OSP should not start the NPAC process without confirmation from the NSP. This prevents inadvertent cancellations of port requests at the NPAC due to timing errors. When the OICP receives the Confirmation of Receipt, the OSP continues with their Porting Procedures *(Box 10B)*. If a receipt is not received within a defined time period, the OSP initiates a resolution process *(Box 10A)*.

The Receipt of the Response *(Box 11)* ends the Timer *(Box 17)* that was started when the NICP received the OICP confirmed receipt of the Request *(Box 14B)*. If the Timer expires (Box 15) before the receipt of the Response, an alarm will be issued from the NICP and sent to the NSP *(Box 15B)*. The NSP will then contact the OSP for resolution *(Box 16)*. If the Timer is not expired, then no action is required *(Box 15A)*.

The NSP reads the Response to determine if it has been confirmed, denied or is delayed *(Box 12)*. If the Response is "C" for Confirmation, then the NSP interprets Response Type and the Reason Code *(Box 12A)*. If the Response Type is "D" for Delay *(Box 13),* then the timer is reset to allow for the extra time requested by the OSP *(Box 13A)*. If the Response Type is "R" for Resolution Required, then the NSP initiates a resolution process *(Box 13B)*. Depending on the reason for the Deny, the NSP determines if the port request should continue *(Box 18)*. The NSP can either end the port *(END)* or correct the information and resubmit the Request *(Box 2)*. If the Response is confirmed, then the NSP continues with the porting process *(Box 12B)*. The NSP should not start the NPAC process without receipt of a Confirmation Response from the OSP.

Refer to Appendix A for the complete Wireless to Wireless ICP Report.

6.1.2 Business Arrangements

One of the most challenging aspects of porting in the wireline environment is the difficulty incurred when performing the Inter-carrier Communication Process (ICP). In wireline operations, Inter-carrier Communications is facilitated using the Local Service Request/Firm Order Commitment (LSR/FOC) forms. This process is a guideline developed by the Alliance for Telecommunication Industry Solutions (ATIS) Ordering and Billing Forum (OBF). The LSR/FOC process allows each carrier broad latitude in determining how and what information will be used within each wireline carrier's porting process. As a consequence, each wireline carrier may require a different set of mandatory data elements to drive their systems. As a result, there are unique service level agreements between each SP.

Multiple unique service level agreements require complex systems and internal processes to identify where the LSR originated, what information to expect and how to properly respond with the FOC. It was a goal of the CTIA Number Advisory Working Group to eliminate the need for unique service level agreements by establishing a process that defines a specific communication method with a mandatory set of fields.

Business arrangements are required to facilitate and support the pre port and porting processes. The arrangements establish inter-carrier methods and procedures for problem resolution, management of complex ports, coordinated hot cuts, system outages, and delayed responses. The business arrangements also include SP contact and routing information for the ICP.

6.2 Network

6.2.1 Non-Porting Service Providers

All MSCs and billing systems must be upgraded with software equipped to support separate MIN and MDN numbers for all subscribers. This will be necessary in order to comply with the FCC's requirement that wireless carriers continue to support nationwide roaming in a number portability environment. Today all IS-41 operations and billing processes operate on a single identifier, the MIN. The wireless solution selected to support the number portability mandate will require change to this fundamental mode of operation. Subscribers existing prior to number portability will have their MDN automatically set to their MSID (MIN) and will not be impacted. However, subscribers who "port" to another carrier, will be assigned a MSID (MIN) that is a different number than the MDN. Wireless providers that do not plan on porting subscribers but currently participate in roaming agreements must upgrade a subset of their network to recognize roaming subscribers with an MSID of a different value than the MDN.

6.2.2 Porting Service Providers

Wireless providers that plan on porting subscribers must upgrade all network nodes and test all call scenarios and services for subscribers with MSIDs of a different value than the MDN.

Wireless SPs that use IS-41 protocol must upgrade all applicable elements in the network to support the MIN/MDN separation and the protocol modifications identified by standards. The development of additional software to support the MIN/MDN separation must be completed and tested by vendors so that SPs can install, test, and integrate the software into their network. Furthermore, porting wireless SPs must integrate this software functionality with their operational/business support systems before deployment. From start to finish this work typically takes 18 to 24 months to complete refer to section 3.3 for the WNP project timeline.)

6.3 OSS

Development of new interfaces and modifications to the existing OSS is unique and specific to each company. The amount of required development work will vary greatly between porting and non-porting companies.

Vendor management will be a critical issue. Companies will need to ensure that vendors are progressing according to internal project timelines. Vendor testing must be completed prior to acceptance testing by the company. This adds an additional layer of testing that is not reflected
in the industry timeline, but still needs to be completed.

6.3.1 Service Order Entry

6.3.2 Message

6.3.3 Billing

6.4 System Development (Needed to implement SOA)

SOA -

7.0 TESTING

7.1 Internal Testing

It is very important that all service providers, facility based and non-facility based, who have made any LNP modifications to their systems perform complete internal testing.

For non-porting service providers, this will include testing the new MSC upgrades as well as modifications to the Message Processing System to accept the modified switch call detail record and properly format the billing records, such as CIBER X2. In addition, testing of these billing records with the clearinghouse may be necessary.

For porting service providers, internal testing will be more extensive than for non-porting service providers. Testing of the MSC upgrades will include not only the ability to store and record the MSID and MDN in the VLR and call detail records, but also the ability to provision unequal MDNs and MSIDs to the HLR, correctly distinguish between home customers and roamers, provide correct information for messaging, correctly provide ANI, and what else??? Emergency Services

Service order testing should be completed for the following scenarios: assignment of an unequal MDN and MSID for a new subscriber, porting in a MDN, porting out a MDN, assignment of "dedicated" MSIDs for specific NPA-NXX based services (such as Pre-pay), what else??? In addition, the interface between Service Orders and the Inter-carrier Communication process and SOA must be completely tested.

Message Processing testing will include the ability to generate and receive billing records (including with the clearinghouse as necessary), processing switch call detail records, generation and receipt of reseller call detail records as necessary, and generation and receipt of call detail records for adjunct systems as necessary. Changes to Billing, such as the display of the MSID in addition to the MDN on the customer's bill, also need to be thoroughly tested internally.

Other interfaces also need to be tested. SOA interfaces may include an interface to telephone number inventory to accommodate "snap-back", or an interface to an ad hoc reporting group or a "Port Center" for audits. The ICP may interface with an accounts data base to perform complete or preliminary customer information validation. It may also interface with the "Port Center" for customer validation and problem resolution.

Finally, complete regression testing should be included in all aspects of internal testing to ensure that no unexpected changes have occurred. -- JG

7.2 NPAC Turn-up and Testing

7.2.1 Testing Overview

As transactions flow between NPAC/SMS and LSMS/SOA, it is required that LSMS/SOA respond correctly to NPAC/SMS interface messaging. The initial test plans must be in accordance with industry accepted data exchange protocols. The scope of the NPAC/SMS Internal Verification Test Plan, Turn Up Test Plan, and the NPAC SMS Interoperability Test Plan are to:

- Provide service support documents that will let participating SPs and their respective SOA and LSMS vendor(s), identify their specific interoperability testing responsibilities.
- Identify the tests that have to be performed.
- Interpret the results of the tests for follow-on regression testing (if necessary).

In view of the dynamic nature of Number Portability, it is envisioned that the testing processes will continue as an on-going activity and critical function of the NPAC. NPAC Turn Up Testing is a pre-requisite to actual service initiation. When a SP begins porting in a local market, their LSMS/SOA must receive Interoperability Certification with the NeuStar NPAC/SMS Test Lab. On a recurring basis, NPAC regression testing and Interoperability Testing with the SPs must be conducted for each new software release of the NPAC's SOA, or LSMS.

Standalone and Interoperability tests for the SOA/LSMS within the respective SP's network should be completed to ensure conformance to acceptable standards prior to Certification tests with NPAC.

Testing can be broken down into several different segments including Interoperability, Turn-up, Regression, Round Robin and LTI. Each segment is described in the following paragraphs.

7.2.2 Interoperability Test

LSMS/SOA providers must test with the Interoperability test laboratory to ensure local systems properly interface with the NPAC/SMS. This phase tests Stack to Stack, Security, Recovery, Managed Object Compliance and Application to Application functionality. The Interoperability Test Plan (ITP) is developed by NeuStar and reviewed with the SP's to ensure completeness.

The ITP will be jointly executed by the NeuStar Test Center and the individual SPs or SOA/LSMS vendors wishing to test their SOA and/or LSMS systems. The test cases defined in the test plan must be executed and passed, before any SP is allowed to connect their SOA or LSMS to the actual NPAC SMS. This is to ensure that the SOA and LSMS do not corrupt the NPAC SMS and vice versa. Interoperability testing is required under the following circumstances:

- New release interoperability test cases must be run if a SP is supporting new functionality included in the release.

- If a SOA or LSMS product implements new features that existed in the NPAC SMS prior to a new release, the product must execute the previous release ITP test cases corresponding to the new functionality.

- It is mandatory for all LSMS and SOA products to execute the interoperability testing for a new release including the standard regression test cases to ensure backward compatibility with their existing SOA or LSMS products.

NPAC training is available from NeuStar and can be scheduled at the time the SP's User Agreement is signed. *For more information regarding training classes and schedules contact NewStar's Global Training & Documentation manager Joe Ferrallo as 312-706-6528 or e-mail to joe.ferrallo@neustar.com.*

NeuStar also hosts quarterly Cross Regional meetings. The Cross Regional meetings are designed as an open forum for all NPAC users to discuss technical and operations issues associated with number portability and the use of the NPAC service provided by NeuStar. *For more information refer to* http://www.npac.com/.

7.2.2.1 SOA/LSMS Preparation for Interoperability Testing and Certification

Participating SPs are required to design, code, and internally test their LSMS/SOA systems prior to initiating testing with the NPAC/SMS. Since the LSMS has a peer-to-peer relationship with the NPAC SMS, the LSMS will perform the role of both Manager and Agent from a Common Management Information Protocol (CMIP) perspective. This requires that the scripted LSMS/SOA initiated test cases and drivers (NPAC/SMS Interoperability Test Plan), be implemented and executed by the SP before actual testing with the Test Center.

7.2.2.2 SOA/LSMS Interoperability Testing and Certification with the NeuStar Test Lab

Interoperability testing between the SP's LSMS/SOA and the NPAC/SMS test lab is designed to ensure that each platform meets the technical and operational processing requirements for the transactional exchange of ported SP information. In some cases, the SP and the vendor may be one and the same. Each SP/vendor will be provided test access in an isolated environment that will allow careful and methodical execution of each test phase with evaluation times incorporated in the testing schedule.

Total elapsed time to complete all test phases is estimated at six weeks for an LSMS interface and three weeks for a SOA interface. However, these estimated times can vary depending on the functional complexity and size of the release. The SP is responsible for scheduling a test window with the NPAC. It should be noted that the SP (or through its designated agent) may test the SOA and LSMS separately. However, the SP is required to implement all SOA/LSMS initiated test cases and drivers before actual testing can be completed.

Interoperability Test scenarios contain representative samples of mandatory and optional tests. These tests are designed to address general areas of LSMS/SOA

conformance to the ISO/ITU standards for OSI Conformance Testing Methodology and Framework.

Upon successful execution of all mandatory test cases, a certification shall be issued to the SP authorizing connection to the production NPAC/SMS.

7.2.3 Turn Up Testing

Testing is done by NEUSTAR and new SPs to ensure that their software is functional in the normal operating environment, utilizing data communication support systems to communicate with a SP's LSMS/LSOA Systems. The Turn-up Test Plan (TTP) is a derivative of a variety of sources developed by NEUSTAR and reviewed by the SPs to ensure completeness. Depending upon the nature and complexity of the release and the associated number of test cases, this phase of testing takes 3 to 7 weeks.

7.2.3.1 SP/NPAC SMS Turn Up Testing

Once a SP has obtained LSMS and/or SOA certification, connection to the production NPAC/SMS will be permitted so that Turn-up Testing can be conducted. Although the Turn-up Test Plan is based upon elements similar to the Interoperability Test Plan, and some elements of the NPAC Internal Verification Test Plan, it addresses issues specific to activation and testing of the SP systems within the real production environment.

7.2.3.2 Scope of Testing

The scope of this testing is limited to conducting a subset of test cases identified in the Interoperability Test Plan and the NPAC internal Verification Test Plan, and the addition of certain test cases pertinent to the environments such as back up and recovery. These test cases will be conducted in the production environment with each SP, allowing the SP to test and repair any problems with LSMS or SOA functionality.

7.2.4 Regression Test

Testing is done in accordance with the Regression Test Plan (RTP) between the NPAC and existing SPs to ensure changes have not adversely affected functionality previously tested and in production, as well as testing new functionality included in a particular release. The RTP is developed by the NPAC and reviewed by the SPs to ensure completeness of the plan. Regression Testing may take between 6 to 10 weeks to complete, depending on the nature and complexity of the release.

7.2.5 Round Robin Testing

This is the final phase of new release testing, identified as Round Robin Testing (RRT). RRT permits SPs to test LNP functionality in a "live" environment between two or more SPs. SPs who have successfully completed SP to SP testing in other regions are only expected to do RRT and Fail over testing.

7.2.6 LTI Testing (Gene please review and correct as necessary)

SPs utilizing the Low Tech Interface (LTI) rather than a SOA system must also plan to test. Test cases for this purpose can be obtained from NeuStar. These cases will need to be executed by a new entrant in a region for primary or backup processing.

7.3 Inter-carrier Testing

The inter-company wireless to wireless testing will be organized through a national Wireless LNP Operations Team. For wireless to wireline and wireline to wireless, the National Number Portability Operations (NNPO) Committee agreed to form a testing subcommittee. Each SP will designate national coordinators who will attend the Operations Meetings. Inter-company testing will be coordinated through SP bilateral arrangements. Each SP will agree to and conduct a set of tests or use the recommended tests defined in the Test Plan. Participants may choose to run additional tests that address any specific needs, architectures or business arrangements.

A "black box" testing approach will be used for inter-company testing. Black box testing implies that the tester is not concerned with what is inside the black box. Instead, the testing validates that the black box functions and interfaces with another SP as specified. When applied to inter-company LNP testing, the black box approach means the NeuStar Test Lab will validate the interactions between SPs but not delve into the internal systems or processes of the SPs.

The following SP functions are impacted by LNP and are included in the test validations:

- Porting Order Exchange
- Service Provisioning
- Exception Processing – Order Cancellation
- Disconnected TN Snapback to Code Holder (or Block Holder)
- Call Flows
- 911 Record Changes
- Inter-SP Billing

7.3.1 Inter-carrier Test Plan

The Inter-carrier Test Plan tests the LRN solution for LNP Phase II.

The goal of the Test Plan is to accurately evaluate the ability of various SPs to implement LNP. The focus is to ensure conformance and compatibility of individual networks to the various standards. Testing includes the associated support systems, business arrangements, and interfaces between the various SPs. The intent is to establish test cases in these areas to ensure that the customer does not encounter any disruption or degradation of service when porting DNs from one SP to another. The transition will be transparent between SPs using the LRN method.

The Test Plan contains a series of tests developed by a team of participating companies. These tests are meant to ensure that the porting of DNs to or from a SP using the LRN solution will be successful. The Test Plan includes the porting of simulated live customers between SPs. This is accomplished by establishing test numbers and using existing or new processes. Using existing or newly established processes for testing will ensure that each SP's internal processes and systems will support number portability. This plan includes testing of porting between wireless SPs as well as porting between wireline and wireless SPs. Any potentially destructive tests should be performed in a lab or another internal environment and should not be performed between SPs.

Additionally, this test plan only addresses LNP functionality between SPs. Validation of processes that were in place prior to the implementation of LNP will only be addressed to the extent that they impact or are impacted by LNP. Additionally, interactions between SPs and their vendors or third party network SPs are considered part of the SP's internal processes and are outside the scope of the inter-carrier test plan. The test cases and validation points in this test plan are defined to address LNP systems and processes between SPs.

7.3.2 Inter-carrier Test Coordination

7.3.2.1 National Test Organization Structure

Each SP will identify a company testing coordinator. If a SP does not provide this information or is unwilling to, then it will be assumed that they do not wish to engage in inter-carrier testing.

The testing coordinator will be responsible for all LNP testing activities for their respective company. This may be done on a national basis, regional basis, or any other geographic basis of their choosing. This information along with names and contact telephone numbers should be made available to the National Number Portability Operations (NNPO), the LNPAWG, or any other similar organization.

This is for company to company LNP testing and does not include any NPAC certification activities or any third party vendors. Third party vendors will be the responsibility of those companies to which services are provided.

Resellers will be treated as SPs and all support activities / business arrangements should be transparent to their respective test partners.

7.3.2.2 Local Test Organization Structure

Similar to the wireline industry, the wireless industry must form a LNP Operations Team to address nationwide deployment of LNP. Included in this activity is the formation of an inter-carrier testing group to establish the logistics and a project management plan for inter-carrier testing. In addition, for wireline to wireless and wireless to wireline inter-carrier testing, a joint testing subcommittee of the Wireless LNP Operations Team and the NNPO will be formed to establish the logistics for integrated testing.

8. IMPLEMENTATION CONSIDERATIONS

Disclaimer: This list of implementation considerations is not intended to be all inclusive nor is it intended to provide the correct association between all responsibilities and functions for all departments for all wireless service providers.

Please reference the Wireless Industry Timeline in Appendix I for the appropriate milestones.

8.1 Cross Functional Team

Establish a Cross-Functional Team comprised of:
Network, Customer Care, TN, MIN (MSID) & IMSI Administration, Billing (Customer, Revenue Operations & Access), Product Development, Marketing, Legal, and IT for planning purposes.

- Track the LNPAWGand all sub-committee developments.
- Attend the NeuStar Cross-Regional meetings.
- Participate in the NNPO meetings.
- Develop a problem resolution process.
- Interface with the NPAC for capacity, performance and M&P familiarity.

8.2 Network

- Upgrade all MSCs with the MIN separation release and Number Portability CDR configuration.
- Test all functionality in a test bed environment to include 911, roaming (U.S. and International partners), prepay, etc., for feature compatibility with number portability.
- Verify all Translations; TN and MIN tables, GTT, Point Codes, etc.

- Verify the Signaling System and Network capacity.
- Verify SCP and/or SCP capacities.
- Develop Troubleshooting and Network Monitoring M & Ps.
- Develop a disaster recovery plan.
- Execute a First Market Application and Network roll out.

8.3 IT, Billing, Customer Care, TN Administration and Legal

Please note that this grouping is due to regulatory and financial requirements as much as it is to the overlapping of technical requirements.

- SOA/LSMS planning, purchase, and implementation.
- Develop an Inter-carrier communication process for interaction between wireless SPs.(Refer to the CTIA document in Appendix A.)
- Develop Inter-carrier communication M & Ps for all wireless and wireline Service Providers not utilizing the CTIA ICC process including but not confined to the LSR/FOC method.
- Establish LLC membership and NPAC contract.
- Obtain NPAC certification and perform release and regression testing, and M & P establishment.
- Perform Inter-carrier testing with both wireless and wireline Service Providers in all Regions.
- Test CDR creation and data field verification for downstream processing (Revenue Operations, Customer and Access Billing).
- Coordinate all service order and maintenance window activity with the NPAC.
- Monitor NPAC associations, bulk data downloads, and large port activity.
- Provide for MDN, MIN, MSID, IMSI administration and database integrity for porting and pooling as well as managing NPA splits and overlays.
- Provide for disaster recovery and association failure.

(Needs to be moved) See section 5.2 , Anna.

9.0 GLOSSARY

AMPS - Advanced Mobile Phone Service
ANI - Automatic Number Identification
ATIS – Alliance for Telecommunication Industry Solutions
CCB - Common Carrier Bureau
CDR - Call Detail Record
CMIP – Common Management Interface Protocol
CMRS - Commercial Mobile Radio Services
CTIA - Cellular Telephone Industry Association

DN - Directory Number
FCC – Federal Communications Commission
FOC – Firm Order Commitment
FRS – Functional Requirements Specifications
GR – Generic Requirements
GTT - Global Title Translation
GUI - Graphical User Interface
ICP - Inter-carrier Communications Process
IIS – Interoperable Interface Specifications
IMSI - International Mobile Station Identifier
IXC - Inter Exchange Carrier
LEC – Local Exchange Carrier
LERG – Local Exchange Routing Guide
LNP - Local Number Portability
LNPAWG - Local Number Portability Working Group
LRN - Location Routing Number
LSMS - Local Service Management System
LSR - Local Service Request
LTI - Low-Tech Interface
MBI - MIN Block Identifier
MDN - Mobile Directory Number
MIN - Mobile Identification Number
MPS - Message Processing System
MSA - Metropolitan Service Area
MSC - Mobile Switching Center
MSID - Mobile Station Identifier
NANC - North American Numbering Council
NANPA - North American Number Plan Administrator
NPAC – Number Portability Administration Center
NPDB - Number Portability Date Base
NPREQ - Number Portability Request
NSP - New Service Provider
OBF – Ordering and Billing Forum
OSP - Old Service Provider
OSS - Operational Support System
PC - Point Code
PCS - Personal Communications System
POI – Point Of Interconnection
POS – Point of Sale

RTP – Regression Test Plan
RRT – Round Robin Testing
SCP – Service Central Point
SOE – Service Order Entry
SMS - Service Management System
SMR - Specialized Mobile Radio
SP - Service Provider
SOA - Service Order Administration
SS7 - Signaling System Seven
SSN - Sub System Number
SV – Subscription Version
TN – Telephone Number
TR - Technical Requirements
VLR - Virtual Location Register
WNPSC - Wireless Number Portability Subcommittee
WPR - Wireless Port Request

Appendix A - Wireless Inter-carrier Communications Process

WIC-V2_1.doc

Appendix B - Inter-carrier Test Plan

"TEST DOC7.doc"

Appendix C - Wireless Wireline Integration Report

rptNANCrev.doc

arch_admin.doc

Second Wireless Wireline Integration Report

2ndRptFinal6.doc

Appendix D (Standards) (Do we want to add documents - or web sites?? Web Sites)

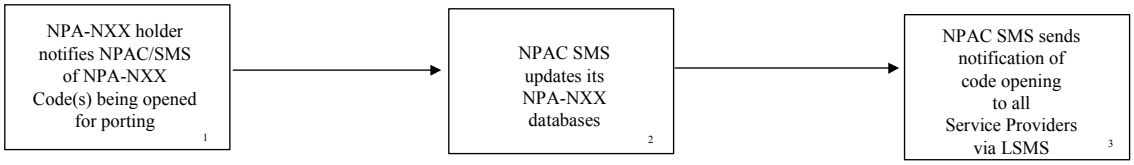
Appendix E INC LRN Assignment Guidelines

"LRN Assignment Guidelines 0798.doc

Appendix F

INTER-SERVICE PROVIDER LNP OPERATIONS FLOWS
- CODE OPENING PROCESSES-

NPA-NXX Code Opening



First TN Ported in NPA-NXX

figure 9

Step	Description
1. NPA-NXX holder notifies NPAC SMS of NPA-NXX Code(s) being opened for porting.	• The SP responsible for the NPA-NXX being opened must notify the NPAC SMS via the SOA or LSMS interface within a regionally agreed to time frame.
2. NPAC SMS updates its NPA-NXX databases	• NPAC SMS updates its databases to indicate that the NPA-NXX has been opened for porting.
3. NPAC SMS sends notification of code opening to all SPs via LSMS.	• The NPAC SMS provides advance notification of the scheduled opening of NPA-NXX code(s) via the LSMS interface.

First TN Ported in NPA-NXX

Step	Description
1. NPAC SMS receives subscription create request for first TN in NPA-NXX	• SP notifies NPAC SMS to create subscription for the first telephone number in an NPA-NXX.
2. NPAC SMS sends notification of first TN ported to all SPs via SOA and LSMS	• When the NPAC SMS receives the first subscription create request in an NPA-NXX, it will broadcast a "heads-up" notification to all SPs via both the LSMS and SOA interfaces. Upon receipt of the NPAC message, all SPs, within five (5) business days, will complete the opening for the NPA-NXX code for porting in all switches.

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Appendix G Meeting Dates and Carriers Represented

(Anna - can you provide this information?)

Appendix H - Useful Web sites.

www.npac.com (NPAC Home Page)
www.global.ihs.com (Global Engineering Documents
www.t1.org/t1p1/pl-grid.htm (can't access this one - is it right?)
www.atis.org/atis/clc/inc/incdocs.htm (INC Documents)
www.fcc.gov/ccb/Nanc/nanchot.html (NANC Hot Topics)
www.fcc.gov/ccb/Nanc/nancordr.html (NANC Related Orders)
www.fcc.gov/ccb/Nanc (NANC Home Page)
www.ported.com

www.webproforum.com/siemens1/index.htm
www.evoiving.com
www.tsi.gte.com
www.illuminetss7.com
www.bellcore.com
www.nist.gov/ext_links/industry/industy.html
www.industry.net/c/orgindex/tia

Appendix I - Wireless Implementation Timeline

WNP4400Timeln.ppt