- Some system in the Customer Acquisition/Care provisioning stream must interface to the regional SMS for negotiating/announcing ported numbers with the other service provider(s) and for querying existing subscriber records.
- Any system which interfaces with the regional SMS system must do so with the enhanced format of the Customer Account Record Exchange (CARE), also known as the Inter-Service Provider Maintenance, Administration, and Provisioning (ISPMAP) information.

5.12 Impacts to Billing

The following list describes the potential impact of NP on billing and fraud management systems.

- Roaming tables may need to be modified to support both IMSI and MIN. If the billing systems store IMSI, standard call records will also need to be modified and expanded. Additionally, telephone inventory records must be modified.
- Billing systems will most likely need to support more than one identifier for a subscriber: MIN, IMSI, and/or MDN.
- Any system or process which is built on MIN must be modified to support another ID - rating, cycle changes, splits, et al.
- Fraud Management will also be impacted for the same reason as above. Call Detail Records from the visited service providers are currently extracted on the basis of NPA-NXX translation of the billed number.
- A billing module may have to be added to the existing AMA records for calls involving ported numbers. The details are for future study.
- A billing identifier may be added to the call setup or AMA records. Future study is required.
- Call data message handling (e.g., IS-124) needs must be addressed.

5.13 Impacts to Maintenance

The following list describes the potential impact of NP on the maintenance operations:

- Performance and measurements
- Fault Detection, isolation and recovery
- Alarm detection and alarm reporting
- Maintenance and administration position
- Test procedures of the non-ported number, ported number and disconnected ported number

5.14 Impacts to Number Portability Data Administration

The following list describes the potential impact of NP on customer and network data administration.

- Service providers need to have an EDI interface for exchanging ported subscriber's data.
- WSPs must provide for an LSMS function to mediate the data sent from the NPAC-SMS to the NP-SCP, including the CMIP interface to the NPAC-SMS.
- WSPs must provide for an SOA function to mediate the data sent from the WSP's service order entry systems to the NPAC-SMS, including the CMIP interface to the NPAC-SMS.
- The CTIA Cellular Operations Record Distribution (CORD) and the LERG data distribution procedure must be updated to provide rapid exchange of PC/SSN, MIN, and other pertinent routing and subscription information.
- WSPs must provide for a means (e.g., an Operations Support System, manual) with which to provision network data, including
  - portable NPA-NXX block indicator for the MSCs,
  - new TT and new GTTs in the STPs,
  - HLR updates to include ported numbers, and
  - translation data in NP-SCP.

5.15 Impacts to Service and Network Reliability

The porting of a customer from one service provider to another requires provisioning changes that are both accurate, timely, and precisely coordinated between all service providers in a portable area. This provisioning is especially critical with respect to GTT databases. Incorrectly provisioned GTT databases can result in SCCP circular routing conditions that may utilize all of a link set's capacity within seconds. A circular routing mechanism is therefore needed that eliminates SCCP circular routed messages from occurring.

ANSI T1.112 provides procedures for SCCP message looping in the form of the SCCP Hop Counter. This hop counter is available in SCCP X-Unitdata (XUDT) messages only. Network elements will require upgrades to support XUDT message formats. Due to economics and desired dates of implementation, the UDT message will be used for number portability and existing applications. The XUDT message has been flagged as the desired long term solution.

5.16 Human Factors Impacts

Today, mobile subscribers may dial seven digits for calls within their home NPA. An NPA is pre-pended to the dialed digits for some mobile originated calls. In a Number Portability environment, 10 digits must be sent in the query to the NP-SCP. Wireless Number Portability is driving the separation of MSID and MDN, with the possibility that the MSID (as MIN) will not reflect the NPA of the subscriber's MDN.

The question then is how will the MSC determine what NPA to pre-pend to a 7 digit dialed number. The call might be misrouted, or the wrong information sent to the NP-SCP, if the MSC relies on the MIN MSID or the NPA of the MSC to determine the NPA of the called number.

There are 3 possible solutions:

(a) Require 10 digit local dialing for all mobile subscribers. This would treated all mobile subscribers equally (whether ported or non-ported) but may put the wireless carrier that implements 10 digit local dialing at a competitive disadvantage if the other local carriers, wireless or wireline, still support 7 digit local dialing. (A variation would be to have only the ported subscriber dial 10 digits. But that disadvantages that subscriber, would not meet dialing parity criteria, and would require the carrier to maintain multiple dialing plans for different classes of subscriber.)

(b) Assign the ported subscriber an MSID in MIN format with the same NPA as the ported MDN. It is not clear if this would always be possible, and this practice may affect MSID administration and may lead to inefficient use of the MSID. (MIN administration is for further study.) If the mobile subscriber has an IMSI as MSID, and no MIN, the MSID provides no value for this process since an IMSI does not contain an NPA.

(c) Use the NPA of the MDN of the calling mobile subscriber. This solution assumes that the calling party's MDN is available at the time of this substitution.

5.17 Service Impacts

The following impacts to services, as known today, are anticipated with the introduction of number portability as proposed in this document:

- Over the Air Activation must support the delivery of a MDN to the MS.

  The User Initiated Over The Air Function (OTAF) will not have impact with Call Origination on Wireless Number Portability. The Network Initiated OTAF with Call Termination will have some impact on Wireless Number Portability.

- CNIP must support the delivery of the MDN and not the MIN as the call party number for mobile originated calls.

- Emergency services must ensure that the subscriber is known to the operator by the MDN and not the MSID. Refer to section 3.3.2 for further discussion.

- Delivery of an SMS message to the Destination MC and ultimately the mobile station is based upon the MIN. In WNP, the delivery network only has the MDN of the mobile station. Therefore, the service is impacted in routing to the Destination MC. Refer to section 3.3.5 for presented solutions.

Impacts to CLASS type services are similar to those outlined in the ICCF document "INC Report on Number Portability," section 13.1.5.1.

There may also exist impacts to proprietary service implementations not appropriate for this document.

6. RELATED DOCUMENTS

The following documents can provide additional information regarding Number Portability:

- *Industry Numbering Committee (INC) Report on Number portability, Industry Service providers Compatibility Forum (ICCF)*, INC 96-0607-013, July 11, 1996.
- *FCC First Report and Order and Further Notice of Proposed Rulemaking*, FCC 96-286, June 27, 1996.
- *Federal Communications Commission (FCC) Notice of Proposed Rulemaking (NPRM) for the Local Number Portability*, Docket Number 95-116, July 13, 1995.
- *Generic Requirements for SCP Application and GTT Function for Number Portability*, Illinois Number Portability Workshop, Issue 0.95, September 4, 1996.
- *Generic Switching and Signaling Requirements for Number Portability*, Illinois Number Portability Workshop, Issue 1.02, June 17, 1996.
- *CCPN*, T1 Letter Ballot 557
- *IMSI Assignment Guidelines and Procedures*, Version 1, February 12, 1996.
- *North American Numbering Council LNP Architecture and Administrative Plan*, Issue 5, March 4, 1997.
- *T1 LB 557 Signaling System Number 7-Number Portability Call Completion to a Portable Number - Integrated Text*, currently in ballot to become an American National Standard

Information is available via the World Wide Web regarding number portability. In some cases, the above mentioned document may be found at these web sites.

- *www.fcc.gov* - information regarding the NANC LNP activities, FCC orders, meetings, etc.
- *www.ported.com* - this site contains various documents and information related to wireline portability.
- *www.tl.org/index/0701.htm* - this site contains, among many other things, the CCPN document.

7. ISSUES

The following issues are currently being or must be investigated before implementing the WNP Solution:

(a) How many LRNs will be assigned per MSC -- one per serving area, one per POP/POI, one per NPA-NXX, one per MSC, and/or one per MC (if multiple MCs are associated with an MSC)?

(b) Are there any methods wireless could employ for more efficient routing.

The following text was submitted as contribution to this document but has not been agreed upon:

"Call routing for mobile to mobile calls can be more efficient if the originating wireless network can identify that the outgoing call is wireless. There are two options for identifying a wireless call:

- The Originating MSC could maintain a list of LRNs assigned to MSCs. After the MSC receives the LRN in the WNP Query Response, the MSC can check to see if the LRN is assigned to an MSC.

- A wireless indicator could be maintained in the NP-SCP. The indicator would be returned in the WNP Query Response along with the LRN. This option requires significant effort and corporation with all industry providers.

An originating MSC, upon identifying an outgoing wireless call, may route a Location Request message to the called party's HLR using a 6-digit LRN to HLR GTT a the STP or per internal translations. (Note: If there are multiple HLRs, either the MSC has multiple LRNs or more than 6-digits may be needed for the GTT.) If the called party is roaming, the HLR will return the TLDN in the location request return result message. The originating MSC can route the call using the TLDN."

(c) The impact of WNP with regard to Emergency Callback whether the call back is over a roamer access port or otherwise requires further study.

(d) Performance and capacity impacts should be studied.

(e) How will MINs be administered?

(f) It may be assumed that providing resellers with numbers in and of itself does not make these numbers ported (and thus have LRNs assigned in the NP database). However, what if a reseller wishes to resell off a different facility provider and still retain its

numbers? Can a reseller port a block of numbers? What other issues will existing WNP with resellers? The treatment of resellers, resellers numbers and number portability will be noted on this issue list and addressed at some future date.

(g) Uniform treatment by wireline providers of calls to wireless subscribers continues to be an issue. Will the rating be based on the original wireline rate center or the fact that the subscriber is being served by a WSP?

(h) Will notification of an NPA-NXX opening for portability in order to provision the MSC be obtained from the LERG? If so, what is the process and system impact? Will this data also be available from the NPAC-SMS, and if so, in an automatic download?

(i) A standard solution (for the included alternatives or other) for delivery of a short message to a ported MDN must be chosen.

(j) Impacts of WNP on Code Splits must be further studied.

(k) The following implementation alternatives have been submitted for contribution in order to aid the complexities of routing a Location Request to the HLR from the gateway MSC:

- The MSC can translate the called MDN to the address of the called subscriber's HLR.
- The SS7 Signaling network can translate the called MDN to the address of the associated subscriber's HLR.
- The Originating MSC can query a NP-SCP to obtain the LRN, and route the signaling message to the HLR associated with the LRN.

Choosing the appropriate solution for the problem documented in Section 3.1.8.1 requires further study.

8. LIST OF ACRONYMS

The following acronyms have been used within this document.

Acronym	*Expansion*
ACG	Automatic Code Gap
AIN	Advanced Intelligent Network
AMA	Automatic Message Accounting
AMPS	Advanced Mobile Phone System
CC	Customer Care
CCPN	Call Completion to a Ported Number
CDMA	Code Division Multiple Access
CdPA	Called Party Address
CdPN	Called Party Number
CFNA	Call Forward No Answer
CgPA	Calling Party Address
CgPN	Calling Party Number
CLASS	Custom Local Area Signaling Services
CMIP	Common Management Interface Protocol
CMRS	Commercial Mobile Radio Service
CNAM	Calling Name
CORD	Cellular Operations Record Distribution
CTIA	Cellular Telecommunications Industry Association
DN	Directory Number
EDI	Electronic Data Interchange
EO	End Office
ESN	Electronic Serial Number
ESP	Emergency Service Provider
FCC	Federal Communications Commission
FCI	Forward Call Indicator
FGD	Feature Group D
GAP	Generic Address Parameter
GSM	Global System for Mobile Communications
GTT	Global Title Translation
HLR	Home Location Register
IAM	Initial Address Message
IMSI	International Mobile Station Identifier (E.212)
IN	Intelligent Network
IS-41	Interim Standard - 41
ISDN	Integrated Services Digital Network
ISUP	ISDN User Part
IXC	Inter Exchange Carrier
LATA	Local Access Transport Area

Acronym	*Expansion*
LEC	Local Exchange Carrier
LERG	Local Exchange Routing Guide
LIDB	Line Information Database
LRN	Location Routing Number
LSMS	Local Service Management System
LSP	Local Service Provider
MC	Message Center
MCC	Mobile Country Code
MDN	Mobile Directory Number
MIN	Mobile Identification Number
MNC	Mobile Network Code
MS	Mobile Station
MSA	Metropolitan Statistical Area
MSC	Mobile Switching Center
MSID	Mobile Station Identifier
MSIN	Mobile Station Identification Number (as part of IMSI)
MTP	Message Transfer Part
NANC	North American Numbering Council
NANP	North American Numbering Plan
NE	Network Element
NP	Number Portability
NP-SCP	Number Portability Service Control Point
NPAC-SMS	Number Portability Administrative Center Service Management System
NPRM	Notice of Proposed Rulemaking
O-MSC	Originating Mobile Switching Center
OAM&P	Operations, Administration, Maintenance, and Provisioning
OEO	Originating End Office
OSS	Operations Support System
OTAF	Over The Air Function
PC	Point Code
PODP	3/6/10 Digit Public Office Dialing Plan
POI	Point of Interconnection
POP	Point of Presence
PSTN	Public Switched Telecommunications Network
RBOC	Regional Bell Operating Company
SCCP	Signaling Connection Control Part
SCPs	Service Control Points
SME	Short Message Entity
SMR	Specialized Mobile Radio
SMS	Service Management System
SMS	Short Message Service
SOA	Service Order Activation
SP	Service Provider

Acronym	*Expansion*
SS7	Signaling System 7
SSN	Sub-System Number
STP	Signal Transfer Point
TCAP	Transaction Capabilities Application Part
TCPN	Translated Called Party Number
TDMA	Time Division Multiple Access
TEO	Terminating End Office
TLDN	Temporary Local Directory Number
TT	Translation Type
V-MSC	Visited Mobile Switching Center
VLR	Visiting Location Register
WIN	Wireless Intelligent Network
WNP	Wireless Number Portability
WSP	Wireless Service Provider