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INC REPORT ON NUMBER PORTABILITY

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For ordering information, please contact:

ATIS
1200 G Street N.W., Suite 500
Washington, DC 20005
(202) 628-6380
inc@atis.org

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The Industry Numbering Committee (INC) provides an open forum to address and resolve industry-wide issues associated with planning, administration, allocation, assignment and use of North American Numbering Plan (NANP) numbering resources within the NANP area.

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ICCF

Industry Carriers Compatibility Forum

Under the auspices of the
Carrier Liaison Committee

3 Corporate Place
Piscataway, NJ 08854
Fax: (908) 336-3640

Madeline Bogdan
Moderator
Room: 2F305
Phone: (908) 699-2494

Kathy Cullen
Secretary
Room 2F309
Phone: (908) 699-3245

INDUSTRY NUMBERING COMMITTEE CO-CHAIRS

Denny Byrne
USTA
1401 H Street NW
Suite 600
Washington, DC 20005
Phone: (202) 326-7296

Bob Hirsch
AT&T
900 Route 202/206 North
Room 5A257
Bedminster, NJ 07921
Phone: (908) 234-4197

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INC REPORT ON NUMBER PORTABILITY

Executive Overview

The Number Portability Workshop of the Industry Numbering Committee (INC) was formed in October, 1993 with a mission to develop a set of definitions, identify and describe potential network architectures, and assess the technical feasibility and implementation requirements, impacts and attributes of number portability. The Industry Carriers Compatibility Forum (ICCF) and all its subtending committees, including INC, are open to all interested parties. Participants in the INC Workshop have included representatives from most segments of the industry. The Workshop's initial focus was on one form of portability (Service Provider Portability) that had received a lot of attention and interest from regulators and competing local exchange carriers. This INC report attempts to capture the key elements of the discussion and presentations that took place within this Workshop to address this form of number portability. Some of the issues and concerns with other forms of number portability (i.e., Service Portability and Location Portability) are raised as well.

The North American Numbering Plan (NANP) utilizes a standard, 10-digit format comprised of a 3-digit area code (NPA), 3-digit central office code (NXX) and 4-digit line number. This NANP number is used by the public switched network for both routing and rating of calls between parties. Because the first six digits are used to uniquely identify a specific central office or carrier Point-of-Presence (POP), NANP numbers do not easily lend themselves to porting between several different carriers or serving switches.

The Workshop identified a set of objectives (i.e., Portability Principles) that needs to be considered in the development and implementation of any solution for (long term) number portability, including flexibility in implementation , transparency to both ported and non-ported customers, efficiency in routing and avoidance of adverse service impacts. All of the long-term architectures that have subsequently been discussed within the Workshop thus far have a common set of network components that include the following:

- Switches equipped with the capability to launch database queries
- A signaling network capable of routing database queries and responses and forwarding routing instructions
- One or more databases containing routing and rating information for ported numbers
- A regional Service Management System (SMS) comprised of the necessary software and hardware needed to maintain records of ported numbers and for downloading information to individual, network databases.
- Access links to the SMS to allow responsible organizations to create and update records contained therein.

Administration and provisioning of numbers within the regional SMS and individual network databases were found to follow one of two different alternatives: 1) management limited to

previously-assigned numbers that have been ported; or 2) pooling of numbers within new codes (NXXs) and/or all unassigned numbers within an existing NXX. It was generally acknowledged that the latter alternative provides the best potential for conservation and efficient use of NANP resources, but the former introduces fewer complexities in service provisioning, default routing and intercept/disconnect treatment.

Routing and rating of calls, many operational support systems, and existing AMA record processing procedures are predicated upon information directly associated with an NPA/NXX. This association may no longer be possible with number portability. Therefore, a number of concerns must be addressed, such as:

1) Proper routing, rating and billing of calls

2) Potential for additional delay in connection time

3) Potential for customer confusion

4) Retention of subscriber features

5) Impact on service provisioning methods

There are a number of technical considerations that also need to be addressed when searching for a long-term architecture for number portability. Impact upon the various components of the network, including the SS7 signaling network, local and toll switches, routing databases and operational support systems are just a few. Potential adverse impacts on current features and services such as CLASS features, voice messaging, operator-assisted and coin calls, directory assistance, wireless roaming and E911 must also be identified and minimized.

Several proposals for a long-term, number portability architecture have been presented and discussed within the Workshop. They include:

1) The Location Routing Number (LRN) Plan, which maps (for routing purposes) a common routing address to each ported number terminating at the same switch. The first six digits of this address is comprised of an NPA/NXX traditionally assigned to (non-ported) lines on that switch.

2) The LANP Split Numbering Plan, which separates the customer dialable number from a unique network routing number, the latter of which is utilized to properly identify and route calls to the proper terminating switch.

3) The Carrier Portability Code (CPC) Plan, which replaces (for routing purposes) the dialed NPA of each ported number with a new 3-digit code which uniquely identifies the actual terminating carrier.

4) The Release-To-Pivot (RTP) Plan, which routes calls based upon the dialed NPA/NXX, but in situations where the dialed number is subsequently determined to be ported, utilizes SS7 signaling capabilities to return such calls back to a pivot switch for rerouting based upon new information provided by the original terminating switch.

5) The Non-Geographic Numbering Plan, which requires customers to accept a one-time number change to one using a non-geographic NPA (e.g., 333). This NPA, when dialed, would be easily recognized by the network and calling customers as one requiring special routing, thus possibly reducing customer confusion and network costs.

Proponents of each alternative provide a general description of the architecture's method of operation, followed by details regarding how it accommodates the aforementioned billing, customer and technical number portability concerns. Any and all claims as to the ability of a given alternative to fully address such concerns are offered only from the perspective of the proponent(s) and do not represent consensus by the Workshop as a whole. This report does not offer a recommendation regarding which might best meet the long term need for number portability.

Although the focus of the Workshop was on long-term solutions for providing number portability, several interim solutions utilizing existing technology were identified and discussed as well. Among them were use of switch-based features such as Remote Call Forwarding (RCF) and Direct Inward Dialing (DID) to reroute the call from the original terminating (donor) switch to the new (recipient) switch. Enhancements to these features to more easily accommodate number portability were also discussed. Because of several inherent concerns and limitations caused by the necessity of routing calls through the facilities of the donor switch carrier, these solutions are generally considered as interim measures until a long-term architecture is developed and deployed.

1.0 Introduction

In July of 1993, Ameritech introduced the issue of number portability to the Industry Carriers Compatibility Forum (ICCF). The issue was subsequently accepted and assigned to the Number Portability Workshop, a standing subcommittee under the newly-created Industry Numbering Committee (INC). The Workshop has provided a forum for identifying issues, discussing concerns and presenting proposals for number portability solutions since October of 1993. This first report documents and summarizes much of the activity that has taken place over that two-year timeframe. Since much of focus during this initial period has been on number portability among and between service providers, this report only touches upon some of the issues associated with other forms of number portability identified in Section 3.0. In addition, some issues and concerns with portability among wireless providers and between wireline and wireless networks are addressed. It is anticipated that as discussions continue on interoperability requirements, types of portability supported, roles of the number portability administrator and other related issues, additional reports and/or updates will be published.

2.0 Background

The citizens of the United States, Canada, and the Caribbean nations, the area historically referred to as World Zone One (WZ1), benefit from the most versatile, flexible, efficient and user friendly telephone numbering plan on earth - The North American Numbering Plan (NANP). This shared public resource provides a consistent 10-digit telephone number format allowing for maximum direct dial capabilities for user of the public switched telephone network in WZ1. The NANP was conceived, developed and implemented within the context of the old Bell System in the late 1940s to serve as a basis for dialing, addressing, routing and rating plan for the Bell System and the independent telephone companies operating in North America. It is a geographic numbering plan composed of the traditional combination of area codes, or Number Plan Areas (NPAs) followed by an exchange or central office code (NXX) composed of three digits, and a four digit line number. The full combination of digits equals the familiar 10 digit telephone number format of NPA-NXX-XXXX.

2.1 Current geographic portability limitations

The term "geographic number" has a literal meaning. In geographic numbers, the number identifies a specific physical location, province or country. The first three digits of a geographic number (the NPA) typically identifies a specific geographical area within a state. The second three digits (the NXX) identifies a switching entity, usually a central office switch. Given the fact that numbers have historically been assigned "geographically", there are communities with as few or fewer than 200 telephone stations that have entire 10,000 number NXX blocks assigned exclusively for their use, and conversely there are other communities in which one central office houses several NXXs because tens of thousands of station lines are required at that location. Assignment of a single NXX to serve more than one switch or geographic area is generally not recommended. As a result, multiple station lines remain unassignable in many instances.

In addition to the assignment and availability of "geographic numbers", the physical location of each end office switch also affects the routing and rating of telephone calls. Each end office switch has historically been identified by longitude and latitude (commonly called "V and H coordinates" for routing and rating purposes in order to determine a call's jurisdiction (inter/intra state, inter/intra LATA, etc.) Thus, with the existing method of routing and rating calls based on geographic locations of NXXs, the use of one NXX to serve more than one physical location is limited.

In summary, geographic numbers have provided two unique functions in telephone communications - allowing calls to progress from origination to termination and allowing applicable charges and jurisdiction to be generally known by consumers and determined by telephone switching equipment. In recent years, the increasing availability of new technology (cellular, paging, facsimile, etc.) as well as new competitive telecommunications local service providers have placed demands on the North American Numbering Plan that were not envisioned when the existing assignment criteria were developed. This system of telephone addressing was designed prior to the contemplation or actuality of multiple service providers operating in the same geography/jurisdiction. As a result, modifications to the current

application of geographic number assignments linked to single service providers require careful planning, as the paradigm shifts significantly. While these modifications to the current numbering plan are significant, they are not unresolvable. There are interim measures that can be employed to facilitate the paradigm shift to full local exchange competition. The Industry Numbering Committee (INC), as a standing committee under the Industry Carriers Compatibility Forum (ICCF), is analyzing and describing potential industry solutions to address the need for number portability in North America.

For the definition of, and further information on Geographic and Non-Geographic numbers, see Section 3.2.

2.2 There exists considerable interest in number portability

While the importance of retaining a telephone number was recognized in the early (1960s) exchange tariffs and became a significant issue associated with 800 service during the 1980s, the need for portability for local numbers was seldom cited until the NANP Administration's "Proposal on the Future of Numbering in World Zone 1" dated January 4, 1993. Since that time, substantial interest has been expressed and effort expended in addressing number portability. The parties involved in these efforts include both competitive and incumbent local exchange carriers, as well as interexchange carriers, commercial mobile radio service providers, regulatory representatives and other interested entities. Not surprisingly, views on this subject vary, concerning both the need for portability and the technical, public interest, cost, implementation and other attributes that surround deployment of the capability. Moreover and perhaps most importantly, this matter has been recognized and is being studied by both federal and state regulatory bodies, and is being embodied in U.S. telecommunications legislation.

2.3 Existing capabilities

There exist certain capabilities deployed in networks which provide end users a measure of number portability (see the descriptions of remote call forwarding and Direct Inward Dialing (DID) in Section 14). The use of these capabilities as sufficient solutions to number portability issues is the subject of some discussion within the industry. Proponents view these existing capabilities as acceptable alternatives to other solutions being considered which may entail complex and costly enhancements to the public switched network. Others consider these capabilities of value only as interim arrangements, and consider them to be inefficient and not suited to a permanent solution for number portability.

As a matter of clarification, wireless providers do not currently offer location portability outside their home serving area, but generally do offer a temporary form of terminal/personal mobility known as roaming. Terminal/personal mobility is defined as the ability of a terminal or person to access a given telecommunications service from different locations and while in motion, and the capability of the network to identify and locate that terminal or person. Roaming permits wireless customers to make and receive calls throughout most of North

America utilizing the NANP number assigned to the mobile terminal instrument by the home wireless provider. The customer will be billed by his/her home provider but service during the roaming period is provided by the wireless provider located in the visited area.

2.4 The Number Portability Workshop

Because of the interest in number portability, and a desire to move beyond existing network capabilities, if technically and economically feasible and in the public interest, a number portability workshop was established under the Industry Numbering Committee (INC). The Workshop has developed the following Mission and Scope:

MISSION:

The Number Portability Workshop will develop a set of definitions for number portability scenarios, describe the possible network architectures and/or provisioning alternatives which could support it and assess the technical feasibility and implementation requirements impacts and attributes.

SCOPE:

The Number Portability Workshop will identify and examine the various types of number portability (e.g., local number portability, location portability, etc.) that are possible, explore the general implications of each, and decide upon standard definitions that will become the focal point for discussions on planning and provisioning. Once the terminology is defined, participants will work towards identifying any and all alternatives for providing number portability and assess the technical feasibility, target technology, service impact (both positive and negative), timing and relative complexities/benefits for each. These definitions, network architectures and implementation requirements will be documented. The documentation will include a set of baseline requirements, high-level capabilities, call flow diagrams, network performance expectations, etc., as appropriate.

3.0 Definitions

3.1 Number Portability

The Workshop has defined the term "Number Portability" as follows:

> Number portability refers to the ability of end users to retain their geographic or non-geographic telephone number when they change any of the following:
>
> a) their location
>
> b) their service provider

c) their service

The three types of portability referenced in this general definition were further defined as f ows:

Location Portability:

The ability of an end user to retain the same geographic or non-geographic telephone number (NANP) numbers as he/she moves from one permanent physical location to another. Location Portability will involve either of the following scenarios:

1) New permanent physical location is within the same serving wireline central office area.

2) New permanent physical location is within a different serving wireline central office or wireless serving area[1].

Service Provider Portability:

The ability of an end user to retain the same geographic or non-geographic telephone number (NANP number) as he/she changes from one service provider to another.

Service Portability:

The ability of an end user to retain the same geographic or non-geographic telephone number (NANP numbers) as he/she changes from one type of service to another (e.g., POTS to ISDN).

Regarding location portability, consideration of restrictions to (within) specific geographical boundaries (e.g., NPA, LATA, MSA, RSA, MTA, BTA) may be appropriate as an interim or long-term measure to minimize potentially adverse network and end-user impacts.

The Workshop agreed that NANP numbers that are assigned for specific service applications (e.g., 800, 500, 555, 950) should not be service portable for applications outside of their respective industry-approved service definitions or guidelines.

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[1] Wireless serving areas (i.e., Basic Trading Areas (BTAs); Metropolitan Statistical Areas (MSAs); Rural Service Areas (RSAs); Metropolitan Trading Areas (MTAs); etc.) are generally much larger geographically than wireline central office serving areas. Thus wireless location portability would inherently involve different scenarios.

Scenario #2 may not apply depending upon the distance and ported area involved. Typically, a wireless service area (MSA, RSA, MTA, BTA, etc.,) encompasses several thousand square miles.

3.2 Geographic & Non-Geographic Numbers

The "Central Office Code Assignment Guidelines" (ICCF 93-0729-010) helps define the terms geographic and non-geographic numbers in its classification of NPAs:

> Geographic NPAs are NPAs which correspond to discreet geographic areas within the area served by the NANP.
>
> Non-geographic NPAs are NPAs that do not correspond to discrete geographic areas, but which are instead assigned for services with attributes, functionalities, or requirements that transcend specific geographic boundaries. The common examples are NPAs in the N00 format, e.g., 800.

The focus of this Workshop has been on geographic numbers, since portability of non-geographic numbers has, or is being addressed, in other forums and proceedings.

3.3 Portability Scenarios

The three types of portability can be considered together with both geographic and non-geographic numbers to describe multiple portability scenarios. They are listed in the matrix below. A number (Scenario #) for each of the listed scenarios is provided for identification purposes only.

As stated previously, the primary focus of the workshop's efforts is that of portability of geographic numbers. Moreover, the initial focus has been to understand the network needs required to implement service provider portability of geographic numbers, the scenario identified as #4 in the matrix.

Scenario #	Numbering Resource	Location	Svc. Provider	Service
1	Geographic	Y	N	N
2	"	Y	Y	N
3	"	Y	Y	Y
4	"	N	Y	N
5	"	N	Y	Y
6	"	N	N	Y
7	"	Y	N	Y
8	Non-Geographic	Y	N	N

9	"	Y	Y	N
10	"	Y	Y	Y*
11	"	Y	N	Y*

*Note: NANP numbers assigned for specific service applications (e.g., 800, 500, etc.) should not be service portable outside of their respective industry-approved service definitions or guidelines.

4.0 Portability Principles

The Workshop has established a number of objectives that it believes should be taken into consideration in the development and implementation of any solution for number portability. While perhaps not exhaustive, the following list represents several key concepts that have been identified as desireable to ensure that number portability is deployed in an efficient and consistent manner.

Preamble

All service providers who participate in portability will adhere to the following principles which apply to network technical considerations. It is recognized that considerations involving the recovery of costs associated with the development and implementation of number portability are very important, as well as the consideration of the initial and subsequent economic effects on all impacted entities. In addition, any solution should not preclude the development of appropriate cost recovery mechanisms. However, such considerations are not included in these principles.

Architectural Flexibility Principle

To the extent possible, architectures proposed for the support of number portability should allow network providers reasonable flexibility in the manner in which the architecture is implemented. Specifically, architectures which require a database(s) solution should not preclude any carrier from incorporating the database(s) in their own network. In addition, proposed number portability solutions should consider service providers' networks that utilize existing, industry-approved standards.

Customer Transparency Principle

The mechanism by which portability is provided should, as an objective, be transparent to the ported and non-ported customer.

Efficient Routing Principle

Number portability should support the efficient and consistent routing of telephone calls to ported numbers. Service providers serving ported customers, and service providers routing to other service providers should be able to route those calls in as direct and efficient manner as is technically possible. The architecture should subject the call to minimal (if any) performance degradation relative to that incurred in today's non-portable environment.

NANP Number Principle

Where number portability is required, it applies to geographic ten-digit NANP numbers, except in situations where industry approved service definitions limit or preclude such portability (e.g., 555).

Participation Principle

At a minimum, each of the service providers (e.g., CMRS, ICs, CAPs, LECs, CLECs) participating in number portability should also participate in number portability development, deployment and associated administrative functions. In addition, other impacted entities are encouraged to participate.

Reciprocal Interconnection Principle

All service providers (e.g., CMRS, ICs, CAPs, LECs, CLECs) offering portability within the same specific geographic area should interconnect and allow for call completion. The method of interconnection (direct, tandem, hub, etc.) is a business decision for the service provider requesting interconnection.

Service Impact Principle

Regardless of the selection of the network provider, care should be taken to avoid any adverse impacts to customers who do not desire number portability.

Service Provider Principle

Customers should have the option of retaining their geographic telephone number as they change between service providers (e.g., CMRS, ICs, CAPs, LECs) serving the same specific geographic area. The obligation to provide number portability should be borne by all service providers as required by appropriate regulatory bodies with jurisdiction over a common geographic boundary area.

Technical Equity Principle

The technical characteristics of existing interconnection arrangements with non-participating networks should not be fundamentally changed as a result of number portability.

5.0 The Focus of Number Portability

5.1 Service Provider Portability

As described in Section 3, number portability is defined to include three major categories, is relevant to both geographic and non-geographic numbers, and can be considered in a multitude of scenarios. Although all types of number portability are described, early issues of this document will focus primarily on service provider portability; that is, the ability of an end user to retain their existing geographic telephone number when they change (local) service provider. In addition, emphasis on service provider portability carries the added constraint of a fixed location, the assumption that the end user has not changed his/her permanent physical location or rate center.

Although it is believed that the primary number portability concern is that associated with a change of service provider, some of the network operational considerations necessary to accommodate location portability and service portability are described in various sections of this document. Moreover, although portability of non-geographic numbers was identified in the scenarios described in Section 3, the relevant network issues are being addressed in a separate industry workshop and are discussed only as related to a specific proposal to this workshop (see Section 13.4).

5.2 Impact on Call Originations

Some issues related to number portability that might be associated with call origination (e.g., call rating) are not addressed in detail within this document. However, provision of the basic signaling information necessary to support network operations such as billing. fraud detection/investigation, and services should be of concern.

Under some conditions it may be desirable to generate information about the geographic origin of a call at the originating switch and provide it in the Initial Address Message (IAM). This may include information about the switch and rate center where the call originated and/or an explicit indication that the call originates from a ported number. This information can be of assistance in:

1. Properly rating the call. For example, if a caller has a ported number, if the caller's rate center is not associated with the calling party number, and if billing records are made at some location other than the originating switch, then it may be desirable to

include switch/rate center and ported number information in the IAM generated by the originating switch. This information may be used to support billing.

2. Supporting fraud detection, investigation, and prevention measures. Many fraud detection measures rely on the geographic location of the calling party. For example, many fraud perpetrators tend to cluster in a geographic area (e.g., a city block) and geographic information is used to target detection in those areas. If the calling number is ported, the availability of information about the geographic origin of the call in the IAM could facilitate this type of detection.
3. Efficient operation of network services. For example, operation of services in the terminating switch might be made more efficient by the availability of additional information, such as the ported number or the switch where a call originated, in the incoming IAM.

Note that the generation of this information may require changes in applicable standards, and the use of this information may require changes to a variety of billing and operations systems.

5.3 Impact on Call Termination

Network issues associated with number portability relate primarily to call terminations; specifically, call processing required for the routing and rating of calls. Issues dealing with access of a local service provider to its customer (i.e., the availability of a local loop), although arguably complementary to the subject of number portability and clearly essential to the understanding of local exchange competition, are often considered a separate and distinct matter and are not covered herein.

Specific items related to this competitive concern might involve:

- The existence of multiple loops to an end user's premises (e.g., EC and CATV)
- The unbundling of the local network infrastructure by the dominant local service provider and the availability of these network components through lease arrangements
- The provision of "equal access" for local service, allowing a customer to presubscribe and to "dial around" to access a local service provider
- The availability of network and/or end user premises equipment that allows an end user to efficiently use the services of any one of several available local service providers.

Although clearly of significance, because these issues are not directly related to number portability, they will not be discussed further here.

6.0 Numbering Resource and Call Routing Considerations

Critical to an understanding of the potential impacts of number portability is an awareness of the current format of dialable telephone numbers and how that format is used by network providers.

6.1 The Use of Numbers in a Non-Portable Environment

Today, a geographic North American Numbering Plan (NANP) telephone number (of the form NPA-NXX-XXXX) and, most often, specifically the first six digits of that number (NPA-NXX), can be used to identify the service provider as well as the network location from which services are offered and to which calls dialed with that number should be routed. The use of these numbers and their meaning is pervasive in all phases of call processing, in all (CAP, CLEC, CMRS, IC and LEC) networks. NANP numbers are inherently linked to routing the call to its destination, to rating the call for charging, and to the support of the call and the associated transport networks for operational purposes such as provisioning and network management.

Assignments of central office codes (NPA-NXX) are made not only to established LECs, but also to wireless carriers and competitive exchange carriers (CLECs). Accordingly, calls dialed with numbers asigned to all local exchange providers are routed based upon NPA-NXX. The information associating NPA-NXX with service provider and location is disseminated throughout the industry via the Local Exchange Routing Guide (LERG), published by the Traffic Routing Administration Group (TRA) within Bellcore.

6.2 The Use of Numbers in a Portable Environment

In a number portability environment, it is likely that call processing (e.g., routing and rating) based upon NPA-NXX (6 digits) of the dialed number will no longer be viable. Rather, in many instances, some phase of call routing will require analysis of all ten digits. Consequently, it is likely that network infrastructures will have to be modified to accommodate these changes. Moreover, because number portability will impact all types of calls, both intraLATA and interLATA alike, the necessary modifications will, over time, have to be made in all carriers' networks.

In today's environment, the dialed number serves not only as a customer address, but also identifies the network address (and in wireless networks, the specific mobile terminal) to which the call must be routed for completion. This "multiple use" of the dialed number demands that any customer who might choose to change their location, service or provider and therefore, the network address from which he/she is served, must, in most cases, also change his/her telephone number. Accordingly, this arrangement precludes any implementation of number portability.

Clearly, in order to provide number portability, the dialed number must be separated from its associated network address. This separation will allow a new network address, to be associated with a customer's existing telephone number.

7.0 Architectural Considerations

Network arrangements which support number portability must provide an effective means through which all carriers can complete calls in the most direct and efficient manner. The architecture should support all of the portability principles listed in Section 4 of this document, and there should be general consensus that the potential benefits derived by all end users outweigh the costs of its deployment. The underlying methodology should be "user-friendly" to both carriers and customers alike in that it facilitates an easy transfer of customer service from one carrier to another, accommodates location and service portability, and allows both called and calling customers full use of their subscribed features. This section contains an overview of the fundamental components needed to support many of the solutions proposed thusfar for number portability.

7.1 A Database Architecture for Number Portability

It is proposed that the association of customer number and network address be located in network (number portability) databases.

It is generally acknowledged that the architecture required to support these network databases includes the following hardware components (for ease of understanding, these components are shown in Figure 7.1-1):

- switches (e.g., end offices, tandems) equipped with a capability to launch database queries

- a signaling network capable of routing database queries and responses and providing the necessary routing information to all switch points in the call path

- one or more databases containing sufficient information to rate and route calls to ported numbers

- a Service Management System (SMS) comprised of the necessary software and hardware needed to create and maintain records of ported numbers and to download such information to the individual databases owned and operated by various carriers and contractors.

- access links to the SMS to allow responsible organizations to create andupdate the records contained therein

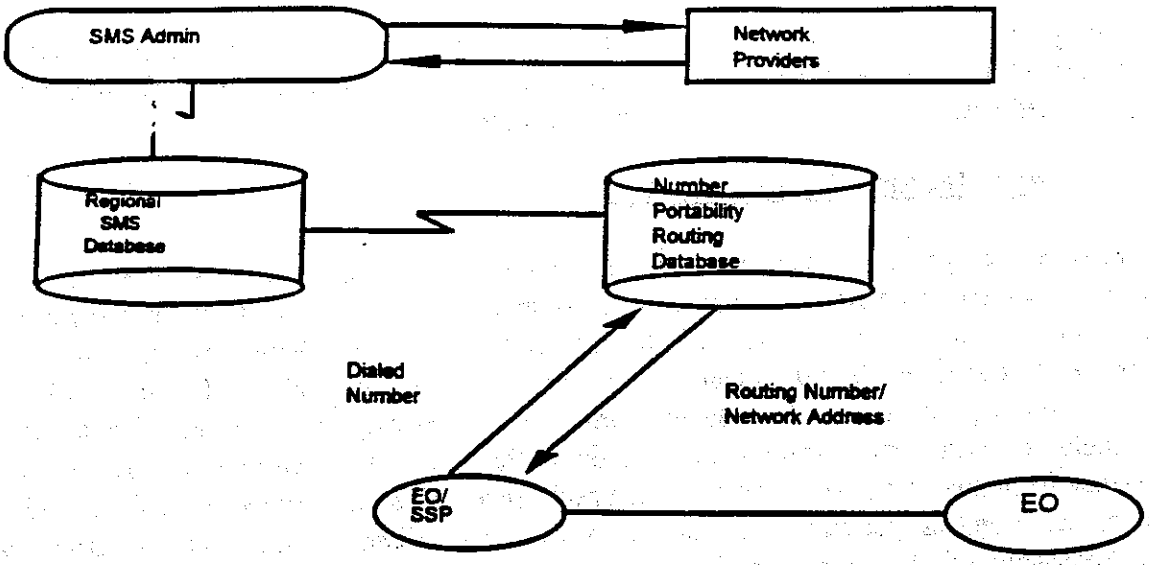

Figure 7.1-1

These components and supporting functionalities are further described in the sections that follow.

7.1.1 Network Switches

Network switches which support number portability must be able to receive and analyze the digits of the called party number, recognize the need for a database query, if required, identify if the dialed number is within a portable code (NPA/NXX), launch the database query, analyze the response and route the call. If the switch isn't capable of performing these tasks itself, it must route the call to another switching node that can. Such a capability generally requires that the switch be equipped with Service Switch Point (SSP) functionality, and have Intelligent Network (IN) or Advanced Intelligent Network (AIN) software loaded within. Existing IN and AIN triggers (to generate the database query) may need to be augmented to allow proper interaction with all existing features and service types.

The wireless industry does not generally have an IN/AIN trigger capability equivalent to the wireline telecommunications industry. Although work in this area is underway, it is unclear whether the wireless IN triggers would provide a capability equivalent to the IN/AIN triggers or be compatible with a number portability architecture based upon an IN/AIN architecture. See Section 12.11.2 for further detail.

7.1.2 The Routing Database

Number portability routing databases will contain information that allows for proper rating and routing of dialed numbers. It is likely that there will not be one single database containing

information on all ported numbers, but rather a number of databases. Depending upon the number of queries needed, each database may contain the same information or, alternatively, each may be limited to information for a specific area. This area may be defined by a geographic boundary or some other commonly recognized criteria. Moreover, in contrast with the architecture deployed for 800 portability, where 800 access databases are only located in access providers' networks, these number portability databases could be located in any carrier's network, or offered by an independent, non-carrier provider. For those carriers who choose not, or are unable to deploy databases in their own networks, other methods of accessing this information will be necessary.

7.1.3 The Database Record

For each customer record in the database, the related information will contain, at minimum:

- a network address or terminating service provider identifier which will uniquely identify either the specific network switch or (at minimum) the service provider's network to which the call must be routed.

- information which can be used to properly rate and bill the call

The database record might contain additional elements optionally populated by certain carriers or commonly populated by all. For example, it might be necessary to include the destination point code (DPC) of the terminating switch, to assist in routing non-call setup, i.e., (SS7) signaling messages, as further discussed in later sections of this document.

7.1.4 The Network Address

Essential to the implementation of LNP is the ability to associate a network destination with a (dialed) ported number. This information will identify either the specific network node termination (address), the terminating switch or simply the terminating carrier's network. Clearly, such information is a key element in the number portability database.

A unique identity must be given to each carrier or switching entity which terminates calls to subscriber numbers. Although the use of a unique identity may significantly impact call processing in all networks, it is desireable if its use:

- minimizes modifications to the existing network infrastructure

- allows for the continued use of current network routing methods

- permits the use of existing signaling protocols

- minimizes the need for new technical standards

Most of the alternatives proposed in Section 13 use some form of the 10-digit NANP number as the switch address. However, any number of formats might be considered for use as the switch entity identifier. For example, a simple five digit numeric code would allow for the unique identity of up to 100,000 end offices. Alternatively, the code could be designed to include routing information indicating, for example, a region of the country in which the end office was located; or the code could be designed to include the identity of the service provider. Some have suggested there is no need to always identify the actual serving switch, but simply the terminating network provider. In such instances, a service provider ID (SPID) would permit the call to simply be handed off to the terminating provider's nearest access point (e.g., point of presence).

It should be recognized, however, that addresses that fail to meet all of the previously-listed criteria may introduce added costs and complexities to any solution deployed for number portability. Today, routing is based upon the geographic information contained in NANP numbers - specifically, the first six digits of those numbers (NPA-NXX). Accordingly, the use of an identifier in a format different than that associated with the NANP would create the need to develop routing based upon the new code. It appears appropriate, therefore, that the code retain the NANP format used to identify offices today.

Several variations of a terminating switch/network termination identifier have been proposed thus far and are described in detail in Section 13.

7.1.5 The Service Management System

Within a given area, individual number portability network routing databases will be administered and maintained by a master database or Service Management System (SMS). The SMS is the vehicle in which service providers will create and update records through which numbers will be "ported" from one service provider or location to another. In addition, the SMS, will act as a central clearinghouse for administrative and operations related functions necessary to provide the efficient and consistent management of data required to support number portability in a given area.

The SMS will contain listings of, at minimum, all ported customer numbers. For each listed number the database record will provide the associated network address and possibly, rating information and the service status as well. Records created or modified within the SMS will be simultaneously downloaded to individual network routing databases at regular intervals, thereby providing accurate and consistent information to all these databases, and therefore, to all service providers. Interconnection between the SMS and each service provider's network will either be directly between the SMS and the network routing databases or via a network interface to a specific SMS established by the service provider to administer its own network routing databases. It should be recognized that the SMS provides only a data administration function and is not involved in real time call processing. Database queries launched during call processing are received by network routing databases which respond to network switches. An overview of the SMS architecture is shown in the figure 7.1.5 below.

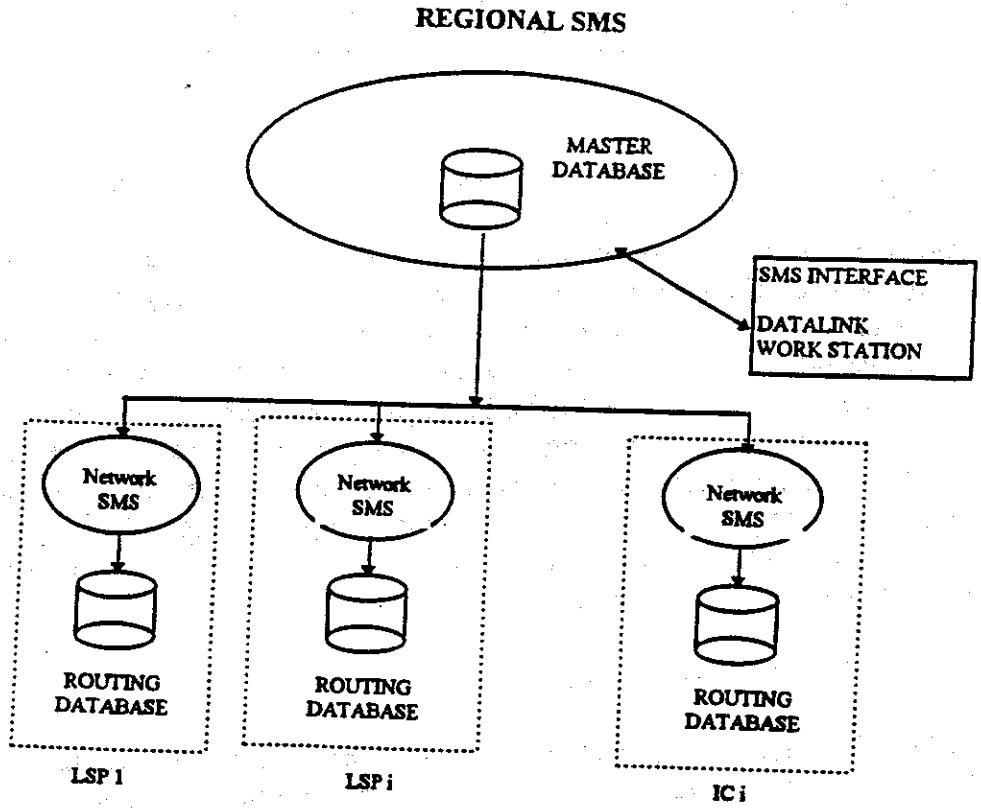

Figure 7.1.5

It is assumed that the data downloaded from the master database/SMS will be in a standard format, allowing the local service providers (LSPs) and/or Interexchange Carriers (ICs) - the SMS users, to maintain the data in that standard format or customize the data format to satisfy its specific needs. Moreover, it is necessary that the interfaces and associated protocols used to effect interconnection of the SMS with network routing databases be standard and consistent to all SMSs, for all carriers. Finally, it is further assumed that the primary arrangement through which service providers will access the SMS to create or modify records will be through a mechanized interface, established through permanent datalink. In addition, it is likely that SMS access will also be available via a dial-up connection, assuming the necessary security concerns can be satisfied.

It may be preferable that there exist several distinct SMSs, each containing and administering records for a given geographic area, rather than a single nationwide implementation. Although a single, national SMS is theoretically conceivable, the volume of records that will ultimately need to be stored suggest a more practical implementation of regional SMSs. Moreover, with the possible exception of wireless roaming, there appears to be no service related need for a single, national SMS as number portability will initially be confined to a more localized area and, therefore, within wireline networks, implementation of number portability does not require an instant, nationwide deployment. Accordingly, an SMS may contain records for a set of specific, geographic areas (e.g., an NPA or set of NPAs).

Finally, and most importantly, it is suggested that the SMS be administered by a neutral, independent entity, without any affiliation with a local service provider.

7.2 Call Processing

With number portability, processing of calls which involve a ported number will include a database query and its associated response. The information obtained from the database response will provide routing information necessary to complete the call, and the data required to accurately rate the call. The necessary database query could, in theory, be launched from any network involved in the call. Consider, for example, an interLATA call which transits an IC's network and includes the use of both originating and terminating switched access. Accordingly, upon recognition that the NPA-NXX of the dialed number is a "portable" code, the database query could be made by the orignating access provider, the IC, or the terminating access provider. To avoid redundant database queries at multiple points during the same call, it may be desireable that the process allow for the provisioning of a "dip indicator" in the call setup signaling message to inform subsequent switching nodes in the call path that the needed database query has already been performed.

7.2.1 A Terminating Network Query

The provision of the database query in the network of the service provider originally assigned the NPA-NXX of the dialed number -- the terminating network -- allows calls to be transported from the originating carrier's network and across the IC's network with normal call routing, and therefore requires no change in the manner in which the originating and intermediate networks handle the call. However, this type processing demands the call be routed to the "wrong" service provider, results in inefficient routing, and potentially causes increased call set-up time. It is acknowledged, however, that for an undetermined amount of time, the ability to launch a query and reroute the call from the donor switch may be necessary to handle situations in which calls are misdirected as a result of a failure or inability of the originating or intermediate carrier to launch the query. In the event that number portability impinges on toll calling areas (e.g., location portability), after the query is performed, the donor switch may be required to determine the presubscribed carrier of the billable party to route the call appropriately.

7.2.2 An Originating Network Query

The provision of the database query in the network of the originating access provider (the carrier that serves the calling party) immediately provides the proper network address or terminating carrier to which the call must be routed, and therefore minimizes call set-up time. This arrangement, however, mandates database queries on many calls in which the originating access provider has no need to make such a query. Specifically, on calls which can be clearly identified as interLATA calls, for example, if a simple examination of calling and called party NPAs is sufficient to make this determination, the originating carrier need only forward the call to the interexchange carrier presubscribed to the calling line. Moreover, if the originating access provider were to make these queries, it would need knowledge of all NPA-NXXs

throughout the country which were "portable" and access to the necessary routing databases where information on 10 digit numbers contained within these NPA-NXXs was stored. Accordingly, these carriers would require copies of all network databases in their networks, or the ability to launch signaling messages to the appropriate database located in another carrier's network. It is recognized, however, that absent some limits on the boundaries for provisioning location portability (e.g., restriction to within a LATA boundary) originating network queries may be required to determine the proper category of the call (e.g., intra vs. interLATA).

7.2.3 A Query From the (N-1) Network

Alternatively, in a connection that consists of "n" (number of) networks, the query to the routing database could be launched from the (n-1) or "next-to-last" network in that call path. For a call which transits an IC's network and, therefore, uses three networks -- an originating access provider, the IC, and a terminating access provider -- the (n-1) carrier is the IC. An intraLATA call which does not use the facilities of an IC can be considered to route the calls through two "networks", that is, the networks of the originating and terminating local service providers. In this case, the (n-1) network would be that associated with the originating network or, in fact, the originating switch. A query from the (n-1) network provides that network with the necessary routing information allowing efficient, direct routing of traffic to the appropriate terminating end office with minimal call set-up time.

7.2.4 Other Alternatives

Some have suggested a modified approach to the Originating and "N-1" query options by employing use of a "look-ahead" signaling capability to first determine whether the dialed number is actually ported before performing the database dip. Using SS7 call setup signaling messages, an attempt is made to first establish a call path to the switch assigned the NPA/NXX of the dialed number, as reflected in the LERG. If a release message is returned from this office (the donor switch), indicating that the dialed number is ported, the reserved call path will be dropped and a query will be launched by the originating or N-1 carrier. Others have suggested that the donor switch actually perform the database query and return both the release message and new routing instructions.

7.2.5 Call Flows - General

Detailed call flows associated with specific architectural proposals are described, along with those architectures, in Section 13. The following brief high level description is intended to provide a broad understanding of the manner in which calls to a ported number will progress through the networks which are involved in the call path.

A network switch, located in either the originating, terminating, or (n-1)st network in the call path will (1) recognize a potential ported number, and (2) launch a query to the appropriate number portability routing database. If the called number is ported, a record in that database will contain the information to properly route the call, and that information will be forwarded

to the network switch in the form of a database response . This information will be used by the network switch to route the call. Additional information within signaling messages may be necessary to provide other network switches in the call path not only the network address required to route the call, but also the original dialed called number and possibly an indication that the database query has been performed. The original dialed number will be used -- depending upon the particular call processing methodology employed -- to properly complete the call in the end office which serves the called party and to effect proper use of calling number based services such as caller ID. A database query indicator will prevent unnecessary, redundant queries.

8.0 Numbering Administration

Number administration typically refers to the assignment and general oversight of both central office codes (code adminstration) and line numbers (line number administration) within those codes. The introduction of number portability demands changes in the manner in which dialable NANP numbers are assigned and administered. In today's non-portable environment, NPA-NXXs, which serve both as customer numbers as well as network addresses, are assigned to local service providers by the local code administrator, typically the dominant LEC, consistent with industry guidelines. Line number assignments within those NXX codes are the responsibility of the assigned service provider. Today, in the United States, the Local Exchange Routing Guide (LERG) provides information on which NPA/NXXs are assigned to which wireline and, in many cases, wireless switches or Points of Interconnection (POI).

8.1 Administration of Portable NPA-NXXs

In a number portable environment, there will exist two types of numbers; dialable, customer numbers, and numbers used exclusively for the routing of calls (i.e., network addresses or switch IDs). Accordingly, the administration of both these types of numbers must be considered, including whether the administrator for these two types of numbers should be the same or different entities. It is generally agreed that with the introduction of number portability, central office code (NPA-NXX) administration should be the responsibility of a neutral, third party, rather than a local service provider. Further, it is understood that line number assignments to end users will continue to be the responsibility of local service providers, but the manner in which those assignments are made will be dependent upon which number administration scenario is chosen.

Two general number administration scenarios can be considered. In the long term, it is possible that customer numbers (NPA-NXXs) will no longer be assigned to specific service providers, but will be assigned by the administrator to a "pool" for use in a given geographic area and accessible for use by all carriers who provide service in that area. Assignment of numbers in this manner offers the benefit of improved utilization of numbers with the potential for reduced demand for additional NXXs and the associated area code relief. This scenario, however, demands that all potentially portable numbers be associated with database records in the SMS, and that all requests for service, whether they involve the porting of an existing number or a request for new service, make use of the SMS for service provisioning (see

Section 9). Moreover, with this scenario, there exists no default carrier to which the call could be routed if database information is unavailable, which may prove problematic if the originating or intermediate carrier network cannot launch a query. Furthermore, with no default carrier, announcements necessary for disconnected or vacant numbers must be provided via the switch that launched the query (based upon information obtained from the routing database) rather than via the terminating switch.

Yet another consideration would involve a hybrid scenario which supports the pooling of numbers but still assigns each NPA/NXX to a given service provider. This arrangement offers the benefit of improved utilization of numbering resources derived from pooling, but provides default routing to accommodate those situations where database information may not be available to an originating or intermediate (N-1) carrier. In addition, a hybrid scenario would allow the continued provisioning of vacant code treatment in the terminating switch. This hybrid scenario would require determination of how to assign NPA/NXXs to service providers.

Alternatively, it is possible that existing NPA-NXXs, as well as new NPA-NXXs will continue to be associated with (assigned to) specific local service providers. Customer requests for new service will, therefore, continue to be accommodated as they are today, with line number assignments made by service providers from the specific NPA-NXXs which they are assigned. Porting of numbers will require communication between the service provider assigned the NPA-NXX and the service provider to which a customer chooses to port their number. This communication will lead to the creation of a customer record in the SMS with the information necessary to properly route the call. In this administrative scenario, only numbers which have been ported need to have records in the SMS. Furthermore, default routing to the carrier "assigned" the NPA-NXX can easily be accommodated and announcements for disconnects and vacant numbers can be provided by the default carrier.

It may be advantageous to consider an evolutionary scenario, in which, initially, NPA-NXXs are assigned to service providers with the transfer of the code to the "pool" only after some percentage of numbers have been ported. In this way, the introduction of portability might be effected with an optimum trade-off between the desire to limit the complexities of implementation and the desire to realize the full benefits of portability as quickly as possible.

Finally, it should be understood that the administration of numbers assigned for routing purposes, (e.g., network addresses or service provider IDs) will be the responsibility of the neutral, third party, and that these assignments will continue to be documented in the LERG. Further discusssion of the role of the LERG in a number portable environment is described in Section 8.2, below.

8.2 Industry Notification

Industry notification will be required when an existing NPA/NXX becomes portable, or when a new NPA/NXX that is immediately deemed portable is first introduced. It is expected that existing industry guidelines and notification methods will be modified to accommodate this need. Further study is required in this area.

The Routing Database System (RDBS) is administered by the Traffic Routing Administration (TRA) of Bellcore. The RDBS processes LEC routing and rate center data to produce both on-line and off-line reports for the administration of routing within the NANP (excluding Canada). Results of processing data obtained from the RDBS include:

- The Local Exchange Routing Guide (LERG)
- The NPA-NXX Activity Guide (NNAG)
- The NPA-NXX V & H Coordinates
- The LIDB Access Routing Guide (LARG)

The Bellcore Rating Input Database System (BRIDS) data forms the input for the Industry Number Plan Guide (INPG) and the Telephone Area Code Directory (TACD).

It is anticipated that the entity responsible for CO code administration will continue to enter and maintain the databases from which these documents are produced.

In a portable number environment, the LERG is expected to indicate which NPA/NXXs are designated as portable. The LERG is further expected to document network addresses and their association with service providers (e.g., switch Ids or Network Node Addresses). The LERG might also provide information indicating the service provider to which the NPA/NXX was initially assigned, the geographic area it serves, and the identity of the regional SMS in which information on numbers within the NPA/NXX reside. The actual impact of number portability on the LERG and other industry routing guides (e.g., Seamless Roaming Implementation Guide (SRIG)) requires further study.

9.0 Service Provisioning

Service provisioning in a portable number environment is closely related to the method employed for number administration. It should be recognized that service provisioning should be examined for two distinct activities, the provisioning of service to new customers (i.e., customers who have no existing service in the area) and the porting of service from one service provider to another.

If NPA/NXXs are assigned directly to a pool by the neutral third party administrator, control of an existing number might pass to the new service provider upon entry of a change record into the SMS and notification to the previous service provider. Activation of new (previously-unassigned) numbers might be performed by the service provider entering a new record in the SMS after first scanning the pool of available numbers and making a selection. Alternatively, service providers may be assigned blocks of telephone numbers from the SMS in order to speed the process.

If NPA/NXXs continue to be assigned to service providers, the provisioning process for existing and new numbers could be similar to that described above, with the exception that there is no need to scan the SMS before assigning a new number.

Regardless of whether number pooling or traditional NXX assignment methodologies are employed, transfer of existing numbers will require close coordination between both the new and previous service providers.

Although the considerations reflected in 9.1 and 9.2 generally apply to both wireline and wireless networks, there may be additional considerations unique to wireless services that need further study. For example, most wireless customers are able to enjoy an FCC-endorsed form of mobility known as roaming. Wireless carriers have established a number of distinct and individual partnerships, also known as roaming agreements, with other wireless carriers. These partners carry each other's customer calls when those customers "roam" in a partner's system. At this time, inherent to the functionality of most roaming arrangements is the presence of a Mobile Identification Number (MIN) in each wireless unit. This MIN, which includes the NPA/NXX of the home system, not only facilitates call processing, including rating and routing, but also identifies the home system of the caller to the visiting system. Number pooling, if applied to wireless carriers, may render such agreements unmanageable since identification of the home system might not be possible.

9.1 Number "Pools" for Geographic Areas

Consider one of the number assignment scenarios described above, where numbers are assigned to geographic areas (rather than specific central offices) and are available to all service providers[2]. With this arrangement, all numbers will be identified as working or spare, and those numbers that are assigned will identify the service provider or the responsible organization (RESPORG). As is the case with the SMS used to support the portability of 800 numbers, records will be accessible for modification only to the RESPORG assigned to that number. Porting of service will proceed in a manner identical to the procedures currently in place for 800 service.

9.1.1 Provisioning of Ported Service

Upon receipt of an order from a customer wishing to transfer service, the selected provider must generate a service order and input information into its network and administrative systems. The new service provider must also contact that customer's current provider and indicate the customer's order for the change. The current provider will them transfer RESPORG responsibility for the number, allowing the new provider to access the record. The new provider can then modify the record as necessary, establishing an effective date at which the record will be downloaded to the appropriate routing database(s).

The exchange of Inter-Service Provider Maintenance, Administration and Provisioning (ISPMAP) information between the current and new service providers will require some form of standard data format for ensuring that such information is transmitted and received properly. To develop this standard format, the use of existing information exchange formats, such as the Customer Account Record Exchange (CARE) format, can be expanded to provide

[2] Note that not all service providers' serving areas conform to the same geographic boundaries.

a wider functionality satisfying the needs of all service providers. The use of a currently standardized data format, such as the expanded CARE format, will facilitate a timely and efficient means of data exchange between service providers and the SMS.

9.1.2 Provisioning of New Service

The provisioning of new service should be straight-forward. Upon receipt of a customer order, the selected service provider will scan the SMS for available numbers and select a number for assignment to the customer. The service provider will then create the necessary record with the appropriate service date.

9.2 Service Provider-Specific Number Assignments

An alternative number assignment scenario is one in which NPA/NXXs continue to be initially assigned to service providers and the SMS contains records only for numbers actually ported.

9.2.1 Provisioning of Ported Service

Porting of service is similar to that described in Section 9.1.1. That is, the selected carrier will inform the customer's current service provider of the customer's order to change, and if the record exists in the SMS, the current provider will transfer RESPORG responsibility. Because, under this method of number assignment/administration, records exist in SMS only for previously ported numbers, it is possible that no record is in place. If this is the case, the current carrier must first create a record for this number, as it is assumed that only the carrier initially assigned the NPA/NXX will be allowed to create this initial record. After the record is created, the current carrier can then transfer RESPORG responsibility to the new service provider.

9.2.2 Provisioning of New Service

New service may be provisioned without the use of the SMS, in the same manner service is provisioned today, prior to the introduction of portability. Specifically, service providers will provide new customers with service only from the NPA/NXXs they have been assigned.

10. Rating and Recording

Today, call rating is based on information associated with end office location as specified by NPA-NXX. This information is listed in the LERG and related documentation, and specifically provides the V&H coordinates of a given switch or (wireless) Point of Interconnection (identified by NPA-NXX) and the associated rate center. Downstream processing uses Automatic Message Accounting (AMA)[3] data recorded during call processing which identifies the calling and called party location, again as specified by NPA-NXX. This AMA data together with the LERG-based information to determine calling and called party rate centers is used to calculate the distance of the call, and ultimately establish

[3] Similar considerations apply to other billing formats such as CIBER and CDR.

the corresponding rate. The introduction of local competition, and subsequently, number portability, impacts both call recording and rating, for both the end user and access charges billing.

As indicated previously, most call rating is currently performed in a downstream process using call detail information from AMA recordings, which identifies the calling and called (dialed) numbers, and the associated location information provided in the LERG. In a number portability environment, the AMA information may not explicitly provide the necessary location information for call rating. Rather, the downstream rating process will need to determine the appropriate location routing numbers or network node addresses associated with call origination and termination. Accordingly, this process could include a query to a database, either one specifically deployed to provide rating information or perhaps the same as that used to route calls. If both calling and called numbers were ported, two queries and the associated responses would be necessary. Alternatively, the network address of the calling party switch may be identified in the SS7 call setup (signaling) message. Once the location routing numbers (NPA-NXX) or network node addresses were obtained, the specific V&H and rate center data could be determined from tables derived from the LERG. On the other hand, it may be more efficient to include the V&H and rate center data in the database record itself, thereby eliminating any subsequent table look-up. It is possible that within the interval between the time of call processing and the time at which the rating process takes place, a customer may have switched carriers causing the database record to be updated accordingly. In this situation, a database query and response during the rating process would provide inaccurate information and an improper rate. This difficulty would be avoided if, at a minimum, the location routing numbers or network node addresses of ported calling and called party are included in the AMA record. Including the V&H and rate center data as well would preclude the need for additional database queries or table look ups during the downstream rating process.

Moreover, if V&H and rate center data are part of the database record, those data could be associated with the customers premises rather than with the customers serving wire center. Association of rating data with the customers premises would resolve any potential rating problems that might otherwise arrise. This association has not been done previously, and may lead to significant development and administrative issues, possibly depending on the number of additional data points involved. Another potential solution is the use of distance insensitive, postalized rates.

10.1 Impact on Billing Information

Billing information systems may be heavily affected by Location Portability and Service Provider Portability. Traditionally, there are extensive edits within the systems to control the validity of numbers. These edits will require modifications to allow numbers which were formerly outside the scope of the entity to be stored in CRIS accounts and Message Processing Systems. These systems will also need modifications to control these non-standard numbers and ensure that they are used properly. The systems will need to be able to identify numbers which were formerly assigned to one entity, but were transferred to another entity.

Treatment processes will need to react to the new scenarios. Accounts (identified by Telephone number) are often retained for extended periods subsequent to disconnect to permit collection of unpaid amounts. When a customer transfers to another service provider and retains her TN, information about the transfer may need to be stored for this purpose.

Sent Collect Messages, i.e., billing detail for calls originated in one service provider's area but billed in another, will also be impacted by number portability. Within the settlements processes, these messages are transmitted (and proccessing charges billed) to the proper billing carrier based upon the NPA/NXX of the charged telephone number. Changes will be required to message processing systems to ensure that the appropriate billing carrier can be identified in a portable number environment.

10.2 Impact on Telephone Call Accounting Systems

It has been suggested that number portability, in particular location portability, will impact existing telephone call accounting systems such as those used by universities, hotels/motels, some payphone providers and other entities. These call accounting systems use their own call rating databases based on the NPA-NXX association with unique V&H coordinates. Suggested solutions include the use of postalized rates, or allowing call accounting systems access to the information stored in the appropriate SMSs.

10.3 The Impact of Regulation

The method used for call rating in a competitive, number portability environment will likely be controlled by regulatory directive. If a state commission[4] accepts the fact that different charges may be incurred on calls made to a given party after that party has changed service provider, the process of call rating could remain the same. That is, call rating could continue to be based upon the V&H and/or rate center of the calling and called party serving offices. In such a case, the end user may experience the problem of unexpected toll charges as detailed in section 11.2.

If, however, a commission considers the prospect of such price variation, and especially the possibility of unexpected toll charges to be unacceptable, it may direct the industry to adopt consistent rate center boundaries or to perform call rating based upon the location of the customers premises, rather than the location of that customer's serving central office. In either situation, whether calls are rated based upon the location of a serving end office, or rated based upon the location of a customers premises, changes in the rating process will be necessary.

Finally, one other solution which would mitigate any added complexity which might otherwise be encountered with call rating, in a number portability environment, would be the use of flat,

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[4] It is important to note that in Docket PR 94-103-109 the FCC preempted the states from regulating CMRS rates and entry conditions. Also, CMRS providers have been granted calling areas that do not conform to wireline calling areas. Both of these factors differentiate CMRS providers from wireline entities and could influence number portability initiatives.

distance insensitive (e.g., postalized) rates. The use of such a rating and charging scheme would again be subject to regulatory approval.

11.0 End User Impacts

Solutions developed for number portability should, to the extent possible, be transparent to both called and calling customers in respect to call setup delay, use of existing features, toll charges, transmission and service quality and blocking. Concerns have been expressed regarding the ability of any solution identified thusfar to fully meet this objective. The following section details a number of these concerns.

11.1 Impact upon Portability Subscriber

The focus of the Workshop thus far has been on terminating calls to a ported number customer. It is generally acknowledged, however, that calls originated by a ported number customer should allow both the calling and called customer full use of their subscribed features. In addition, number portability must allow customers use of their (ported) number for both receiving and placing calls. Solutions that utilize a different (calling) number associated with the placement of outgoing calls may prove problematic because of their potential to cause customer confusion for both called and calling customers. For example, called customers with Caller ID terminals may see a different number displayed from that which was expected from the calling party. A similar situation may be encountered if the ported number customer dials the Operator, business office, customer care center or a 911 service provider. The calling or called customer may also see that his calls are billed to, or received from a number that is different from the number that was expected.

Existing and planned services that provide unique routing based upon the calling number assume that the originating location can be determined by screening the NPA/NXX of that number. For example, some national retail chains may advertise a single 800 number for callers to dial from any area of the country. Callers are routed to the closest outlet, based upon the NPA/NXX of the originating number. In addition, wireless carriers are able to determine which numbers are home versus roamer in any particular system via NPA/NXX or a similar form of screening. Misdirected calls may result if the network cannot screen all 10-digits to determine the originating location. Access to the LNP database may need to be provisioned for such services, and the database may need to contain some indicator of the serving location.

Another concern is that with number portability, ported number callers attempting to transmit or receive packet or circuit-switched data over ISDN lines may be unable to do so, due to the lack of portability between data networks.

11.2 Impact upon Party Calling Ported Number Customer

For individuals calling a ported number customer, the dialed number may no longer be sufficient in identifying the physical location of the called party. There is also some concern that certain calling features, e.g., CLASS features, such as Repeat Dialing and Automatic

Callback Calling[5] may be compromised. These features rely on signaling messages passed between the originating and terminating switches to monitor the status of the called line. A problem may arise because the type of signaling messages employed today cannot access a database to determine if the serving switch is different from that assigned the NPA/NXX of the called number. Without this determination, these features may not function properly. Expanded translations within the STPs could be employed to solve this problem, but are viewed by many as overly burdensome and otherwise limiting.

Another concern is that the calling party may incur charges not expected when placing calls to a ported number. For example, under a location portability environment, an end user may be allowed to retain his number when moving to a distant city. Callers served by the same NXX may be unaware of the move, assume that the call they are making is still local in nature, and be surprised when they receive a toll bill. A similar situation may occur if there is no consistency in rates between competing providers serving the same area, e.g., calls to ported numbers served by one carrier may be billed differently than calls to other numbers within the same NXX, or if the serving switch and its network address (NPA/NXX) is outside the rate center of the calling/called customer. In addition, numbers within NPA/NXXs used to uniquely identify a type of service (e.g., Calling Party Pays), if ported, may result in improper or unexpected charges to the calling or called customer, if the new service provider does not conform to the service in question.

Some have suggested the need for a special announcement or "toll warning tone" to precede the establishment of ported number calls to advise callers that a toll charge may apply. Such tones or announcements may quickly become obtrusive on subsequent calls to the same number, however, and be considered as discriminatory if only applied on calls to ported numbers.

11.3 Post Dial Delay

Since, in a number portability environment the dialed number will no longer identify the actual terminating location of the called party, the network will need to employ some other means (e.g., number retranslation or external database access) to identify and terminate the call to the proper destination. Such mechanisms will add some delay to the actual time required to connect the called and calling parties. The amount of additional post dial delay will vary depending on the actual methodology, implementation and architecture used to provide the capability. The potential for noticeable (additional) delays by the calling party must be closely scrutinized for any solution under consideration.

12.0 Technical Considerations

Besides the potential impacts of number portability on end users, there are a number of concerns regarding its impact on service providers' networks and support systems.

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[5] Repeat Dialing allows the user to activate a feature which repeatedly checks the status of a busy line and notifies the caller if the line becomes idle within a given period of time. Automatic Callback Calling allows the user to return the last call received.

12.1. Impact on SS7 Signaling

It has been suggested that number portability could have a significant impact on service providers' SS7 signaling networks. Several INC contributions have suggested that although the existing links between the end offices and the STPs may be sufficient to handle the additional traffic generated by number portability, the number of new links provisioned between the STPs and routing databases could be substantial, as described in section 12.5.

In addition to the number of SS7 messages required, some alternatives for number portability suggest new uses of existing parameters such as the Generic Address Parameter (GAP). The suggested uses of these new parameters may increase the length of SS7 messages used for NP. Some of these issues are presently under consideration by Committee T1.

12.2 Interworking/MF Signaling.

Some alternatives proposed for number portability require that SS7 signaling links be employed end to end in the call path. This may not accommodate current network configurations which involve a mix of both SS7 and inband signaling trunks. Accordingly, SS7/MF interworking impacts must be considered.

12.3 Impact on Switches/Service Switching Points

It has been an assumption of this workshop that switches cannot perform translations past the NXX for more than a minority of calls. The call processing and administrative burdens are considered too great for switches to perform 10-digit translations on all calls.

To accommodate number portability on a wide scale, switches and access tandems equipped with SSP functionality must be programmed to recognize portable NXXs and launch queries to the appropriate network databases. If a switch lacks SSP functionality, the switch must hand the call off to another switch (or Access Tandem) that has SSP functionality. The switch or Access Tandem with SSP functionality must be able to act upon the instructions from the routing database. These routing instructions may require the switch/SSP to interpret SS7 messages or fields in these messages in a manner different from what is done currently, thus dictating the possible need for hardware and/or software modifications. Standards efforts may be required for these proposed modifications as well. Furthermore, it has been suggested that some alternatives for number portability identified thus far require new or significantly-modified routing tables within the switch.

The use of external databases to support number portability may dictate the need for the development of new AIN or IN triggers to launch queries from various switching nodes within the call path. Some of the triggers currently available may be unsuitable for number portability because they were developed for a specific purpose, have already been assigned for other service applications, or if used for number portability, may negatively impact some existing services. Proper sequencing of events associated with any new trigger(s) also

becomes critical to ensure that certain attributes of the call (e.g., carrier preselection) are maintained.

The proper sequencing of translation changes in the donor and recipient switches, in coordination with updates to the routing databases, will also be essential to prevent misroutes and "looping" conditions, whereby the recipient switch does not recognize the dialed number as resident within and attempts to reroute the call back to the donor switch.

12.4 Signal Transfer Points

Service provider portability will cause increased SS7 traffic due primarily to increases in the number of non call-associated (TCAP) messages and due secondarily to increases in the length of SS7 messages. This may increase the number of links required at the STP. Specifically, the number of links to the routing database(s) will depend upon the penetration of number portability, the method used to provide it within a given area, and the use of services associated with ported numbers that require non call-associated messages.

At the STP, Global Title Translations (GTTs) examine the called and/or calling number to determine the proper signaling end point to which the message should be routed. The identity of the signaling end point is generally associated with a Destination Point Code (DPC). Currently, most GTTs are 3 or 6 digits - that is, routing is determined by examining only the NPA or NPA/NXX. In the event the STP is required to perform this function to support number portability, the size and administration of GTT tables becomes a concern. Furthermore, GTTs are processing-intensive, and some STPs have upper limits on their processing capacity.

Specific areas of concern with respect to GTTs include:

- GTT Changes for Existing Services

  As described elsewhere in this document (Sections 12.7.3 & 12.8.3), some existing services that currently use 6-digit GTTs would require 10-digit GTTs for ported NPA/NXXs. 10-digit GTTs would be necessary to route the TCAP message to the proper SSP or SCP. Two such examples are services such as Automatic Callback/Repeat Dialing and Calling Card Validation.

- Routing Portability Queries to the Routing Databases

  For a given network, as long as all portability queries for all called numbers within a given NPA/NXX are routed to the same SCP(s), 6-digit GTTs are sufficient. If number portability expands beyond a limited geographical area, however (e.g., state or nationwide portability), 10-digit GTTs may be required to determine which SCP(s) contains the necessary routing information for a particular number. In addition, some have suggested that a new SS7 Translation Type may be required to route the query to the SCP(s) dedicated to number portability.

Several potential solutions to the 10-digit GTT concern have been proposed, but may involve various economic and administrative tradeoffs. They include upgrades to existing STPs (e.g., larger GTT tables), STP adjuncts to perform the GTTs, or use of other signaling components (e.g., SCPs) to perform this function. The impacts of each on current signaling functionality must be fully assessed.

12.5 Routing Databases

As mentioned in section 7.1.2 the routing databases will contain information allowing for the routing and rating of calls to portable numbers. The queries must be received and responses formulated and transmitted so as not to significantly increase call set-up time. The database responses must be able to be interpreted by the SSPs setting up the call. Databases may be deployed in mated pairs, should be sized to accommodate the anticipated transaction requirements, and should be designed for appropriate levels of reliability.

An INC presentation has suggested that if portability were widely deployed, a LEC's network may only be able to handle data base queries generated locally, not those launched from other areas. The significance of this discovery is that calls to ported numbers that originate from outside of the specific area in which portability is deployed may have to access data bases other than those handling traffic originating within the area. This implies that unlike the LIDB (Line Interface Data Base, used for calling card service) model, multiple sets of redundant data bases may need to be deployed to accommodate number portability signaling traffic.

12.6 Impact on Operations Systems

The structure of the existing embedded base of legacy systems used by most regional telephone companies was designed around the idea that a telephone number has a specific, non-mobile, geographic relationship that exists from the time the number is placed into service until that number is removed from service. Provisions were made for movement of the telephone number from one location to another, but with restrictions within certain geographic areas (i.e., within the area served by the wire center).

Current operations systems use either a seven or ten digit identification of the telephone number. Those systems that use only a seven digit number identification cannot support a number portability scheme and would require modification to their database structure to permit the identification of lines with a ten digit identifying telephone number. In the cases where the operations systems support a ten digit number the impacts become administrative.

Most operations systems are deployed with specific administrative boundaries and areas of responsibility. The introduction of number portability will tend to conflict with the administrative boundary scheme used with the operations systems. Many operations systems use geographic specific databases, an example being the Service Order Administrative and Control System (SOAC).

The NPA-NXX code is used internally by service providers for customer contact, provisioning, maintenance, installation, and planning functions. The operations systems that support these functions are highly automated and may require significant modification or replacement as number portability is introduced. For example, wireline provisioning systems generally include a "flow-through" capability which automatically assigns the outside plant facilities, telephone number, and central office equipment to a new service order. They also provide mechanized updates to repair bureau and directory listing databases. NXX sharing or the association of more than one number with an individual customer will compromise this process.

12.7 Impact on Switch Features

Of special concern to service providers is the impact of number portability on existing features and services, especially those that rely on the transmittal of the proper calling number or the association of a (called or calling number) NPA/NXX with a specific serving switch. A partial listing of potentially-affected features follows.

12.7.1 Call Forwarding

Some solutions employ the use of certain call forwarding triggers and/or signaling parameters to launch database queries and transmit routing information to other switches in the call path. It is essential that, when invoked, the call forwarding feature continues to function properly and that both the original called and calling numbers are received and properly interpreted by the terminating switch.

12.7.2 Caller ID/ Calling Number Delivery Blocking

When a call is placed by a calling party who has a portable number, the called party expects to receive a recognizable, dialable number of the caller on the display unit. Similarly, customers that build call blocking or screening lists will populate them with dialable numbers of parties they wish to deny or allow. Solutions that transmit special routing or non-dialable numbers in the calling number field of the signaling message may disable or otherwise compromise such services.

12.7.3 Automatic Callback/Automatic Recall

Use of currently available originating triggers for AIN Release 0.1 (e.g., PODP) for number portability will result in the denial of these two features. This may dictate the need for a unique, AIN trigger or an upgrade to a newer AIN release. Furthermore, these features may require the use of 10-digit GTTs in order to function properly.

12.7.4 Network Voice Messaging

Some voice messaging services employ the use of TCAP messaging to provide a message waiting indicator to the called line after treatment of the incoming call is rendered at a

centralized location. As indicated in section 12.4, current TCAP messages rely on the association of the NPA/NXX with a particular switch for identifying the proper destination.

12.8 Impact on Operator Services

The Operator Services (OS) networks deployed by most OS providers use inband, multifrequency (MF) signaling. These OS systems rely on NPA/NXX screening for most functions, including call routing and rating. Although data base queries are performed for certain billing validation purposes, (e.g., credit card, collect, and third number billed calls), there is currently no provision for performing a separate data base query to a Number Portability Data Base (NPDB) to determine the actual terminating location. The following represents several concerns identified thusfar regarding the potential impact of number portability on certain operator functions.

12.8.1 Busy Line Verification

One concern is the impact of number portability on the provisioning of busy line verification/barge-in services. To verify a busy line on an intraLATA call, today the operator keys in the number to be monitored. The operator switch (e.g., TOPS, OSPS) seizes a no-test trunk to the terminating office based upon the keyed NPA/NXX. If the monitored line is within the LATA but served by another Operator Services provider, the operator can establish a connection directly to that provider if Inward Operator trunks have been provisioned between both. Similarly, for interLATA busy line verification traffic, the operator may be able to transfer the request to the operator of the customer's choice if Operator Transfer trunks exist. There is currently no means for temporarily suspending the action to perform a data base query to determine if the desired number is now served from a different end office,carrier or LATA.

12.8.2 Emergency Calls

Another issue involves emergency situations whereby an end user dials the operator (0-), reports an emergency, and either hangs up or is unable to provide location information. One issue is what information the Operator is given for the end users number.

If location portability is allowed, the operator may not be able to determine which police or fire department to contact by examining the Calling Party Number. Although such situations are encountered today where an NPA/NXX is served by multiple fire/police districts, the problem could be exacerbated by the introduction of location portability.

12.8.3 0+, 0- Calls Made by the Ported Number User

When placing a 0+ or 0- call using a calling card, the Operator switch will attempt to validate the calling card number by launching a query to the LIDB that serves the billing number group (e.g., NPA/NXX) of the calling card number. The call will be denied if the new service provider does not have that calling card number loaded in the same LIDB as that used by the previous service provider. A 10-digit Global Title Translation (GTT) may be performed at the

STP, which is used to properly route the query to another LIDB, but the number of GTT slots available in a STP are limited, and performing the necessary translations changes for all ported numbers could become extremely burdensome.

12.8.4 0+, 0- Calls Made to Ported Numbers

In the direct-dialed (1+) environment, the originating end office will perform the database dip on an intraLATA call to determine the actual terminating service provider and/or location. For 0+ calls, however, this method cannot be employed today, because the Operator switch trunks employ MF signaling, which precludes the ability to forward information on the actual terminating service provider from the originating end office to the Operator switch.

Today, the Operator switch does perform a database dip to LIDB to validate the calling card number or special billing arrangement (e.g., collect, 3rd number billing). In order to identify the proper terminating provider/location for subsequently routing the call to its final destination, a second database dip would need to be performed to the NPDB. If SS7 trunking is available, that information can be forwarded either direct to the terminating provider or via an access tandem. For Operator switches, however, this may create a problem because they may only be equipped with MF trunking.

Additional software would need to be provisioned at the OPERATOR switch to perform the second database dip and undesirable call set-up delays may be encountered. If the calling party is dialing his/her own number, it may be possible to include terminating service provider information in the LIDB response (similar to Billed Party Preference information) but this would also require additional software and would only address the "calling home" scenario. Another alternative may be to implement OSS7 in all OPERATOR switches so that SS7 signaling can be employed for all OPERATOR trunking, thereby allowing the database dip to take place at the originating end office. This will be essential if location portability across LATA and NPA boundaries is allowed, in order to initially determine which operator should handle the call.

12.8.5 Directory Assistance

End users may have choices on which and how many white pages directories carry their listings. The impacts of number portability on Directory Assistance do not appear to be distinct from those impacts caused by local competition.

12.8.6 Impacts on Directory Assistance/Call Completion

A concern exists as to how to complete a call to a portable number, from a DA position, since a database query is necessary to determine correct routing information.

12.8.7 Impact on Public Telephones/Customer-Owned Coin-Operated Telephones (COCOTS)

For local, coin sent-paid calls, the totalizer within the paystation itself (for most LEC-provided phones) notifies the originating end office when sufficient money has been deposited to allow the call to be completed. For the more distant coin zone or intraLATA toll calls, the call is forwarded to the Operator switch for rating and routing. In both situation, the determination of whether local (end office) or Operator switch treatment is required is based upon an examination of the dialed prefix (i.e., NPA/NXX). If the call appears to be local but is actually toll in nature, or vice-versa, due to location portability, the call will be incorrectly handled. Even if the call is correctly identified as coin zone or toll, the Operator switch equipment may incorrectly determine the amount of money to deposit because its rating tables are based upon the NPA/NXX of the called and calling numbers. One remedy may be to initially route all coin traffic to the Operator switch where, under a scenario previously described, a NP database dip could be performed to determine proper rating and treatment, based upon the response received. Again, this assumes that the Operator switch has the capability to access the NP database. This may also require massive additions to the Operator trunk groups, because the majority of coin calls in many metropolitan areas are local and today only one coin call in ten needs to be forwarded to Operator.

Other types of paystations in use by independent pay phone providers and some LECs utilize programmed intelligence within the instrument itself to properly rate and route the call. These "smart phones" rely solely on the dialed NPA/NXX to determine appropriate charges for each call. Direct access to a database to determine the actual destination may not be feasible. This situation requires further analysis and identification of a solution to accommodate location portability beyond a rate center boundary.

12.9 Impacts on 911/E911

There will be some administrative issues in ensuring that all local service providers have all end users' telephone numbers entered into the appropriate E911 database, and that changes in service providers do not adversely impact E911 for end users. It is essential that the calling number transmitted to the Public Safety Answering Point (PSAP) is a dialable number (rather than a network routing number) to allow PSAP operators to return the call of the calling party under certain circumstances. In addition, to help ensure that calls can be transferred from one PSAP to another during periods of network congestion or disruption, PSAP numbers should probably not be ported.

Procedures will need to be developed that involve all local service providers and the E911 provider. E911 has an audit procedure in which DNs are checked to ensure that calls from those DNs are routed to the correct PSAP. If an NXX is made service provider portable, and the end user location does not change, then the PSAP should remain the same, but the new service provider's switch must be able to route calls to the aforementioned PSAP. Business arrangements may be possible wherein an alternative (new) local service provider could elect to obtain E911 service through an existing local service provider, rather than providing his/her

own routing hub and E911 database. Such arrangements will result from the introduction of local exchange competition in general and are not unique to number portability.

E911 could accommodate location portability, with appropriate administrative procedures, provided the customer location is fixed. The interaction of E911 with mobile (e.g., wireless) services is not covered in this document. With location portability, the end user changes physical location (e.g., business address) but retains the previously assigned telephone number. In the E911 Automatic Line Identification (ALI) database, the telephone number is associated with an end user's street address, with an indication of serving switch address, in case ANI is not available. In the ALI database an end user's street address can be changed with the telephone number remaining the same. However, since the end user changed physical address, their PSAP may change, causing confusion with the audit process. New procedures must be developed so that entities offering location portability can ensure that ALI databases are updated appropriately and that E911 audit processes can accommodate location portability.

12.10 Impacts on (Advanced) Intelligent Network Features

A call to an 800/888 number or a 500 number that is translated to a portable number may result in one 800/888 number database query or 500 number database query followed by an NP query. The two queries may be performed in the same or different networks. The particular procedure used may impact overall call setup time. This area is for further study.

12.11 Impact On Wireless Networks And Services

12.11.1 Impacts On Wireless Mobile Station Registration and Call Delivery

The introduction of number portability may cause modifications to the current procedures of registration and call delivery when a wireless customer and a ported number is involved in either of these procedures.

For example, in the case of IS-41 based registration procedures, the service provider associated with a specific Mobile Identification Number (MIN) or its equivalent would have to be determined via an additional or modified set of procedures in order to establish a dialogue between the serving and home systems. This would likely include identification of the MIN as belonging to a portable number block and performance of a 10-digit Global Title Translation (GTT) on the MIN.

In the case of call delivery (set up of the call from the home system to the system serving the roaming subscriber) additional procedures may be required in order to minimize the number of subsequent database dips involving routing a call from the home Mobile Switching Center (MSC) to the serving MSC. For example, call delivery procedures may have to be modified in order to include the pertinent parameters or fields in the ISUP Initial Address Message (IAM) in order to indicate that the Temporary Local Directory Number (TLDN) is the true destination address and no further database dips are required in order to determine the terminating service provider or terminating SSP.

At this point, the impact of number portability on registration and call delivery procedures in the case where a given wireless system serves two or more geographic regions which may have deployed different number portability solutions is unclear. It is possible that the serving MSC may have to accommodate all of the number portability solutions which have been deployed in the operating regions served by the home wireless system with which the serving MSC has a roaming agreement.

12.11.2 Impacts On Wireless Switches For Call Origination

Several proposed number portability architectures require an IN or AIN trigger capability. The wireless industry does not generally have an equivalent IN/AIN trigger capability of the landline networks. For IS-41, standards are actively being developed for the Wireless Intelligent Network (WIN) architecture and call models. It is presently unclear as to exactly when the WIN trigger capabilities will be available and deployed within the wireless industry. Until such time as this trigger is available, the use of a default routing option (see Section 7.2.1) may be necessary.

The impact on call origination in wireless switches serving multiple geographic regions with different number portability solutions is unclear at this point in time and requires further analysis.

It is anticipated that the wireless system will have to accommodate all of the number portability solutions which have been deployed within the geographic regions served by a given wireless system.

12.11.3 Impact On Wireless Anti-Fraud Mechanisms

Wireless carriers employ several anti-fraud techniques. The impact of a service provider environment on wireless anti-fraud mechanisms is unclear at this time and requires further study.

12.11.4 Impact On Wireless Call Detail Recording Mechanisms

Wireless call detail recording procedures required to accommodate the terminal mobility environment are relatively complex. Specifically, in addition to recording "air time" and "interconnect time," call detail recording is also invoked in order to provide for a complete audit of the facilities utilized in a given call. This includes details to identify the trunk facility used for the inter-switch handoff and cell site facilities utilized for cell site to cell site or sector to sector handoffs. The impact of a service provider portability environment on this wireless call detail recording is unclear and requires further analysis.

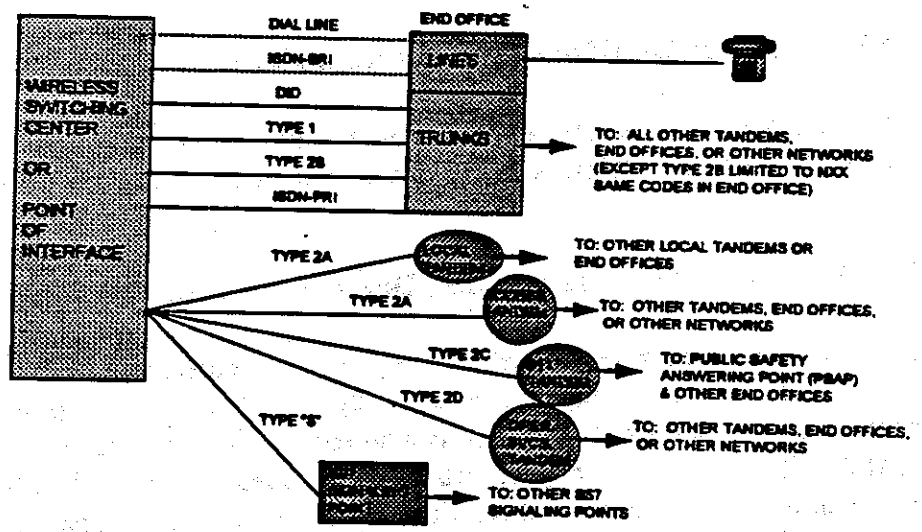
12.11.5 Impact On Wireless/Wireline Interconnection Arrangements

As a fundamental principle, existing technical interconnection arrangements for non-participants should not be affected by the implementation of number portability. These interconnection arrangements for carriers have evolved over several decades from various regulatory decisions and industry negotiations.

Bellcore's Technical Reference TR-NPL-000-145 (TR-145) describes the most common types of interconnection arrangements.

It is possible that the implementation of number portability could adversely affect the existing interconnection arrangements between wireless carriers and the LECs even if the wireless carriers are not required to provide number portability. For example, if a wireless carrier chooses to employ a large degree of direct trunking (Type 2B) connections (See Figure 12.11.1) and the LEC implements number portability, but only equips their tandem offices to perform the query function, the wireless carrier may be forced to change their fundamental network architecture. The result would nullify an existing arrangement that had previously been negotiated by the parties involved.

Figure 12.11.1: Wireless/Wireline Interconnection Overview



13. 0 Architectural Alternatives

Several proposals have been offered thusfar as a means of achieving number portability. Many of these proposals differ not so much in the network components utilized to provide the capability, but rather in the call processing methodologies employed to ensure that the call is delivered to the proper terminating location. This section provides a detailed description of each of these proposals.

The documentation contained within is that furnished by various advocates of each alternative. As such, any and all claims as to the ability of a given alternative to fully accommodate or comply with the issues/concerns identified in Sections 8 through 12 are offered only from the perspective of the proponent and do not represent consensus by INC.

The proposals detailed within this section are as follows:

13.1 LRN Proposal
13.2 LANP Proposal
13.3 CPC Proposal
13.4 RTP Proposal
13.5 Non-Geographic Number Proposal

13.1 THE LRN PROPOSAL

Section 13.1, following, describes AT&T's proposal for the provision of the network capability necessary to support local number portability (LNP). The proposal is presented in nine subsections. Included are (1), a General Description, highlighting the key characteristics; (2) an Architecture Description, explaining the necessary network infrastructure; (3) the Method of Operation, describing call flows and associated call processing; (4) the Network Impacts, identifying necessary network changes; (5) Service Impacts, describing the accommodation of existing services; (6) End User Impacts, illustrating the transparency to the end user; (7) Number Administration considerations, addressing potential administration scenarios; (8) Call Rating issues, suggesting treatment of rating matters; and (9) Timing and Availability projections, estimating the general availability of the proposal.

13.1.1 GENERAL DESCRIPTION

AT&T's proposal for the permanent implementation of local number portability assigns a unique number to each end office switch to which a call could be routed. This unique number serves as a network address and is labeled a Location Routing Number or LRN. An LRN is associated with each ported number in network routing databases, and identifies the end office switch which serves the called party. The LRN is obtained by network switches during call processing through database queries and the associated response.

The LRN is in the form of a 10 digit North American Numbering Plan (NANP) number and can therefore be used by all network switches without the need to change existing routing algorithms. Although network routing is typically and properly performed with the analysis of only six digits (NPA-NXX), the LRN is built out to 10 digits to eliminate any impact on network switches present in the call path which would be expecting a 10 digit number in signaling messages used for call set-up. Because the LRN uniquely identifies the end office from which the called party is served, and to which the call must be terminated, efficient routing -- via either direct or tandem connections -- can be easily provided.

13.1.1.2 A Single Number Solution

The LRN proposal is a "single number solution". That is, the customer is identified in the serving switch by a single number -- the number that is dialed by the calling party to reach that subscriber -- and there is no need to provide a unique, customer specific network address to effect call routing. Rather, all ported customer numbers served by a given switch can be associated with a single network address (the LRN) that identifies that switch. To effect call completion, the original dialed number is carried along in signaling messages and is used by the called party's serving switch to route the call to the appropriate subscriber loop.
The single number solution inherently makes available the customer number for proper presentation of caller ID and can be used by switches, along with the necessary processing, to support other (CLASS type) signaling services. In addition, the one number approach

simplifies the billing process, providing both calling and called party numbers for call detail recording and, therefore, allowing bills to be easily rendered using customer numbers to identify both the calling and called parties. Furthermore, the single number solution easily allows the porting of blocks of numbers served by PBXs, a capability not easily realized if each customer is assigned two numbers, an individual network address as well as a customer number.

It is recognized that this type (single number) implementation of number portability demands that end office switches recognize and complete calls associated with the large number of central office codes (NXXs) that might be included in a number portable area, and must, therefore, "open" a potentially large number of codes on the switch. Many switches can already accommodate several hundred (NXX) codes and AT&T believes that the alternative dual number solution, which assigns a unique network address to each customer, is wasteful of numbering resources, creates the need to extensively modify many operations support systems, and could create confusion in all processes which involve interaction between the customer and network functions (e.g., customer trouble reporting).

13.1.1.3 Use of Numbering Resources

The LRN proposal is especially effective in conserving numbering resources. It requires only one (10 digit) number to identify each switch and that number can be associated with all customer numbers served by that switch. The additional numbers that would be required if network addresses were associated with each customer (the dual number solution) are not needed. Moreover, this proposal does not use numbering resources which are primarily designed for other purposes (e.g., area codes or NPAs) or require additional network intelligence that might be required to distinguish the use of such a common numbering resource as a routing code for the support of number portability.

13.1.1.4 Types of Number Portability Supported

The LRN proposal can effectively support location portability and service portability as well as service provider portability, as any dialed number can theoretically be mapped to any LRN and routed accordingly. Although implementation of widespread location portability adds to the complexity of call rating and originating call processing, the LRN solution does not preclude its introduction and deployment.

13.1.2 ARCHITECTURE DESCRIPTION

This section describes the network infrastructure necessary to support the LRN proposal. In addition, the format of the location routing number itself, and the manner it will be assigned for a given switch is explained.

13.1.2.1 Functional Diagram

Figure 13.1 -1 represents a typical network configuration in a number portability environment where the LRN architecture is used. Consistent with the general architecture described in Section 7, the LRN proposal involves network switches, network routing databases, both centralized and carrier specific SMSs, and the signaling network which supports these elements. Three distinct networks are represented, two local service provider networks (LSP i and LSP j) and an Interexchange carrier network (IC n).

LRN ARCHITECTURE

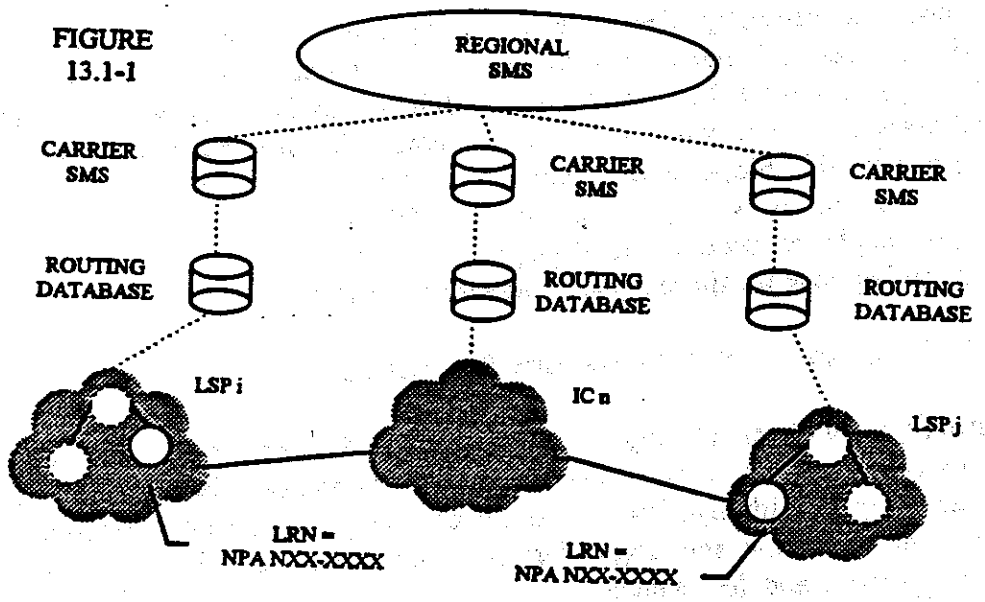


FIGURE 13.1-1

Network switches are shown (as circles) within each LSP network. Although an LRN would necessarily be assigned to every network switch which serves customer lines, the diagram -- for simplicity -- identifies the LRN and illustrates its format for a single switch in each network. Further, although not essential to the LRN architecture, it is assumed that the SMS will be regional and that the network routing databases will likely be located within each major carrier's network. Alternatively, carriers may choose not to deploy routing databases in their

own networks, but obtain access to network routing databases through business arrangements with other carriers or third party vendors. Finally, the use of carrier specific SMSs should provide a given network provider greater flexibility and control over data which is downloaded into that carrier's routing databases. Such carrier specific SMSs are not required however, as routing information could be downloaded directly from the regional SMS to network routing databases.

Key to the functionality required in a number portable environment is the use of the LRN, which provides a unique identification for each network switch terminating subscriber lines. For existing switches the LRN will be selected from within one of the existing NXXs currently assigned to that switch. For example, if a large central office switch currently employed several NXXs, one of those codes would be selected as the NPA-NXX for use as part of the LRN. A given line number would be assigned within that NPA-NXX as the LRN itself. Although it would be convenient if the same line number could be assigned in every end office to identify the LRN (e.g., "0000"), it is recognized that this is unlikely, as their exist no line numbers that have been set aside for non-customer use in every end office.

The single 10 digit number assigned as the LRN will not typically be used for customer service. This number, however, is the only number within the NXX code which is not readily available for customer assignment.* In addition, the NPA-NXX selected for use for the LRN in a given office cannot be an NPA-NXX associated with (i.e., assigned to) any other office. Accordingly, a new central office must receive, as the NPA-NXX from which the LRN will be assigned, an NPA-NXX which is unique. This assignment rule is consistent with the manner that central office codes are assigned today and eliminates the possibility that routing would have to be performed in two "domains", one for the routing of LRNs and another for routing of NPA-NXXs assigned to offices where portability was not yet implemented.

13.1.3 METHOD OF OPERATION

The method of operation associated with the LRN proposal is best understood by examining typical call flows. Basic to an understanding of these call flows is an appreciation of the modifications in signaling necessary to effect call completion in a number portable environment.

13.1.3.1 Signaling Assumptions

As previously described, the LRN proposal will use a 10 digit network address (the LRN) to properly route the call, and will carry, in signaling, the original dialed number. It is specifically proposed that within the SS7 call set-up message, the LRN be contained in the called party number (CdPN) parameter and the original dialed number be placed in the generic address

* Although not recommended, it is technically possible to assign the LRN as a customer number and to properly distinguish this number, either as the LRN or a customer number, for appropriate and proper call completion.

parameter (GAP).* It is further proposed that an indication that the database query has been performed be included in the signaling message and that this indicator be provided within the existing forward call indicator (FCI) parameter. The indication that the query to the number portability routing database has already been performed will eliminate the possibility that switches in the call path will launch redundant, unnecessary queries.

13.1.3.2 Terminating Switch Processing

The use of a single number solution as part of the LRN architecture requires terminating switch processing for call completion. Specifically, the terminating switch, upon receipt of the signaling message and recognition that a database query has been performed must examine the contents of the CdPN parameter to verify that the LRN indicates the call is to terminate in this switch, and retrieve the contents of the GAP (the dialed number) to identify the specific customer served by the switch to which the call must be routed.

13.1.3.3 Query Point

The LRN proposal supports the previously described policy (Section 7.2) that the database query be launched from the "next-to-last" or (n-1)st network in the call path.** Accordingly, for local calls the query is made by the originating LSP; for interLATA calls by the interexchange carrier; and for intraLATA toll calls by the carrier selected to handle the call. Moreover, the LRN solution can be used with default routing. That is, in those situations where the originating LSP cannot provide the database query on a local call, or where an interLATA call is handled by an IC who cannot support the query function, the call will be forwarded to the terminating LSP originally assigned the NPA-NXX of the dialed number. That carrier would perform the query, retrieve the LRN and appropriately route the call to the specific switch in the network of the LSP which now serves the called party.

13.1.3.3 Call Flows

Consider the network configuration shown in Figure 13.1-2. The Figure describes a local network and indicates the manner in which a call to a ported number would flow. The end offices (EO) of two different local service providers (LSPs), LSP1 and LSP2 are shown. LSP1 is assigned two NXXs, (708) 887 and (708) 386, while LSP2 is assigned (708) 267 and (708) 540. Moreover, the LRNs of each of these switches is identified (within the ovals) as (708) 887-0000 and (708) 267-0000 respectively. It is further assumed that the customer, previously served by LSP1 with the line number (708) 887-1234 from the LSP1 EO has ported his/her number to LSP2 and is now, therefore, served from the LSP2 EO.

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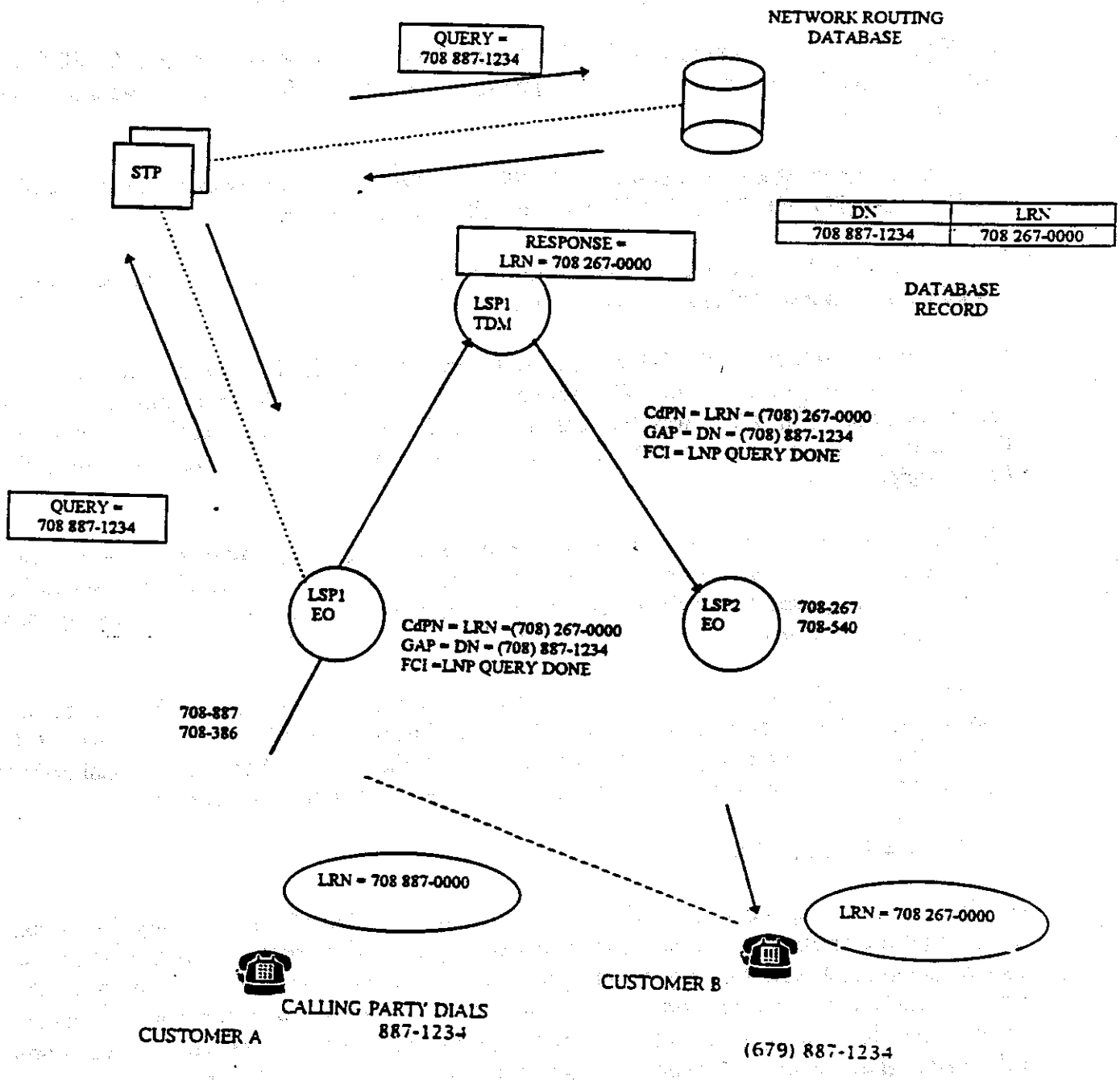
* A specific type GAP entry is required for LNP as multiple types of GAPs are allowed by standards.

** The LRN architecture will, however, support the launching of queries from the originating or terminating networks, as well as the (n-1) network.

FIGURE 13.1-2

THE LRN SOLUTION - LOCAL CALL FLOW



LSP = LOCAL SERVICE PROVIDER
LRN = LOCATION ROUTING NUMBER
CdPN = CALLED NUMBER PARAMETER
GAP = GENERIC ADDRESS PARAMETER
FCI = FORWARD CALL INDICATOR
DN = DIALED NUMBER
EO = END OFFICE
TDM = TANDEM

i. Calling party A, served from LSP1 EO dials 887-1234, a 7 digit local call.

ii. LSP1 receives and analyzes the dialed digits and determines that the call is local and, therefore, is not to be handed off to the presubscribed carrier.

iii. The LSP1 EO determines that customer B, the called party, (887-1234) is not served from the LSP1 EO switch and, therefore, that this is not an intraswitch call. If the line number were resident in the switch, the call would be completed in the normal manner.

iv. The LSP1 EO determines that the dialed number is within a portable code (708-887) and launches a query to the network routing database based upon the dialed number with the NPA (708 887-1234).

v. The routing database returns the LRN (708 267-0000) associated with the dialed number (DN) to the LSP1 EO. The LSP1 EO uses the LRN to route the call.

vi. The LSP1 EO makes an AMA record for the call. The terminating LRN, along with the dialed number, is included in the AMA record.

vii. In this example the LSP1 EO is not directly connected to the LSP2 EO. The necessary routing, therefore, points to the LSP1 tandem office. The LSP1 EO formulates an SS7 call set-up message (ISUP IAM) with the LRN in the CdPN parameter, the dialed number in the GAP, and the FCI set to indicate that the query has been performed, and routes the call to the LSP1 tandem.

viii. The LSP1 tandem switch examines the contents of the CdPN parameter and determines that it is not its own LRN (if the tandem switch also functioned as a end office it would be assigned an LRN), and forwards the call, based upon the LRN, to the LSP2 EO along with the SS7 IAM it received.

ix. The LSP2 EO analyzes the digits received in the CdPN parameter of the call set-up message, determines that it serves the NPA-NXX, and identifies the line number as its LRN. The LSP2 EO therefore recognizes that it must examine the GAP to obtain the original dialed number and uses that number to complete the call to the called party, customer B.

13.1.3.3.1 InterLATA Calls

Similar call processing would be used to complete an interLATA call. The primary distinction here is that the originating switch -- the switch serving the calling party -- would identify the call as interLATA and forward the call to the presubscribed carrier. A switch in the interexchange carrier (IC) network would identify the dialed number as a potential ported call, launch the database query, formulate the appropriate signaling message based upon information (i.e., the LRN) returned from the routing database, and route the call.

13.1.3.3.2 Intraoffice Calls

As indicated previously, intraoffice calls can be completed without the need for a database query. This capability is derived from the fact that the LRN proposal identifies customers using only the customer number; that is, the number dialed to reach that customer. Accordingly, upon the origination of a call and receipt of the dialed digits, a serving end office can determine, without the need for a query to the number portability routing database, if the specific line number is resident in that office.

13.1.3.3.3 Calls Involving Non-LNP Capable Switches

There may be switches which do not have the capability to identify portable NPA-NXXs and launch the necessary query to a network routing database. Those switches will route calls in the normal manner allowing a subsequent switch in the call path, upon recognition that an LNP query has not been performed and that the dialed number contains a portable NPA-NXX, to obtain the LRN and appropriately route the call.

In addition, it is possible that a number could be ported to a switch which is non-LNP capable and therefore unable to identify its LRN and retrieve the dialed number from the GAP. In this situation, the switch routing the call to the non-LNP capable switch will recognize (based upon trunk group identification) that it must not send the LRN in the CdPN parameter, but instead forward the original dialed number.

13.1.3.3.4 MF Interworking

Although LRN, as do most number portability proposals, bases call processing on the availability of SS7, LRN can accommodate MF interworking and provide call completion to ported numbers served from end offices which do not support SS7. Specifically, consider a network switch which recognizes the FCI, identifies the call as completing to a ported number, and routes that call using the LRN. If, in selection of the route it is recognized that the trunks linking that switch with the end office serving the ported number are MF, and therefore, cannot accommodate the necessary use of the SS7 CdPN and GAP parameters, the switch will obtain the original dialed number from the GAP and forward that number to the end office using in-band (MF) signaling.

13.1.3.3.5 Default Routing

In the unlikely situation where a database failure is encountered and network routing information cannot be obtained by an originating or intermediate switch, the LRN proposal supports the use of default routing which will route the call to the end office switch to which the dialed NPA-NXX was originally assigned. Such calls will be forwarded indicating no database query was performed, allowing the terminating switch to launch its own query in an attempt to obtain the LRN.

13.1.4 NETWORK IMPACTS

As may be evident in the description of the call flows, some of the necessary call processing capabilities are not presently available and will therefore require network development. Among the areas impacted will be processing in network switches, the use of existing signaling parameters, and the need for routing databases.

13.1.4.1 Switching

The use of the LRN, as a 10 digit NANP number, allows the continued use of existing routing algorithms and routing tables. Development is required, however, to accommodate the need for terminating switch or GAP processing; that is, the ability of a switch to identify its LRN, and upon that identification obtain the original dialed number from the GAP. Further development may be required if a given end office can complete calls to only a limited number of NXXs, and the number of NXXs in a designated portable area that might be open on that switch exceeds the current limit.

The LRN architecture supports a flexible implementation of switch triggers, allowing the use of either AIN or IN technology. Existing capabilities might be deployed in some cases, depending on the specific switch technology. It is recognized however, that in some current implementations, available AIN triggers which might be used to launch the necessary database queries, can potentially interfere with other existing features. Accordingly, it is suggested that new local number portability (LNP) triggers, either AIN or IN based, be developed to accommodate number portability without the concern of feature interaction.

13.1.4.2 Signaling

The LRN proposal involves the use of existing SS7 parameters, and therefore does not require the lengthy standards process that might be involved in establishing new parameters. LRN does, however, add to the current uses of certain of these existing parameters and does demand some effort in standards to accommodate the necessary changes in documentation. As previously explained, specific changes will place the LRN in the CdPN parameter, the original dialed number in the GAP, and use the FCI to indicate that an LNP query has been performed. The documentation effort is currently underway in the appropriate standards body (T1S1).

13.1.4.3 Database Requirements

Requirements associated with both the network routing databases and the SMS are not unique to the LRN proposal and have been discussed previously in Sections 7.1.2 and 7.1.5. At minimum, the database record will contain the LRN for each ported number, but may also contain rating information (v&h coordinates) or specific service provider identification. Information associated with call rating, such as v&h coordinates, would only be necessary if location portability were extended beyond rate center boundaries, and the calling and called party numbers no longer accurately identified the respective rate centers.

Requirements associated with database capacity and its support of a given number of transactions are dependent upon the volume of portable numbers in the area served by the database. Questions have been raised concerning whether the database might contain all numbers within portable codes or just those numbers which have been ported. Answers to these questions are largely dependent on the type number administration selected. In any event, LRN can be adapted to either scenario.

13.1.4.4 Networks Involved

Within an area in which there exist portable codes, the networks of LSPs who provide service in that area and ICs who choose to terminate calls to end offices in that area could be impacted. As indicated earlier, however, under the LRN proposal, those carriers who choose not to modify their networks or are unable to do so, can continue to process calls to ported numbers by forwarding traffic originating in or transiting through their networks based upon default routing -- the routing of the call based upon the assumption that the dialed number continues to be served from the end office originally assigned the NPA-NXX. In this manner, the FCI will not be set, and subsequent switches in the call path, which are number portability capable, can recognize a potentially portable number and effect the necessary database query and associated call processing.

13.1.5 SERVICE IMPACTS

It is necessary that any proposed architecture for the support of number portability maintain the availability of all services. Those services which are of particular interest include CLASS services, operator services, and emergency services. The LRN architecture permits the continued provision of these services.

13.1.5.1 CLASS Services

Customized Local Area Signaling Services (CLASS) such as Auto Call-Back and Auto Recall rely largely on the knowledge of calling and called party numbers and the use of common channel signaling (SS7) non-call associated signaling messages. With LRN, both calling and called party numbers are readily available. However, the six digit (global title) translations (GTT), based upon NPA-NXX, used to direct non-call associated signaling messages to the proper end office cannot provide the necessary routing in a portable environment. Rather, some form of 10 digit GTT is required. Although 10 digit GTTs in the STP is conceivable, the volume of numbers that might be accommodated in this manner is limited, and the administrative effort necessary to maintain LNP data in STPs could be burdensome. Consequently, 10-digit GTT in STPs should only be considered as an interim arrangement. An alternative might first require a query to the number portability database which would retrieve the LRN associated with the number. The LRN could then be used to support the TCAP CLASS query using existing (six-digit) signaling network functionality. Another option, apparently preferred by some switch vendors, would direct the TCAP CLASS query

to the LNP database where information (e.g. a destination point code) could be obtained from the database record and the query passed directly to its appropriate destination.

13.1.5.2 Operator Services

Operators often need to have access to the ported calling and called numbers to properly interact with customers. With the LRN proposal, the ported calling number, rather than the network address, will always be forwarded to the operator services platform. Accordingly, on operator handled calls (e.g., 0+) no LNP query need be performed prior to the call being sent to the operator system. Rather, the operator services platform will itself perform the query in order to obtain the necessary routing information.

In addition to completion of 0+ calls, other operator services require that routing information be available at the operator services platform. Included are all inward services which are necessarily routed to a specific operator services location. One such service is Busy Line Verification (BLV). BLV allows an operator, accessed by the calling party, to verify the status (busy/out of service) of a given customer number. Such services are currently implemented based upon a six digit translation of the NPA-NXX of the customer number. Clearly, in a portable environment, this type translation is insufficient to route the call to the operator platform of the LSP which serves a ported called party. Operator services platforms will properly route these calls after accessing the number portability routing database and obtaining the LRN for the given customer number.

In addition to services which require routing to a specific operator services platform, alternate billed calls which route through the operator services switch will also be impacted by number portability. Validation of credit card calls, which use telephone number based calling cards, as well as the verification of requests for collect and bill-to-third requires knowledge of the LIDB where the line information resides. Again, in a portable environment the current NPA-NXX based LIDB identification is not sufficient, and a query to the number portability database would be necessary to perform the 10-digit GTT necessary for validation or verification. The ready availability within the LRN architecture of both calling and called party number supports these functions.

13.1.5.3 Services Using Non-Geographic Numbers

Several types of services use non-geographic numbers such as 500, 700, 800, 900, etc., and require a network based look-up, usually in the form of a database query, to obtain routing information to complete the call. It is possible that the routable number itself has been ported and that call processing therefore requires a query to the LNP routing database to identify an LRN and properly direct the call. Accordingly, the query to the LNP database should be done as the last activity prior to call routing, and service access codes such as 500, 700, 800, 900, etc. would not trigger a query to the network routing database.

13.1.6 END USER IMPACTS

Clearly, any architecture selected to support number portability should provide that capability with minimal, if any, impact on an end user, both the customer who ports their number as well as the customer who calls that ported number. That is, in areas in which number portability has been implemented, all users should continue to be able to dial numbers in the familiar manner and receive all services currently provided. In addition, if a number is ported, but remains at the same location, or a location within the same rate center, the architecture must provide the capability to ensure that calls made to that number are not subject to increased charges.

13.1.6.1 Transparency

The LRN proposal will provide number portability without adverse impact to the end user. Calls to ported numbers should be completed with minimal increase in post dial delay (no more than one-half second) and the proper customer number will be displayed if the called party uses Caller ID. Moreover, CLASS features such as Auto Call Back and Auto Recall can be supported and all operator services will continue to be available in the normal manner. In addition, although AT&T suggests that location portability initially be limited to within rate centers to avoid possible rating complexities, the LRN proposal, with the appropriate call detail recording, could accommodate accurate call rating even with an expanded location portability scenario.

13.1.6.2 Ubiquity

Number portability will be implemented within designated areas, consistent with the competitive demand and regulatory directives. Calls to ported numbers will be dialable and completable from customers served by any end office, either within or outside the designated area. Switches in which the necessary capabilities to obtain the network address (LRN) are not available will use default routing to forward the call to a switch with the necessary functionality. Accordingly, all numbers within the designated area should be available for porting.

13.1.6.3 Directory Assistance

Directory Assistance (DA) will be provided in a portable environment in a manner not unlike it is today. That is, assuming location portability beyond NPA boundaries is not supported, DA for a given geographic area will continue to be accessible by dialing (NPA) 555-1212. The service might be provided by a neutral, third party rather than the incumbent local service provider, and competitive offerings [perhaps accessible through other dialed numbers; e.g., (NPA) 555-1X1X] will no doubt be available. Over time it may be advantageous to use the SMS as the source of listings for DA, assuming the necessary interfaces between the SMS and DA platforms can be supported. DA should be available regardless of the particular portability architecture deployed; it will therefore be supported by LRN and other architectures as well.

13.1.6.4 Repair Services

Customer trouble reporting and associated repair service will continue to be available from all service providers. The impact of portability upon these type services is related to the need to identify the end office switch serving the customer number associated with the trouble report. Accordingly, operations systems which support the trouble reporting and resolution activities will have to be modified to provide access to the network routing database where customer numbers are mapped to network addresses. The LRN proposal will support the easy identification of network locations associated with customer numbers to effect trouble isolation and repair.

13.1.6.5 Emergency Services

As described in Section 12.9 of this document, maintenance of emergency services (911/E911) in a number portable environment is dependent upon the availability of a dialable customer number at the Public Safety Access Point (PSAP). The LRN proposal meets this requirement as the dialable number, of the calling party, rather than the network address, is readily available.

13.1.7 NUMBER ADMINISTRATION

Number Administration scenarios are explored in Section 8 with the related provisioning impacts described in Section 9 of this document. The LRN proposal can be implemented independent of either administrative scenario, that is, either assignment of customer NPA-NXXs to specific service providers with only ported numbers contained in the SMS, or with customer NPA-NXXs assigned to a "pool" with all numbers contained in the database. In addition, the LRN proposal demands assignment and administration of the LRN itself; that is, the NPA-NXX-XXXX that identifies a particular end office switch. It is assumed that such assignment and administration will take place under the direction of the code administrator, and subject to processes and guidelines established by the industry.

13.1.8 CALL RATING

The manner in which calls will be rated in a portable environment and the associated complexity of the rating process is directly related to the method in which numbers are assigned and the extent to which location portability is permitted. If NPA-NXXs are designated for assignment only within a given rate center, and location portability beyond rate center boundaries is not allowed, call rating can be accommodated as it is today, based upon the known location (rate center) of the calling and called customer numbers. If these constraints are not maintained, additional rate related data -- such as the identification of the specific rate center for the customer number -- may have to be provided in the database record and the downstream rating process modified accordingly.

If location portability beyond rate center boundaries is supported, it would be advantageous to provide, in real time, the network address (LRN) of the calling party. AT&T believes that this need could be accommodated through use of the Jurisdiction Information Parameter (JIP), an existing SS7 ISUP parameter that would forward the NPA-NXX of the calling party switch. This data could be part of a modified AMA record and used to accurately rate the call.

To avoid such complexities, AT&T suggests that initially, number portability be implemented with location portability limited to within rate center boundaries and NPA-NXX assignments constrained to given rate center areas. With these constraints, call rating and its associated process are not impacted. Over time, if and when location portability is expanded and customer numbers do not directly indicate rate centers, the LRN architecture is fully capable of supporting the additional data and processing required to provide the necessary call rating.

13.1.9 TIMING AND AVAILABILITY

The necessary switch development to support LRN is currently being explored by several switch vendors. It is currently estimated that these developments, which include the use of a new trigger, the modified use of existing signaling parameters, and the necessary end office (GAP) processing can be available by 2Q97. Changes in signaling standards to reflect the modified use of existing parameters are now under consideration in the appropriate standards body (T1S1) and should be completed by 2Q96. Work on the requirements for the SMS has begun in several state workshops and should be completed to allow the deployment of an SMS consistent with the aforementioned 2Q97 date. It is further assumed that the necessary methods and procedures for the porting of calls and the provision of service to new customers, as well as other administrative processes will also be available by that time.

13.2 LANP Description

The Local Area Number Portability (LANP) proposal for the permanent implementation of local number portability (LNP) is offered by U.S. Intelco (USI), Stratus Computer, Inc. (Stratus), and Electric Lightwave, Inc. (ELI). While offered to address the immediate need for service provider number portability (SPNP), LANP also provides the call routing and feature transparency characteristics required to support location and service portability in the future.

13.2.1 General Description

The LANP call model proposal addresses requirements for both call routing and SS7/TCAP message routing in an LNP environment. LANP does not mandate the use of any specific triggering technology within switches to perform the call routing database query to obtain a network address for a call.

13.2.1.1 Call Processing General Description

With respect to call routing, LANP proposes:

I. Calls to portable numbers are queried using an N-1 trigger placement policy. Specifically, local ported calls are nominally queried in the originating local network. Where as, inter-exchange calls to ported numbers are nominally queried in the IC network. N-1 is just a policy for engineering triggers and LNP query-capable switches in a network -- LANP signaling facilities (forward dip indicator) insure that correct ported call processing occurs regardless of where in the call path the querying switch occurs. In either call type, terminating or fail-safe querying must also be supported to enable the donor switch or network to query and re-route the call to insure completion.

II. New LNP-specialized switch triggers are required to implement permanent LNP on a wide-scale. Existing triggering technologies (e.g. AIN 0.1 and IN), while capable of supporting limited LNP trials with work-arounds (i.e. trigger assists), are unsuitable for permanent use in LNP. LANP does not require any specific triggering technology or SSP-SCP message format be used -- either AIN or IN may be used as a basis for developing LNP-specialized triggers. LNP trigger requirements include: (a) interwork with a forward dip indicator (newly allocated bit in FCI); (b) should support 3, 6, and 10-digit match behavior; (c) provide an intra-switch look-ahead facility to determine if the CNA dialed is served in the current switch, and complete the call without a database query; and (d) populate forward call signaling parameters (defined in (3) below) with LNP SCP response parameters and pre-query CdPN value (CNA).

III. Subsequent to the LNP database query for call routing, a 10-digit network address (or network node address, NNA) is obtained from the database associated with the

dialed portable number (or customer number address, CNA). The NNA is a placed in the CdPN parameter; the CNA is placed in a new (LNP-specialized) GAP parameter, and a forward dip indicator is flagged in the FCI parameter (specialized LNP use of a reserved bit within the FCI).

IV. Call processing resumes subsequent to the dip with call routing to proceed based on conventional 6-digit interpretation of the NNA per the LERG. In nominal circumstances (e.g. SS7/ISUP trunking), the new and modified call parameters (CdPN, GAP_{LNP}, and FCI) are required to be forwarded downstream the callpath in the IAM message to the terminating end-office. Non-LNP capable intermediate switches and networks are not impacted, and will correctly route the call, based on 6-digit examination of the CdPN parameter (unaware of the distinction of it containing an NNA value), and will forward the additional parameters downstream.

V. The NNA value associated with the CNA is assigned by the new serving local service provider (LSP) in the process of completing the service order to port the customer from their previous LSP. The NPA-NXX of the NNA unambiguously identifies the actual terminating end office switch for the intended subscriber, so calls may be direct routed using conventional 6-digit routing translations.

VI. At call termination, the serving end office recognizes the NPA-NXX of the NNA as a home NXX, and proceeds to interpret the incoming NNA (CdPN), and CNA (GAP) if needed, to determine the intended destination of the call.

VII. No one specific method of translating an incoming call to a ported number is mandated by LANP. Multiple methods of interpreting an incoming NNA may be implemented within different switching equipment (e.g. class 5 switch vs. MSC vs. ATM switch w/voice SVC) deployed and co-existing in an LNP area transparently to each other. For all intermediate (including querying) switches, the only requirement is that the NNA be a valid 10-d NANP LERG routable number. At the terminating end-office, for example, the NNA could be interpreted in at least the following three ways:

a) Split number address: NNA is opened on the switch and associated with the line, or the switch is otherwise able to translate the incoming NNA to the intended line.

b) Single number address: NNA is an LRN-like address, that is not line/DN associated. Consequently, the CNA is restored to the CdPN, and 7-d translated to identify the intended line. The CNA value is opened as the DN of the ported line. This is identical to LRN call processing.

c) Temporary local directory number (TLDN): The NNA is dynamically assigned by the subscriber's home network (home MSC/HLR) at the time of the LNP routing query, in conjunction the actual serving switch (VMSC), to that very call. The TLDN, once assigned, is uniquely associated with the call to the intended line whose parameters were indicated during the TLDN assignment process (e.g. IS-41 RouteReq). Once an incoming call is received to a valid TLDN, the TLDN value

is de-assigned and able to be assigned for another call setup attempt. Incoming TLDN call processing in this scenario is identical to incoming autoroaming call delivery in a mobile switching environment.

LANP does not dictate the exact mechanism of incoming call processing at the serving end-office, but instead leaves this functionality as implementation detail for network switching vendors, and their customers, to engineer so as to best optimize their costs and availability of LNP conforming product. None of the modes mentioned above is essential to nor mandated by LANP, but are simply examples of modes that can technically co-exist and which may have value to different LSP industry segments.

VIII. LSP's are responsible for assigning NNA types and values to support their network, switch-types, and desired modes of ported line switch provisioning. LSP's independently choose their NNA types and values due to complete transparency in call querying, signaling, intermediate switch processing, and inter-company processes. Inter-company processes such as repair, service order admin, operator services, etc., function identically regardless of the type of NNA used.

13.2.1.2 SS7/TCAP Message Processing General Description

With regard to SS7/TCAP message routing, LANP proposes:

I. The LNP SCP's perform 10-digit routing of LNP-affected TCAP messages, to eliminate functional impacts to existing SS7 network elements (STPs and switches) related to TCAP message routing generated by LNP. TCAP messages employing portable number-based global title addresses or those who DPCs are derived assuming 6-digit interpretation of a DN (e.g. IS-41A), are routed via LNP SCPs where 10-digit global title translation (GTT) routing is performed. Affected applications include: CLASS (AC/AR, SLE, CNAM), LIDB/ABS, and IS-41.

II. TCAP messages requiring 10-digit routing are routed to an LNP SCP by changing the STP-resident 6-d GTT routing translations to the LNP SCP for NPA-NXX blocks opened for porting. Only TCAP messages for NPA-NXX's opened for porting are SCP routed.

III. The LNP SCP's deployed for 10-d SS7/TCAP message routing do not need to be the same physical SCP's queried by the switch network. The term 'LNP SCP' is used generically to refer to an SCP that hosts a copy of a portion of the LNP database that interconnects to the LNP administrative network to receive updates to that database. This functionality may migrate back to STP's or specialized STP-adjuncts.

IV. Both end-point (EO DPC) and gateway routing (STP DPC) options be supported by the LNP SCP's. The only difference between these two modes is whether the SCCP calling party id address is left as a global title or translated to a DPC+SSN. A third routing option should also be considered for implementation: GTT translation type replication. The table below (Table 1 - SCP-based 10-digit TCAP Routing

Options) summarizes these options for SCP-based 10-digit routing of TCAP messages.

Table 1 - SCP-based 10-digit TCAP Routing Options

Routing Method	First LNP SCP Returns	Final LSP Routing	Number of GTTs	Comments
Originating DPC Routing	Final DPC.	Direct DPC routing at STP.	2 (originators STP, originator's SCP)	• Least # of GTT's. • All LSP's know DPC's of other LSP's facilities.
Gateway Routing to LSP	MTP: DPC of LSP gateway STP. SCCP: CNA-GTT.	Final 10-d GTT done at dest LSP SCP.	4 (originator's STP, SCP, destination STP, and SCP)	• Most # of GTT's. • Only destination LSP knows DPCs for their facilities. • All intermediate LSP's route to destination STP gateway.
Replicated GTT	MTP: DPC of LSP gateway STP. SCCP: NNA-GTT.	Conventional 6-d GTT done at dest STP.	3 (originator's STP, SCP, and destination STP)	• Moderate # of GTT's. • Single 10-d CNA->NNA GTT conversion at originating LSP's SCP. • Conventional 6-d GTT thereafter to destination. • Requires additional GTT routing tables in STPs for new TT's (TT's for NNA's).

13.2.1.3 Background

LANP was originally developed in conjunction with the Seattle 'Proof-of-Concept' number portability trial conducted in Washington state starting in 10/94. At that time, the focus of the effort was on trialing and potential immediate deployment as an interim database approach -- one that would require only minimal, if any, switch functional enhancements to support. This constraint dictated the use of existing triggering (AIN) and translations capabilities, and led to the development of the split number addressing concept used throughout the Washington trial. Split numbering assigns line-specific NNAs that enable incoming calls to ported numbers to be completed using existing 7-d switch translations capabilities (the NNA was opened on the switch as a DN of the ported line), and without requiring a terminating dip to perform a parameter swap to restore and translate on the CNA.

As the final phase of the Seattle trial was underway in mid-1995, the LANP effort evolved to focus more directly on permanent deployment of LNP with a view to maximizing the breadth of participation in LNP to all industry segments. This led to a major enhancement to LANP, that multiple interpretations of an NNA were possible on a terminating end-office and could be supported transparently to each other within the previously established signaling and routing facilities proposed by LANP. It was not necessary to insist that the terminating end-office interpret an incoming NNA only as a split number address, but that an LRN-like address, as well as a TLDN-like address (for dynamic IS-41-like call routing), were equally possible. The LANP proposal from the outset included transmission of the CNA in GAP, initially for call recording purposes, but that it's use permitted an LRN-like GAP-CdPN swap to occur at the terminating switch without changing the signaling. If the NNA is opened on the switch and associated with a specific line, then the call could be completed without consulting the CNA in the GAP. If the NNA is instead an LRN, then the CNA from the GAP would be restored as the CdPN prior to performing line translation. The LSP would assign the type of NNA and NNA value based on it's own determination of the ported number addressing mode used: for that switch-type, entire network, or even perhaps by customer or line-type.

13.2.1.4 Network Node Address

Since LANP does not mandate how specific NNA interpretation is performed in the serving end-office of a ported line, either the CNA or NNA values may be used to translate the incoming call to the intended subscriber facilities -- thus there are two general classes of ported line addressing modes, as identified in Table 2 - Basic Wireline Addressing Modes: Single & Split.

Table 2 - Basic Wireline Addressing Modes: Single & Split

Addressing Mode	General Description	Line Translation Based On
Single Number	A shared (by all lines on switch, of a sub-group of lines) NNA is placed in CdPN. The dialed ported number is placed in another parameter (GAP) and restored into the CdPN at the terminating end-office.	CNA
Split Number	A line/subscriber-specific NNA is placed in CdPN. The dialed ported number (CNA) is placed in another parameter (GAP), but not used for routing or translations.	NNA

While single and split number addressing modes appear to be distinct, in practice the basis on which NNA's may be allocated and assigned to serve CNA's form a spectrum of possible NNA types, as identified in Table 3 - Possible NNA Types and Implied Addressing Modes .

Table 3 - Possible NNA Types and Implied Addressing Modes

NNA type	Assignment Basis	Addressing Mode Used
Switch-specific	One per switch: a single NNA for all subscriber's served off of the switch.	Single (LRN).
Rate center-specific.	One per rate center per switch, used where NNA (or LRN) values are used for rating, in lieu of CNA.	Single (LRN).
Reseller-specific	One per reseller per switch.	Single (LRN).
Customer type-specific.	One per customer-type per switch, e.g. residential, small business, large business, interconnect, etc.	Single (LRN).
Large end-user specific.	One per qualifying end-user. May or may not be associated with line-side facilities.	Split (if facilities associated), otherwise single (LRN).
Line-specific.	One per line/line-group. Is normally associated with line-side facilities.	Split or single.
Number-specific.	One per CNA. Is normally associated with line-side facilities.	Split or single.
Call-specific.	Dynamically associated with called party/session via query to called's HLR.	Dynamic (TLDN).

While there are two basic addressing modes (single and split), the allowed combinations of opening up CNA, NNA, and both CNA/NNA values on a serving end-office suggests three possible modes for provisioning ported lines on the serving end-office. See Table 4 - Ported Line Provisioning Modes and Implied Addressing Mode.

Table 4 - Ported Line Provisioning Modes and Implied Addressing Mode

Addressing Mode	Provisioning Mode: Opened on EO? CNA	NNA	NNA Specifies	Notes
Split	No	Yes	Line	Line is opened with NNA on switch, CNA is provisioned as the CgPN generated on outbound calls from line.
Split	Yes	Yes	Line	Both NNA and CNA opened, NNA for incoming routing and translation. CNA for CgPN generation and dip suppression on intra-switch routing.
Single	Yes	No*	Switch only (e.g. LRN)	CdPN just gets call to EO. EO obtains dialed number (via another parameter or reconstruction) and performs translation on dialed number. CNA only is opened.

13.2.1.5 Diversity of Serving Network/End-Office Functionality

LANP advocates diversity in the way LSP's and their networks assign, use, and interpret NNA's in an LNP environment, while defining a standard NNA format (10-digit, LERG routable) and signaling interface between networks and network elements that makes this diversity transparent. The purpose of this principle is not to multiply the number of implementation options that a given vendor must support in their equipment, but multiply the number of types equipment and equipment vendors that could co-exist in an LNP-conforming market. Different LSP's will employ different types of equipment (e.g. class 5 end-offices, MSC's, broadband) as well as have widely varying business and technical objectives. Some may find that certain NNA assignment paradigms (e.g. one per customer account per switch) better meet their OSS (e.g. provisioning and billing systems) requirements than others. Those that employ multiple vendors supported by a common OSS will likely establish a consistent paradigm for NNA allocation and assignment for consistency of OSS implementation (e.g. one per reseller per switch).

Within the Illinois Commerce Commission (ICC) LNP workshop, three different new LNP-specialized triggers have been defined that will be developed and utilized simultaneously with the initial deployment of LRN in the Chicago (MSA-1) area. Each switch vendor will support one of the three triggers. The reason there are three was that no one suitable LNP trigger could be developed in the same general timeframe from all of the switch vendors. Diversity was the key, in this case, to minimizing time and maximizing participation. Complexity was added to the LNP SCP to support (separately or together) all three query/response message formats, but this was viewed as an easy tradeoff for switch availability and therefore LSP participation.

Also in the ICC LNP workshop, carrier participants have expressed a diversity of views regarding their preferred basis for assigning LRN's (NNA's), such as assigning one LRN per reseller per switch, or one LRN per NPA served per switch. This has led the ICC LNP generic requirements subcommittee to specify that conforming switches must support at least two LRN's per switch, with the likely practical limit being substantially greater (> 100).

13.2.1.6 Conservation of Numbering Resource

LANP offers not only NANP preservation, but with wide-scale deployment the potential to defer NANP exhaust through increased resource utilization. LANP's NANP conservation stems from it's treatment of CNA's and NNA's as separate numbering plans. This separation relies on the use of a forward dip indicator to flag, in effect, the type of number (CNA vs. NNA) contained in the CdPN field at any point in the callpath. The forward dip indicator, when present, shows that an LNP database dip has successfully been performed thereby indicating that an NNA is contained in the CdPN field.

The NANP today is only sparsely utilized because a common numbering plan is used for assignment of both customer numbers (CNA's) and line numbers (NNA's) functions. The fill rates for metropolitan areas experiencing NPA splits ranges from 40%-80%. In many cases, CNAs are assigned where there is no dedicated line (e.g. DID blocks, hunt groups) and conversely, NNAs are assigned to identify individual lines and trunks which are not directly dialable. However, in today's NANP, once a number is assigned for any use, it can not be used for any other function. In addition, small rural end-office may not use most of an entire NXX block, but once the NXX is assigned, it can't be moved. Consequently, there is significant waste in the existing NANP.

By decoupling the number plans, both plans will be more efficiently utilized, thereby enabling higher fill rates in both plans. Significant resource recapture can occur if CNA number pooling is used when an area becomes LNP-capable. While the NNA plan will continue to strand NNA numbers in rural EO's, the CNA plan can recapture all stranded CNA numbers and make them available for the whole local area. The decision to pool CNA numbers, and use them for new service orders in addition to number porting, is a policy decision and is not inherent in LANP. LANP enables this administrative policy option to exist.

Also, CNAs for which there are no lines (such as DID blocks and hunt numbers) will no longer deplete available NNA numbers, so they too may be better utilized. Because numbers in each plan are functionally specialized and allocated independently, numbers in both plans will be far better utilized than today.

Demands for office codes for new LEC switches in an LNP environment are effectively requests for NXX's in the NNA space and will not necessarily require NPA splits in the CNA space. New NPA's in the NNA space may be transparently added since they are not dialable. If a new NNA NPA is introduced into an area to affect a rating split along geographic boundaries, an NPA split of CNA's can be avoided if other facilities (call recording, billing, rating) required for inter-rate center location portability are deployed. While converting a mass block of non-ported numbers to use the LNP database to avoid an NPA split of dialable numbers is not a small effort, compared to the enormous end-user costs and disruptions of forced number changes there is a potentially compelling case for end-user benefits in using LNP to avoid CNA NPA splits. Consequently, subscribers may be insulated from demands in the NNA space, even if new NNA NPA's are required. CNA NPA splits need no longer occur due to the creation of new NNA NPA's.

13.2.1.7 Comparison with Other Proposals

While both LANP and LRN approaches have evolved since their original proposals (in the form of INC contributions), there is now commonality with respect to signaling and routing recommendations, and requirements for new LNP-specialized triggers. Consequently, LANP is fully compatible with LRN. LANP, resulting from the evolution (discussed in section 13.2.1.3), is functionally a superset of LRN. It's a superset is the sense that LANP effectively relaxes the incoming ported call processing functionality mandated by LRN (single number addressing), and recognizes that imposing this level of detail of end-office functionality is not necessarily ideal for all potential participants in LNP, nor does it anticipate the proliferation of network and switch technologies that will occur with local exchange competition and the advent of a network-of-networks structure of the PSTN.

Wireless participation in LNP is essential for access to local markets for potential displacement services, such as PCS. Wireless, as well as other new network technologies (e.g. broadband), may find that the paradigm of assigning NNA's on a per subscriber or per terminal basis to be more meaningful than assigning them on a per switch basis. The concept of a central office switch will itself undergo a radical transformation over time with the integration of switching and transport technologies.

Philosophically, it's essential that LNP standards not work contrary to the purpose of enabling open local exchange competition and the inherent diversity of local service offerings ultimately generated. Therefore, LNP standards should not artificially constrain or mandate functionality in switches not essential to the inter-operation of LNP amongst competing LSP's. Standards should define inter-network and inter-element interfaces to guarantee inter-operation, but should not constrain the internal implementation of those interfaces in the marketplace.

It is recognized, on the other hand, that the diversity of NNA interpretation and related switch/network functionality advocated by LANP is not as relevant and valuable when aggressively planning the first stage of permanent LNP deployment in the PSTN. The commendably aggressive timeframes to which leading states such as Illinois are planning on deploying LNP (starting in Q4 1996), justifies focusing on the requirements of the immediate constituents for that deployment: wireline LSP's using class-5 central office switches. Given the switch vendors willingness to develop common new LNP-specialized functionality in support of the deployment schedule lessens the need to consider employing multiple addressing modes that might have enabled existing diverse switch implementations to be utilized within a common approach.

Consequently, the selection of the LRN approach for permanent implementation of LNP in those states should not be viewed as a rebuttal of the diversity principle for wide-scale LNP participation, but instead reflects the practical value of defining initial implementation specifications normally beyond the scope of industry standards that was justified to establish consistency of impacts to areas such as OSS's within a homogeneous group of initial participants. Nothing technically precludes these initial LRN implementations from transparently evolving to support more LANP-like functionality for a broader set of participating LSP's, if they so desire. There is the danger, however, that by not recognizing the diversity principle even where initially deferred, that such selections could be used by the initial participants and their vendors to control access to those local markets from a broader set of future participants.

However, it is not accurate to characterize LANP as either a 'dual domain' or 'split number' approach.

The concept of 'dual domain' is truly generic to LNP. Every portable number requires a routing address (NNA) separate from the portable number (CNA) itself, in order to retain 6-digit call routing functionality in the PSTN. LANP advocates that NNA's be considered a separate address space from CNA's. NANP resource conservation requires this distinction be made to avoid consuming, on average, more than one number per ported customer. Without this distinction, NANP resource is wasted, regardless of whether the NNA is shared amongst multiple subscribers or not.

In the Illinois Commerce Commission (ICC) LNP workshop Generic Requirements subcommittee, the switch generic requirements for LRN implementation specify that LRNs are allocated and assigned out of a separate number space than are DN's, and are stored in a separate LRN table in the switch. Consequently, the same 10-digit value may be used as both an LRN and a DN. This separation, as originally proposed in LANP, is affected through the interpretation of the forward dip indicator (called the NP query done indicator in LRN) in the FCI parameter. This bit is equivalent to an 11th address digit in the NANP, and effectively identifies the number space in which the 10-digit number is assigned. The forward dip indicator in LANP has always been proposed for two purposes: redundant query suppression and number space separation. While originally proposed in LRN for query suppression

purposes, it nonetheless serves the same additional purpose as in LANP in effectively separating the numbering spaces.

While LANP historically has focused on use and advocacy of the split number addressing mode, this is an historical artifact as is discussed in section 13.2.1.3.

Inter-company processes (e.g. repair, service order admin, etc.) in LANP are identical to LRN -- the CNA continues (as the DN is today) as the primary key exchanged between entities to identify the subscriber or service in question. Where required, the LNP database is consulted to obtain the NNA for the CNA to verify call routing and database concurrency. The only potential difference between the two static addressing modes (split and single) lie in the switch-related OSS's which are intra-company.

13.2.2 Architecture Description

Figure 1 - LANP Architecture Reference illustrates the basic types of facilities and interfaces nominally deployed within a participating LSP and between a local neutral third party LNP administrator (or LNASC). Included in this architecture are the network switches, LNP routing database (SCP), signaling facilities, and administrative systems typically involved in an LNP environment. LANP is fully consistent with the general architecture described in Section 7.

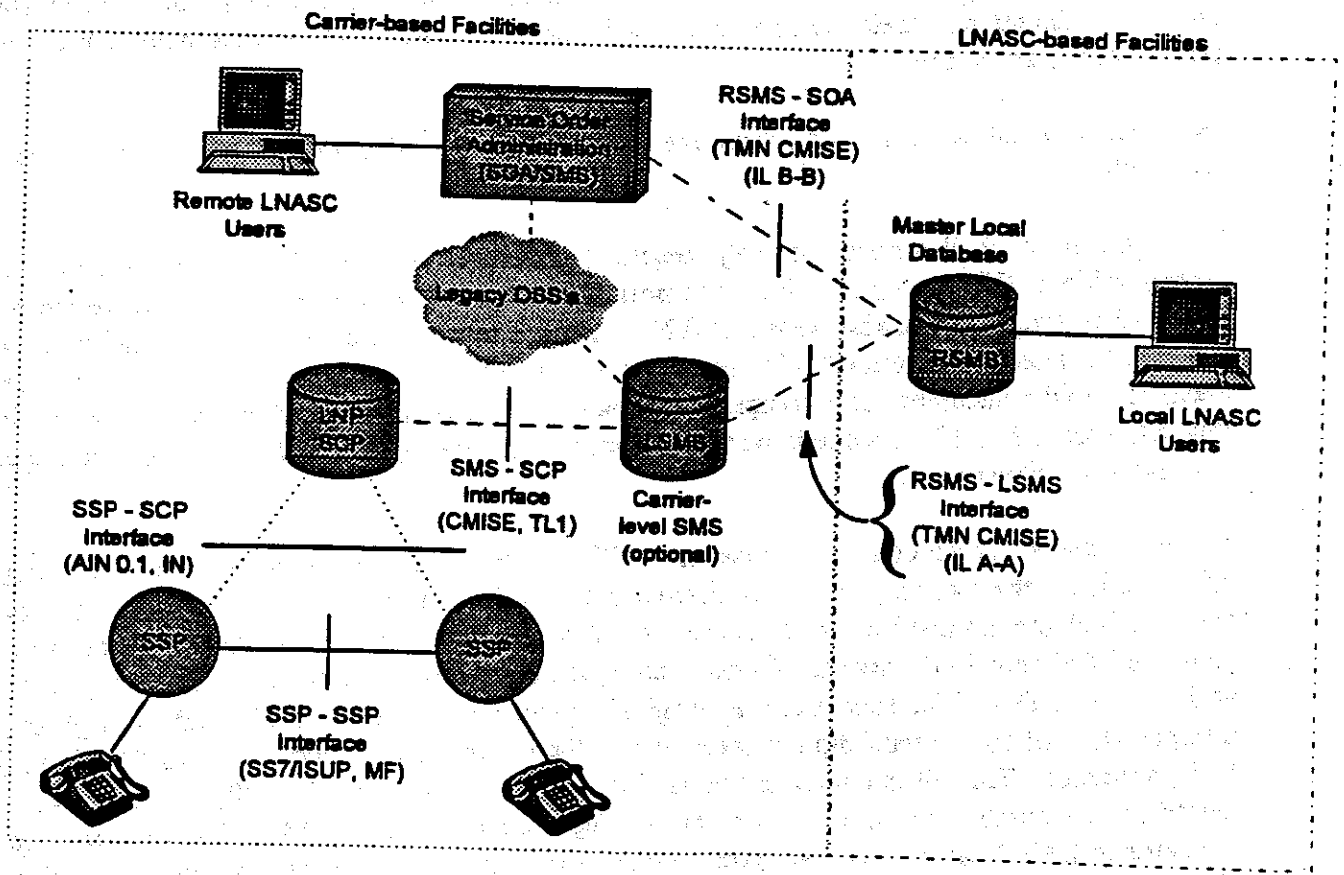


Figure 1 - LANP Architecture Reference

13.2.3 Method of Operation

First, LANP's signaling recommendations are described as preparation for the illustrative call flows in the following sections.

13.2.3.1 Signaling

Subsequent to an LNP database response for a call to a ported number, the following parameters are modified and use in subsequent call processing:

I. CdPN contains the called party's 10-digit NNA.

II. GAP, marked as a new LNP type, contains the dialed CNA.

III. The forward dip indicator bit in the FCI is true.

IV. Optional location portability recording parameter: Generic Digits Parameter (GDP), marked as a new LNP called-party location type, contains the called party's location, service provider, RAO, and/or rating identifier (formatted as either a V&H, zip-code, or other). The GDP, flagged as a traveling class mark (TCM), appears as the TCM parameter in the SSP-SCP message formats defined in AIN 0.1. The GDP is specified current in ISUP to contain various subscriber information, such as account and authorization codes. The use of this parameter for end-user information for LNP is consistent with it's current uses, and due to it's interworking with AIN 0.1 could be accommodated with modifying the SSP-SCP message formats. The LNP-specialized trigger would be coded to populate the return GDP from the SCP (in the TCM parameter) as a new LNP-type. This would enable the database to provide necessary additional call recording information needed for location portability along with the network routing address.

The following parameter is proposed to be generated in call origination from a ported line in support of AMA call recording requirements for location portability.

I. JIP contains the NPA-NXX of the calling party's NNA.

13.2.3.2 Call Flows

IntraLATA Calls Between LNP Participants

The example in Figure 2 - Sample Local Call to Ported Number' illustrates a typical local ported number call scenario. In this case, three LECs (LSPs) serving a sample local region (with CNA & NNA NPA of 206) are participating in LNP. Subscriber 1 (Sub-1, bottom phone) has ported his number (812-1234) from LEC-2 to LEC-3. Originally, LEC-2 served this subscriber from it's 206-812 (this switch's NNA office code) end office, where his CNA and NNA were implicitly one and the same prior to porting. In porting the 812-1234 number

to LEC-3, it assigned a line to Sub-1 off of it's 206-623 EO, and assigned an NNA for the line of 623-9867.

Also in this example Subscriber-2 (Sub-2, top right phone) has ported his number (623-9867) from LEC-3 to LEC-2. Sub-2 is now served off of the 206-812 EO, and is assigned an NNA of 812-1235. Note that in this example, Sub-2's NNA number (623-9867) is the same as Sub-1's CNA number. This demonstrates the full re-use and independence of CNA and NNA numbers.

The steps in a call to Sub-1 are:

1. A call is placed to 812-1234 from a phone in LEC-1's network. The number dialed hits an LNP trigger in the originating network/switch (either a 206 or 206-812 trigger) which causes a query to be launched to the LNP SCP serving LEC-1.

2. The SCP translates the CdPN from it's CNA value of 206-812-1234 (original dialed number with 206 NPA added by the switch) to the associated NNA value for Sub-1 of 206-623-9867. The querying switch updates it's call parameters in response as follows: CdPN = NNA 206-623-9867, GAP_{LNP} = CNA 206-812-1234, FCI (forward dip indicator) = true.

3. LEC-1's originating switch then routes the call based on the NNA value in the CdPN parameter, and routes the call via the most direct route to LEC-3's 206-623 EO. No subsequent LNP triggers are encountered on the NNA value (206-623 is also a valid CNA NXX) due to the FCI indicating that the CdPN contains an NNA and has already be queried.

4. The 206-623 EO receives and interprets the incoming call based on one of the two wireline addressing modes (single or split, described in 0 above). The call is completed to Sub-1's line.

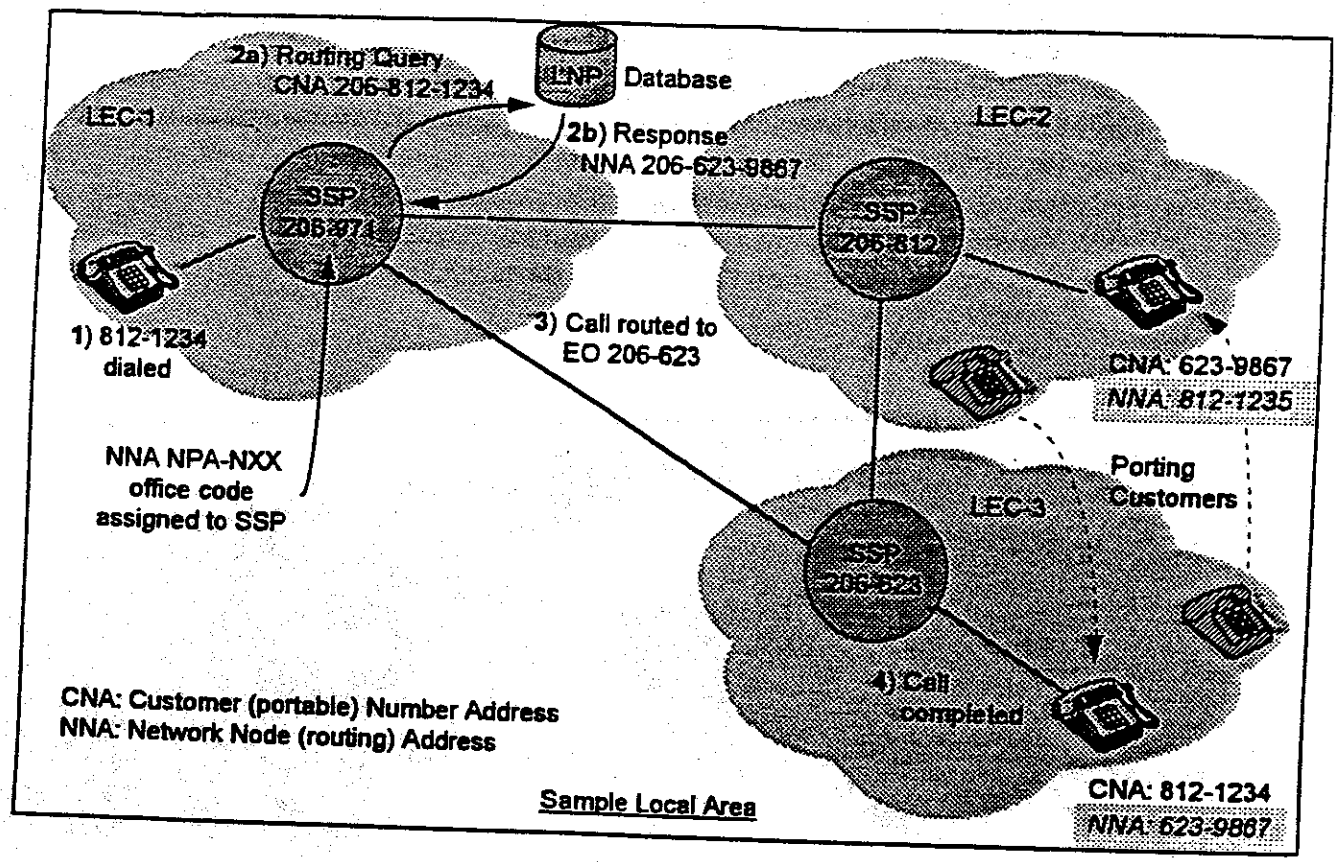


Figure 2 - Sample Local Call to Ported Number

IntraLATA Ported Call from Non-LNP Originating Network

Figure 3 - Sample Local Call from Non-LNP Network' illustrates a similar situation as in prior example above with the exception that here LEC-1 is not LNP-capable (i.e. an old domain network) and is therefore not able to dip calls prior to routing. In reality, any number of old domain networks (both EC and IC) must be accommodated in deploying LNP. The ability to route the call based on CNA value (CNA NPA-NXX) may introduce routing in-efficiencies but must always succeed nonetheless. The same subscribers and phone numbers are used as above:

1. A call is placed to 812-1234 from a phone in LEC-1's network. LEC-1's network is not LNP-capable and is not able to recognize the 206-812 prefix as requiring an LNP query.

2. LEC-1's originating switch routes the call based on the 206-812 CNA prefix to LEC-2, where the 206-812 NNA is assigned.

3. Upon receiving the call at LEC-2's 206-812 switch, the number dialed (forward dip indicator is off) encounters an LNP trigger which causes a query to be launched to the LNP SCP serving LEC-2. The SCP translates the CdPN from it's CNA value of 206-812-1234 to the associated NNA value for Sub-1 of 206-623-9867, as before.

4. LEC-2's switch now routes the call based on the NNA value in the CdPN parameter to LEC-3's 206-623 EO. Here the 206-812 EO is acting as a tandem in redirecting the call to the correct terminating switch. In general, the first new domain switch the call encounters will dip the call and re-route correctly from there. This example is worst case by assuming the 206-812 switch is direct trunked to LEC-1. Old domain (non-LNP conforming) networks which are direct trunked to new domain EO's will encounter re-routing for calls ported from those switches.

5. The call is completed to Sub-1's line.

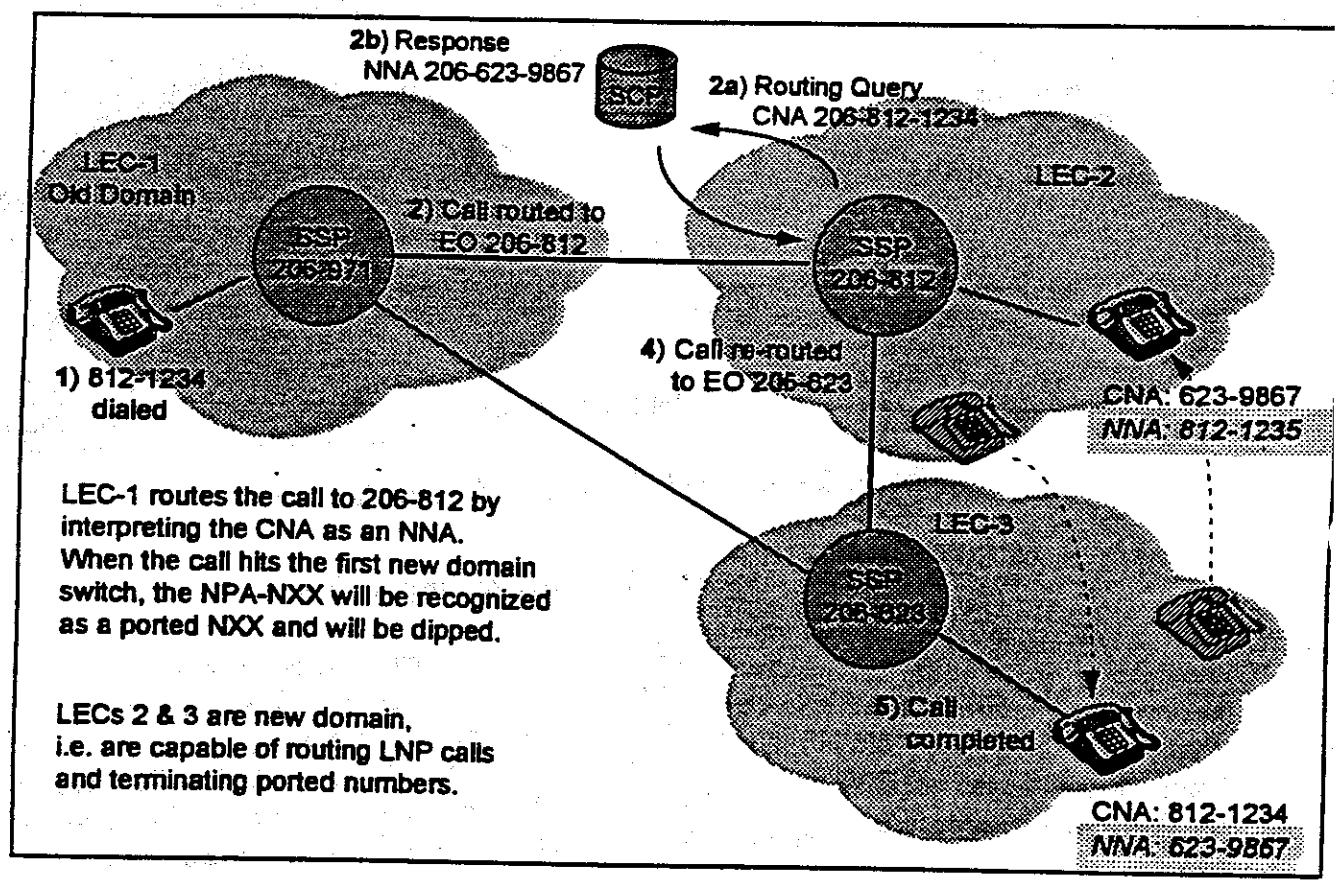


Figure 3 - Sample Local Call from Non-LNP Network

13.2.3.2.3 IXC Call

Figure 4 - Sample Inter-Exchange Portable Call' illustrates a sample inter-exchange toll call to a ported number, where the IC is LNP-capable (i.e. new domain). Generally, inter-exchange calls will not be dipped by the originating LEC, even if it's a new domain LEC. Instead an N-1 policy is supported for trigger placement, where conforming IC's perform dips. In this example, a toll call is placed from LEC-1 (708-312 switch) to a ported number served by LEC-3 in another local region:

1. A call is placed to CNA 206-812-1234 from a phone in LEC-1's network. The CNA NPA-NXX prefix does not match any provisioned LNP triggers in the originating switch/network (i.e. it's not a locally ported number).

2. The call is routed to the IC based on the subscriber's PIC (presubscribed inter-exchange carrier), with the CNA value in the CdPN parameter.

3. Upon receiving the call, the IC's POP switch encounters an LNP trigger (the forward dip indicator is off) which causes a query to be launched to the LNP SCP serving the IC. The SCP translates the CdPN from it's CNA value of 206-812-1234 to the associated NNA value for Sub-1 of 206-623-9867, as before.

4. The IC network routes the call based on the NNA value in the CdPN parameter which identifies LEC-3's 206-623 EO. The IC must forward all LNP-modified signaling parameters to LEC-3 (the terminating LEC).

5. The call is completed to Sub-1's line.

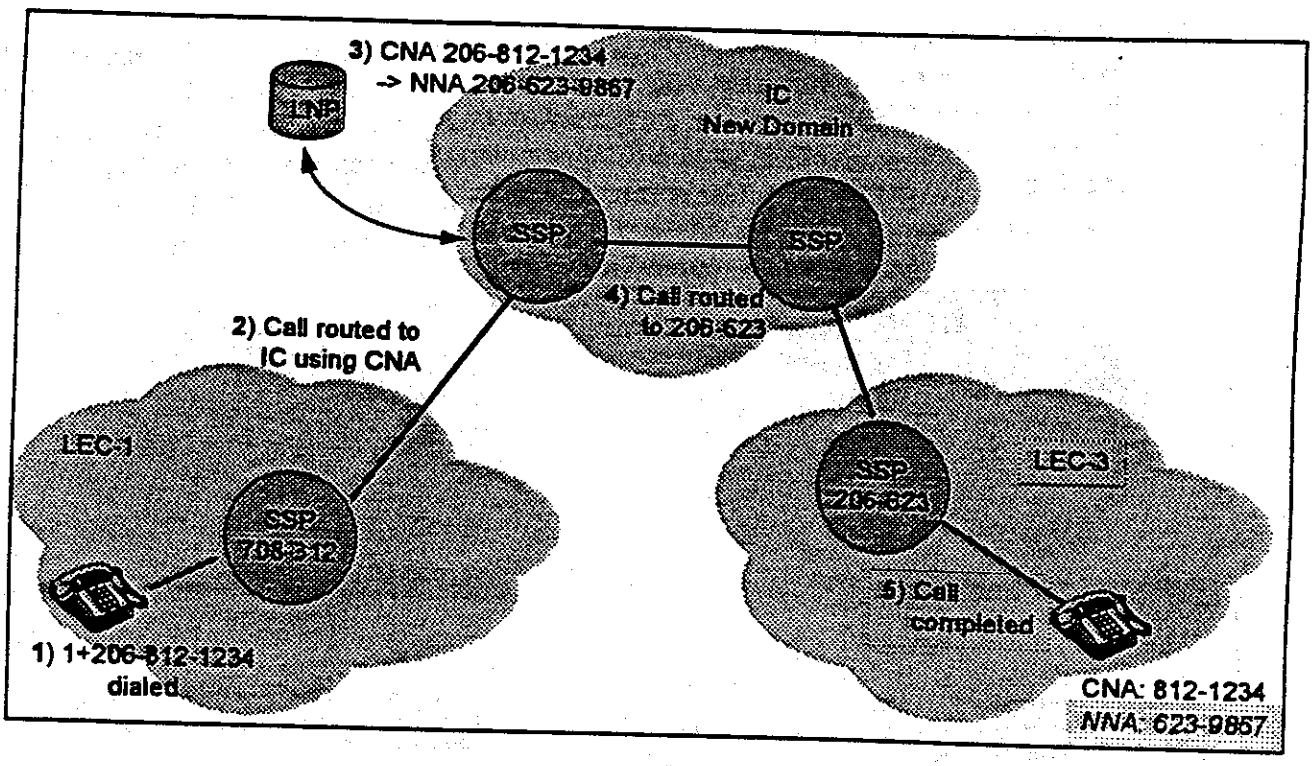


Figure 4 - Sample Inter-Exchange Portable Call

13.2.3.2.4 Call to Mobile Subscriber using Dynamic Addressing

Figure 5 - Sample Call to Portable Mobile Subscriber using Dynamic Addressing' illustrates the use of dynamic addresses for calls placed, in this example, to a mobile ported subscriber. In this scenario, the subscriber's wireless LSP has elected to flag this subscriber's CNA for

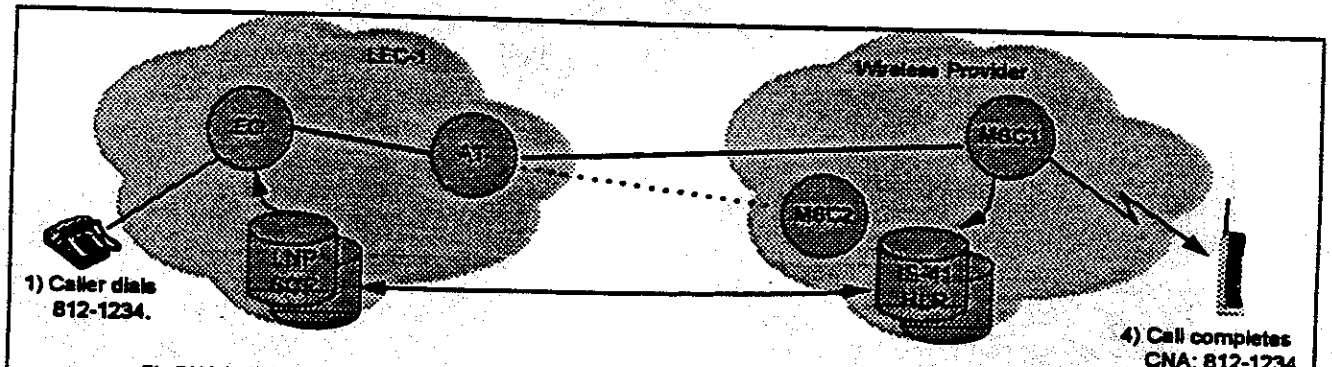
dynamic assignment. No NNA has been pre-assigned in the LNP database, the NNA instead is requested dynamically via SCP-to-HLR query to the subscriber's LSP. The NNA, once obtained, is treated as a TLDN when the incoming call is received at the visiting MSC.

1. Caller (presumably wireline, otherwise a native IS-41-based LNP mechanism might be employed wireless-to-wireless) dials a mobile ported number (812-1234) from LEC-1 network.

2. LEC-1 network triggers based on CNA, and dips into LNP SCP. LNP SCP record for the CNA indicates dynamic NNA assignment. An IS-41 RouteReq is launched from LEC-1's LNP SCP to the subscriber's HLR. The HLR obtains a TLDN, in consultation with a VLR if roaming, and returns the TLDN to the querying LNP SCP. The LNP SCP returns the TLDN as the NNA, as though it had the TLDN in the database.

3. LEC-1 routes the call outbound with the TLDN as the NNA, the other LNP call parameters (GAP_{LNP} and FCI) are forwarded as well since LEC-1 is unaware of the nature of the destination network, nor that the NNA value is really a TLDN. The TLDN routes the call to the serving MSC for the subscriber.

4. Upon receiving the incoming call, the serving MSC associates the incoming TLDN with the CNA of the subscriber (previously setup via the IS-41 RouteReq). The other LNP call parameters (GAP_{LNP} and FCI) may or may not be utilized with the MSC if forwarded via ISUP. If the interconnect facilities are inband (e.g. DTMF or MF), the trunk group at the LEC-1's AT is class marked to outpulse the CdPN as the called party number. The subscriber's terminal is paged and presumably answers the call.



☆ LNP SCP-to-HLR interaction is used to implement a dynamic addressing LNP capability with wireless providers. The NNA obtained at the point of dip (N-1) will have to be dynamically determined by the subscriber's service provider (via the HLR). The returned NNA is a TLDN that will route the call directly to the MSC to serving the dialed mobile subscriber. This functionality can be used to provide direct call delivery for wireline or wireless calls to autoroamers. The LNP SCP mimics an IS-41 gateway MSC for transparency with other MSC's.

Figure 5 - Sample Call to Portable Mobile Subscriber using Dynamic Addressing

13.2.3.3 TCAP Message Flows

Figure 6 through Figure 8 illustrate the three possible TCAP message routing options described in Table 1 - SCP-based 10-digit TCAP Routing Options' for implementing 10-digit message routing in an LNP environment. Figure 9 - Example: LIDB Query from Non-LNP Network' illustrates that TCAP queries (LIDB/ABS in this example) from outside the local LNP area can be routed properly via the donor network similar to the way donor networks are required to provide fail-safe (i.e. terminating) routing for calls.

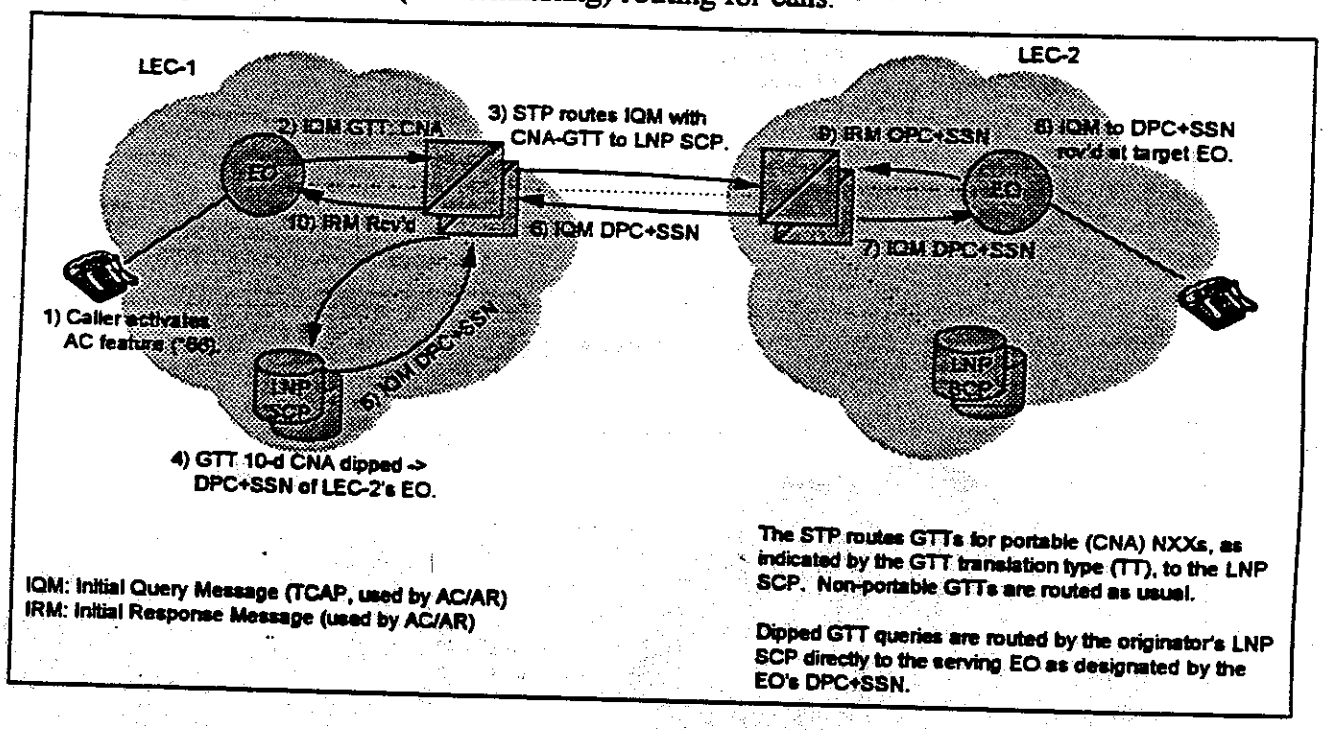


Figure 6 - Direct DPC Routing

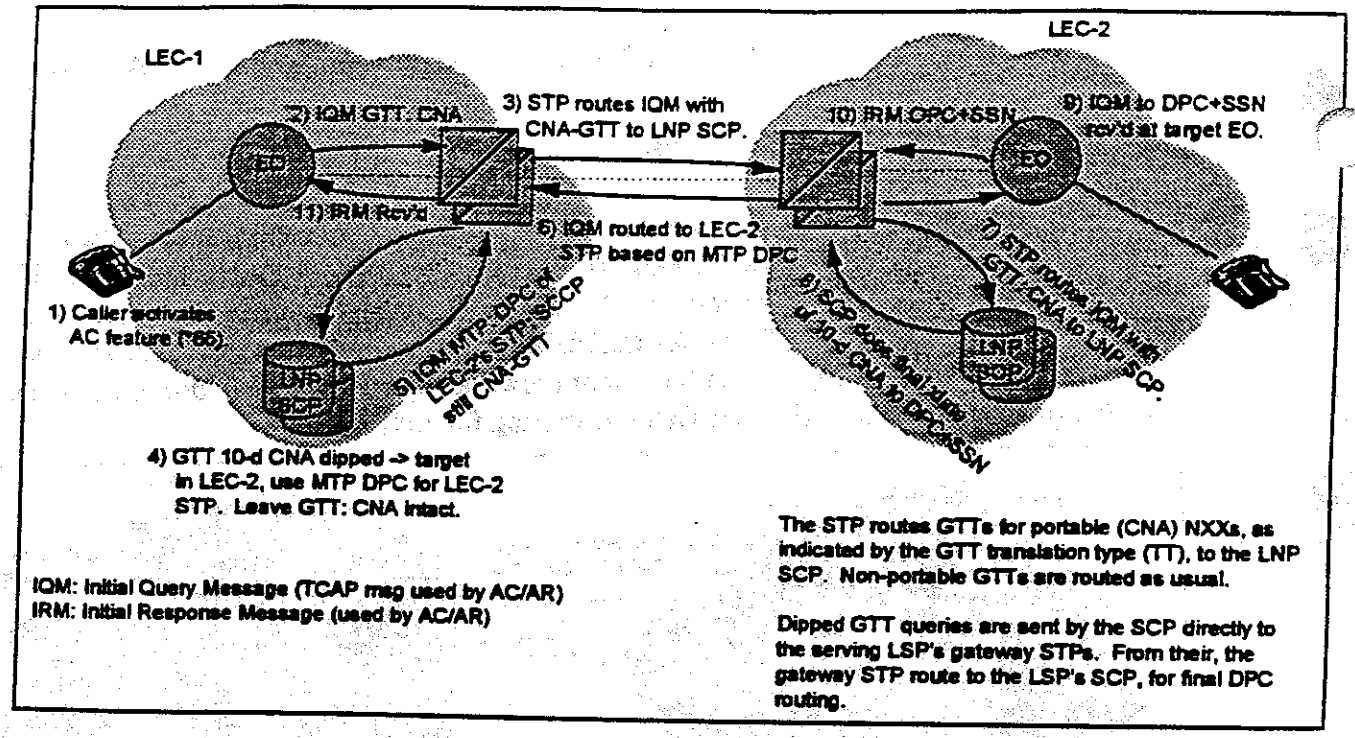


Figure 7 - Gateway DPC Routing

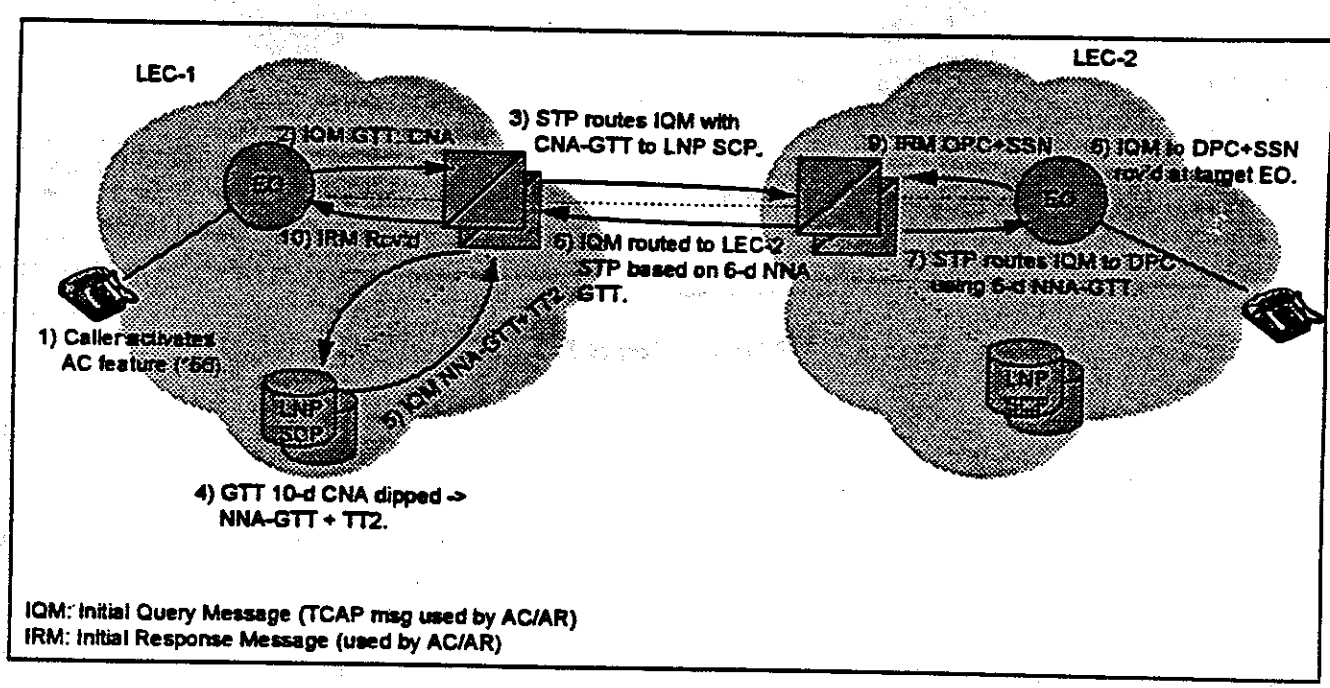


Figure 8 - Replicated GTT Routing

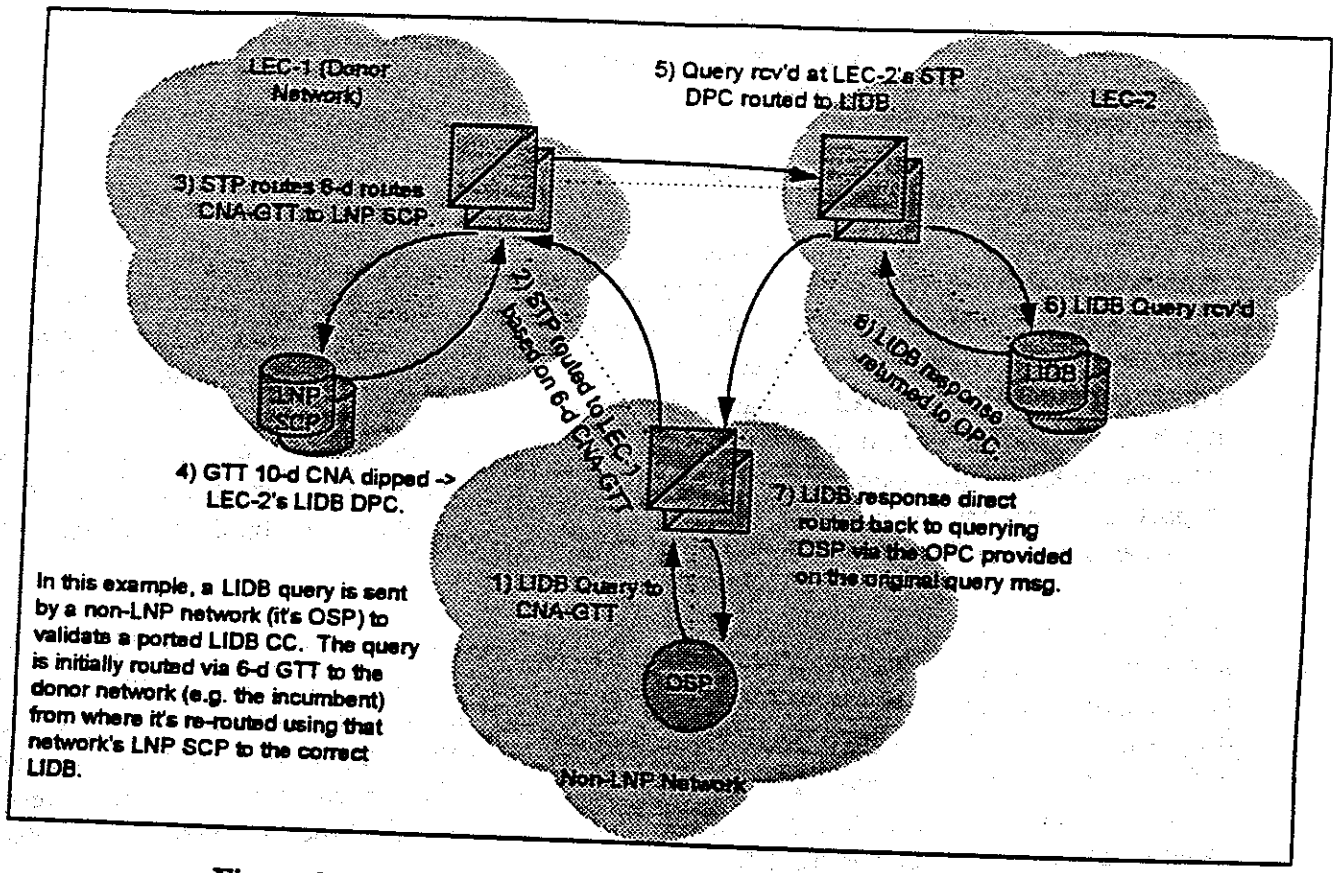


Figure 9 - Example: LIDB Query from Non-LNP Network

13.2.4 Network Impacts

The permanent deployment of LNP will require upgrades to LNP-participating networks as described below. The impacts described are common to the permanent deployment of a database solution.

13.2.4.1 Switching

Participating end-offices will require switch generic upgrades to support LNP-specialized triggering, ported line provisioning, call recording, and incoming ported call translation. Switch generics conforming to LRN will also qualify as LANP conforming. An LANP conforming office need only support one of the ported line addressing modes (e.g. single or split), though the functional differences do not preclude the potential for supporting both simultaneously.

The functional differences between the LNP development required for either addressing mode are: (a) in the LNP trigger, intra-office look-ahead be performed by consulting a different translation table (open DN's vs. public address (CNA) table) depending on the address mode used; (b) in ported line provisioning, with split numbering the CNA and NNA are datafilled in the switch associated with the line to insure the CgPN is populated with CNA value for outbound calls, and that the LNP trigger look-ahead function is able to translate a CNA to

line/NNA for intra-office query suppression; and (c) in incoming ported call translation, if the incoming NNA is an single number address (i.e. an LRN) then a CdPN-GAP swap is performed prior to performing line translations.

13.2.4.2 Signaling Standards

As a minimum, T1S1.3 standards work is required to assign new code points for the GAP type, and assignment of an un-used bit in the FCI for the forward dip indicator. These are identical to standards required for LRN. While standards work is required, the assignment of new code points in existing parameters is substantially less onerous than attempting to create entirely new parameters. Additionally, standards work for call recording in connection with location portability is also appropriate -- ISUP parameters are needed to transport this information for downstream call recording availability. The JIP should be standardized for use in ported call origination processing, and a new GDP type code point should be allocated for ported end-user/service-provider/rate-center identification.

Again, the use of existing parameters should prevent impacts to non-LNP capable intermediate switches, to the extent they conform to the letter of T1S1.3. Potential impacts may occur due to: unintended parameter screening; not passing reserved (forward dip indicator is assigned out a currently reserved bit) FCI bits through; screening of unrecognized GAP or GDP parameter types; and screening of multiple GAP parameters, even of different types. These potential issues for non-LNP capable, but LNP conforming, intermediate switches are generic to LANP and LRN.

13.2.4.3 Signaling Networks

As in any SS7 database LNP solution, existing SS7 signaling networks will require upgrading to support the incremental message traffic generated. Additional message traffic is generated by: switch LNP database queries and responses; and routing affected SS7/TCAP messages via an LNP SCP for 10-digit GTT routing. Changes to STP 6-d GTT routing translation tables will be required to route affected TCAP messages via the LNP SCP.

13.2.4.4 LNP Routing Database

LNP SCP's will be deployed within, or made accessible to, LNP-capable networks to service routing queries from network switches as well as perform 10-digit GTT routing of TCAP messages on behalf of the signaling network.

The LNP database requirements in support of LANP are generic to LNP, as is the LNP administrative infrastructure required to maintain it. Each ported number (CNA) will be stored in the database as a primary lookup key, along with it's associated NNA, TCAP message routing information (e.g. LIDB, end-office routing, HLR routing), and eventually, end-user location identification for call recording purposes.

13.2.4.5 Networks Involved

Networks of service providers who wish to participate in LNP, by porting numbers into and out of their network, will require upgrading. Also, networks of any other involved service providers, i.e. those who may be transporting calls to ported numbers but not necessarily providing local service, may also wish to perform LNP call routing for cost or efficiency reasons and may elect to participate as well. Non LNP-capable networks are not functionally impacted, and continue to perform default routing based on the CNA value.

13.2.4.6 Operational Support Systems (OSS's)

OSS's are seriously impacted by LNP generically, as a result of portability breaking the fundamental identify between a number and it's routing -- an identity with which the PSTN and it's support infrastructure has evolved over the decades. Characterizing the impacts to these systems across the industry is impossible due to the fact that different OSS's and different OSS philosophies are used by different industry segments, e.g.: incumbent LEC's, new entrants, IC's, cellular, and emerging PCS and broadband. These issues differ not just from RBOC to RBOC, even though they use common systems, but even by state to state within a given RBOC's region.

The conclusions offered so far from impacts analysis and trial activities indicate:

1. Different industry segments are impacted disproportionately, depending upon the addressing mode (single vs. split) utilized, if a single one is mandated. No one mode was clearly best for all stakeholders in LNP.

2. The interaction between addressing mode and provisioning mode (which numbers are open in the EO: CNA only; NNA only; or both CNA & NNA) is radically different on different switch types.

3. Secondary switch impacts resulting from LNP were also significant: e.g. open NXX limitations; sparsely populated NXX overhead.

4. Wireless participation in LNP has major impacts, often broader than in the wireline arena. The ability to support a TLDN-like addressing mode for ported call handling may allow wireless providers to defer signaling and switch upgrades to participate.

5. Single number addressing, when used with a rate center-specific, reseller-specific, or large end-user specific NNA allocation policy, generated an identical logical data model (LDM) for the LNP SMS as did using split numbering. Billing-related systems functionality encouraged, rather than discouraged, the allocation of customer-specific NNA's.

6. The intermixed use of both addressing modes did not force different or conflicting OSS impacts, and in some cases avoided the need for significant work to handle special case impacts (e.g. DID, Centrex) where only one addressing mode was used. Intra-service

provider OSS impacts could be minimized by crafting addressing and provisioning policies to minimize overall impacts on OSS's and switches.

7. The LDM for the local-area LNP SMS (operated by the LNASC) was not impacted by choice of addressing mode. Consequently there were no inter-service provider impacts as a result of the addressing mode policy employed by individual service providers.

8. Consequently, recognizing the need for service provider's to minimize their own OSS and switch impacts, emphasizing service provider autonomy in these areas (including choice of addressing and provisioning policies) provides maximum impact relief (i.e. diversity principle).

13.2.5 Service Impacts

Preserving network services and features are essential to LNP as is the necessity for effecting ported call routing. Feature transparency is provided in LANP through: elimination of adverse feature-trigger interactions through the development of new LNP-specialized triggers; transparent 10-d GTT routing of TCAP messages (e.g. for CLASS and LIDB/ABS); generation of correct (CNA) CgPN for outbound calls from ported lines in support of so-called ANI-based features; and inbound ported call translation facilities (for both single and split number addressing modes) to insure hand-off of expected called and calling party number values for correct feature operation, e.g. forwarding, DID & ISDN signaling to CPE.

13.2.6 End-User Impacts

LANP imposes no inherent end-user impacts due to direct call routing to actual service office and feature transparency (as described in 0 13.2.5 Service Impacts above).

13.3 MCImetro Carrier Portability Code

This section outlines the Carrier Portability Code developed by MCImetro and its multi-vendor task forces which includes Siemens, Nortel, DSC, and Tandem.

13.3.1 General Description

MCImetro's Local Number Portability (LNP) model is an IN/AIN-based methodology that uses a Local Number Portability database to obtain the routing information necessary to terminate calls to subscribers who have changed Local Service Providers. Local Service Provider is assigned a unique three-digit Carrier Portability Code (CPC) in each LNP area whether Local Access and Transport Area (LATA) or Numbering Plan Area (NPA). This CPC is stored with the Directory Number of the subscriber in the LNP database, and replaces the NPA for call routing purposes.

This LNP solution allows Local Number Portability to be deployed in pockets, or as portability "islands", without requiring extensive changes to the existing network architecture or to the switch software. Because it uses the existing TCAP 800 Intelligent Network (IN) and Advanced Intelligent Network Release 0.1 (AIN 0.1) protocols and triggers, CPC can be introduced seamlessly into local service areas without creating the problems inherent in other LNP concepts.

Specifically, the CPC model offers the following advantages and benefits:

- Proven in prototype testing across five switch types (5ESS, DMS-100, DMS-250, DEX600, and EWSD switches)
- Complete transparency to all subscribers
- Existing IN/AIN 0.1 protocols
- Requires minimal software changes when used with IN architecture
- Of inherent central office routing capabilities
- Supports both Multi-Frequency (MF) and Signaling System 7 (SS7) trunks
- Transparently supports widely deployed subscriber features (e.g., Call Forwarding, Calling Number Delivery, Customer Originated Trace, etc.)
- Compatible with Non-LNP-capable offices

13.3.2 Architecture Description

To provide LNP to a network, the Carrier Portability Code (CPC) solution requires only the addition of the LNP database. The CPC can be any three digits between 200-999, with the

exception of SAC, N11, and valid or reserved NPA codes. The CPC needs to be unique only within the LATA because it is never delivered to an inter-exchange carrier by the originating Local Service Provider.

Since the CPC is in the same format as the NPA, it can be accommodated by either MF or SS7 signaling protocols. This feature offers significant cost advantages, in that existing direct MF routes between non-SS7 capable and SS7-equipped offices can be maintained, and MF overflow trunk groups between end offices remain useable. Incoming calls from non-LNP-capable switches are handled by existing local tandem end office functionality, which treats the call as a local origination.

In this solution, when a switch queries the SCP with the digits NPA-NXX-XXXX, the SCP checks the LNP posted-number database. If it locates the number, it changes the NPA digits to the appropriate CPC digits, and returns CPC-NXX-XXXX to the querying switch. Because non posted numbers need not be stored in the database, the SCP may not find NPA-NXX-XXXX. It then refers to a default table and provides the querying switch with the CPC of the incumbent Local Service Provider for that particular NXX.

With respect to trigger location (i.e., which switch involved in a call issues the query), MCImetro's model follows the industry-accepted N-1 local number portability network hierarchy. Under this hierarchy, participating interexchange carriers are responsible for querying the LNP database for InterLATA calls and for delivering their calls to the proper Local Service Provider. Participating carriers with TCAP capabilities can query the LNP database using either the IN (TR-TSY-000533) or AIN 0.1 (TR-NWT-001284 and TR-NWT-001285) protocols. Companies whose switches do not incorporate these industry-standard protocols must obtain their own copy of the LNP database.

In an LNP environment, the NPA-NXX no longer defines the address (physical location) of a subscriber. To accommodate inter-switch TCAP queries for CLASS features (e.g., Automatic Recall/Automatic Callback), STPs will be required to perform 10-digit Global Title Translation (GTT) for the NPA-NXXs opened for portability to new Local Service Providers. Solutions to this problem are currently being explored: either by having the switch send the CPC-NXX in the GTT query or by having the SCP perform the 10-digit GTT function while the STP continues to perform six-digit GTT.

The CPC solution does not affect features that use the Calling Party Number and redirecting number. For calls that involve features that use a previously stored called- party number (e.g., Call Forwarding, Speed Calling), an LNP database query is necessary to ensure that the current Local Service Provider is used to route the call. Since the query is launched prior to routing the call, a query is not necessary when these features are activated. To ensure that these features work properly on the terminating side, the terminating office must change the CPC back to the corresponding NPA prior to handling the call. However, this is only required for those exceptional cases where 10 digits are delivered to the terminating office (i.e., when the switch serves subscribers in more than one NPA).

The CPC solution can be expanded to offer Location Portability within a rate center. The following paragraphs describe the concept in detail.

In order for calls to subscribers within the same NXX to be served by multiple end offices belonging to the same Local Service Provider, the LNP database must contain a routing address unique to each end office in the portability area. This proposed that each end office within a portability area be assigned a unique 10-digit routing address consisting of the CPC, an NXX that been assigned to the end office in the LERG database, along with a four digit number determined by the new Local Service Provider (CPC-NXX-XXXX). This is very similar to AT&T's LRN model with the exception that the 10-digit routing number is retranslated in the terminating office to the ported subscriber's directory number. This re-translation function, which should already be available in all end offices, allows location portability to be offered in areas where only MF signaling is available. If SS7 inter-office trunks are widely deployed, our model would follow AT&T's LRN model in that the routing address retrieved from the LNP database will be placed in the Called Party Number field, and the Called Party's number (ported subscriber's DN) will be placed in the Generic Address Parameter field. The originating office would only populate the GAP field if the database returns a routing address (e.g., the last seven digits of the number returned in the query response do NOT match the last seven digits of the called party's number).

In the MF case, when a call is made to the subscriber that has physically moved (708-752-5769), the originating office will launch a query to determine the routing for the call as is done with the CPC model today. The database will respond with a unique10-digit routing address (CPC-488-4952) and the call will be routed to the terminating end office based on normal 6-digit translation of the CPC-NXX digits. This 10-digit routing address identifies both the end office to which the subscriber has moved (CPC-488), as well as an index into the terminating end office's Directory Number translator (708-488-4952, after the CPC has been replaced with the NPA). This index will point to the subscriber's actual directory number (708-752-5769). Once the re-translation is performed, the call will be completed to that directory number.

This solution will initially require the use of two directory numbers for those subscribers using location portability. However, this requirement can be removed once switch vendors implement the SS7 protocol changes required to support the transport of the called party number in the GAP field. The 10-digit routing number would be assigned by the new service provider from a pool of "location routing numbers" set aside in one NXX owned by that Local Service Provider. Since this location portability solution uses existing 6-digit routing based on the CPC-NXX, no changes would be required in Access Tandem offices.

If SS7 is widely deployed, we propose that the Called Party Number (CPN) field be used to transport the 10-digit routing number returned from the LNP database (CPC-488-4952) and the GAP field be used to transport the Called Party Number (708-752-5769). This is no different from AT&T's LRN proposal. If the access tandem determines that only an MF route to the terminating office is available, the called party number in the GAP field is simply discarded. For the short term, this solution could be deployed without the SS7 changes

necessary to support the new use of the GAP field for transport of the called party's number, since it can be used in a MF environment. Longer term, the SS7 enhancements would remove the need to perform the re-translation in the terminating office, thus eliminating the need for two DNs for location portability.

13.3.3 Method of Operations

Figures 13-1 and 13-2 illustrate the call-processing logic for calls to a ported subscriber via IN and AIN triggers respectively. Numbers in parentheses in the following paragraphs correspond to the circled numbers in the referenced figures.

Figure 13-1 illustrates the flow for an originating call using an IN Trigger:

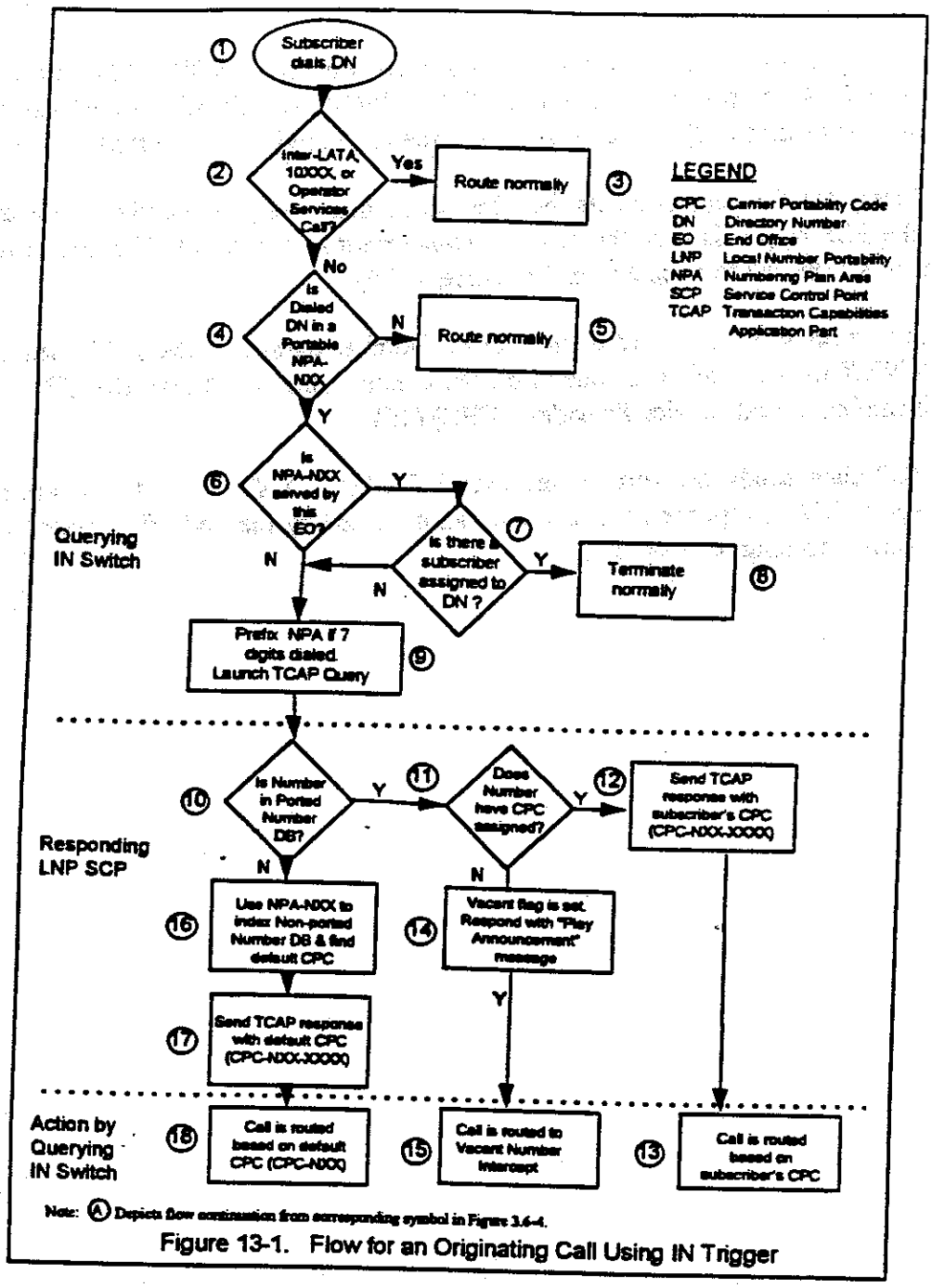
- A Subscriber initiates the call (1).
- The serving end office determines whether the call is an Inter-LATA call made via 1+ or 10XXX dialing, or a call requiring Operator Services (2). If either of these, the call is routed to the appropriate carrier or operator services switch, using current methods (3).
- If the call is neither an Inter-LATA nor an Operator Services call, the end office determines whether the dialed destination is within a portable NXX by checking its own internal database using the digit translation functions of the switch (4).
- If the dialed number is not within an NXX that is marked as portable, the call is routed normally (5).
- If the dialed number is within a portable NXX, another database check determines whether the NXX is served locally (6).
- If the NXX is local (i.e., the office serves subscribers in that NXX), the office attempts to translate the number to a subscriber (7).
- If the subscriber is served by the local office, the call is an intraswitch call and is routed normally (8).
- If the local office does not provide service for the dialed directory number, the end office prefixes the NPA (if only 7 digits were dialed) and launches a TCAP query sending NPA+NXX-XXXX to the LNP database to determine how to route the call (9).
- The SCP checks the Ported Number database for an entry of the dialed number (10).

- If an entry is found, and the number has a corresponding CPC (11), the SCP sender a TCAP response containing the CPC (CPC-NXX-XXXX) is sent back to the querying office (12), which then routes the call based on this number (13).

- If an entry for the number exists, but the vacant flag is set, the number is vacant, and the SCP responds with the *Play Announcement* message (14).The end office then routes the call to vacant number intercept (15).

- If the number was not found in the Ported Number database, the SCP uses the NPA-NXX of the number to index into the default table to retrieve the CPC of the incumbnt Local Service Provider's CPC) (16).

- the SCP then sends the routing number (CPC-NXX-XXXX) to the querying office in a TCAP response (17), and the call is routed by the end office based on the returned routing number (18).



Note: Ⓐ Depicts flow continuation from corresponding symbol in Figure 3.6-4.

Figure 13-1. Flow for an Originating Call Using IN Trigger

Figure 13-2 depicts the flow for an originating call from a switch using the AIN 0.1 protocol :

- A suscriber initiated the call (1).
- The serving end office compares the dialed digits to the ten digit Public Office Dialing Plan (PODP) Directory Number (DN) list (2). If the dialed number is found, the end office sends an AIN 0.1 *InfoAnalyzed* message to the LNP database (5).
- If an entry is not found in the ten digit PODP DN list, the serving office then compares the NPA-NXX to the six digit PODP DN list (3). If an entry is found, the end office launches an AIN 0.1 *InfoAnalyzed* query to the LNP database (5).
- If an entry is not found, the number is not within a portable NXX, and the call is routed normally (4).
- Upon receipt of the *InfoAnalyzed* message, the SCP determines whether the call was made via 0+ or 10XXX+ dialing. If so, the SCP sends a *Continue* message to the querying office with the dialed digits unchanged (7), and the call is routed to the Operator Services switch or the appropriate carrier (8).
- If 0+ or 10XXX+ was not dialed, the SCP checks the Ported Number database for an entry of the dialed number (9). If an entry is found, and the number has a corresponding CPC (10), an *AnalyzeRoute* message containing the CPC (CPC-NXX-XXXX) is sent back to the querying office (11) which then routes the call based on this number (12).
- If an entry an exists in the Ported Number database , but the vacant flag is set, the number is vacant and the SCP responds with the *SendToResource* message (13). The end office then routes the call to vacant number intercept (14).
- If the number was not found in the Ported Number database (9), the SCP uses the NPA-NXX of the number to index into the default table to retrieve the CPC of the incumbent service provider (15).
- The SCP then sends the routing number (CPC-NXX-XXXX) to the querying office in an *AnalyzeRoute* message (16), and the call is routed by the end office based on the returned routing number (17).

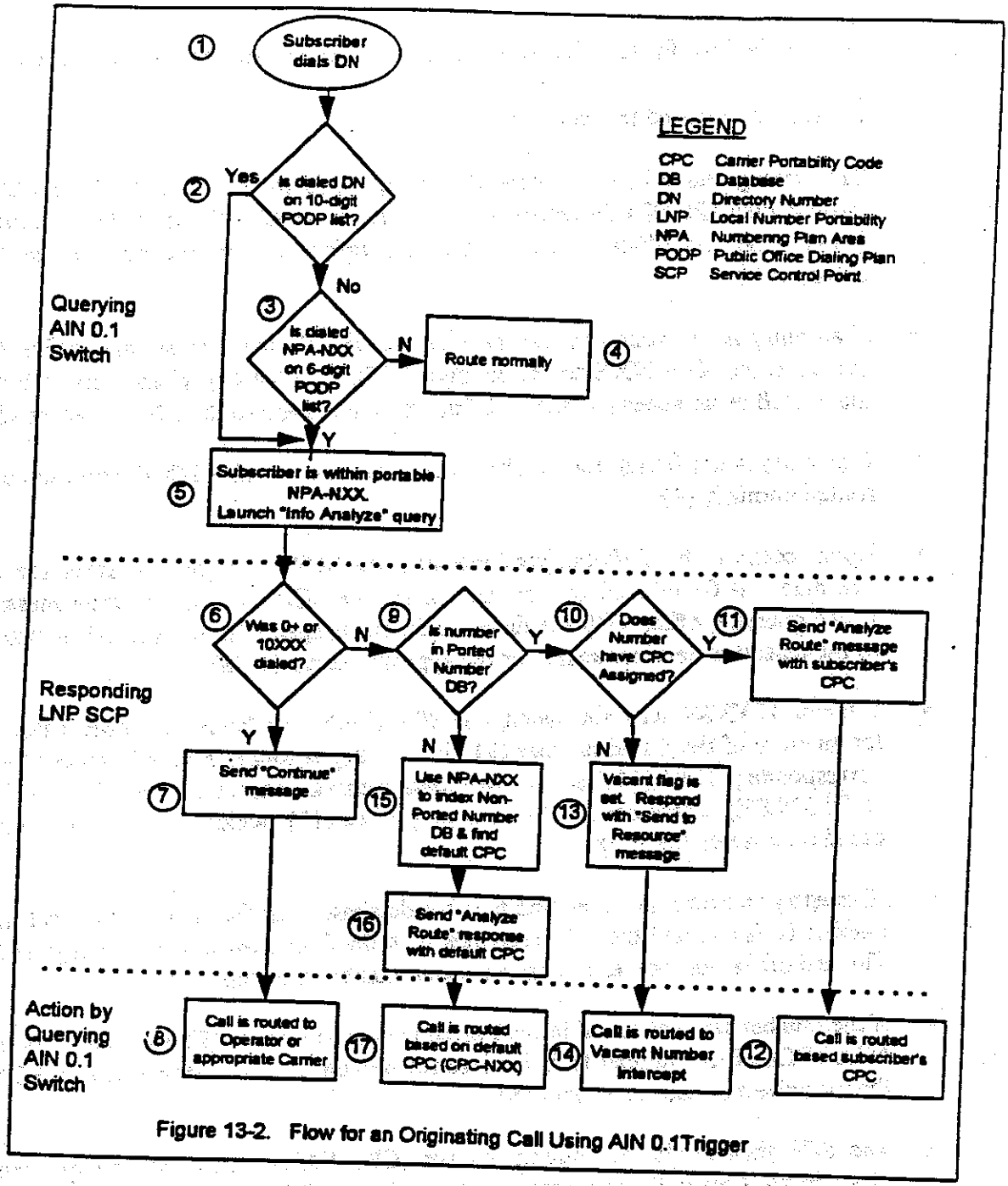


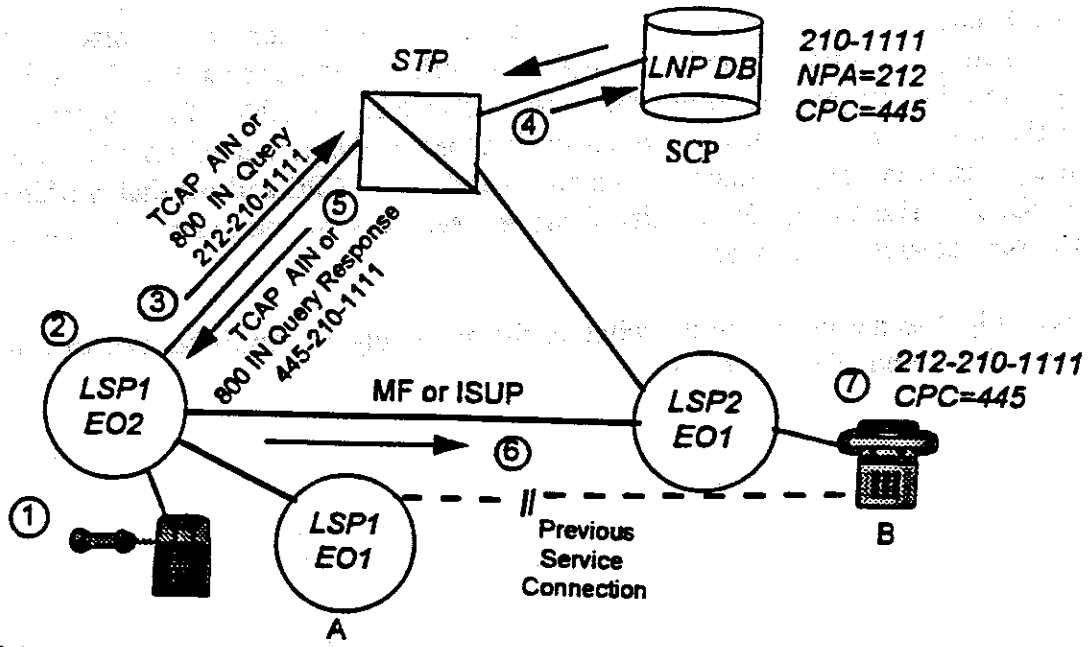
Figure 13-2. Flow for an Originating Call Using AIN 0.1Trigger

13.3.3 (b) Method of operations based on whether the ported number originates or terminates the call.

The use of the CPC does not introduce any changes to existing call processing or routing. When a ported subscriber initiates a call, the Calling Party Number is the subscriber's Directory Number in the NPA-NXX-XXXX format.

As Figure 13-3 illustrates, when a local call is terminated to a ported subscriber, the originating end office (or an LNP-capable end office) will launch a TCAP 800 IN or AIN 0.1 query to the database to retrieve the subscriber's CPC. The LNP SCP responds with the CPC + the last seven digits of the Directory Number of the ported subscriber. The call is then routed using existing six-digit translations based on the CPC and the dialed office code (CPC + NXX). The Carrier Portability Code is used only to route the call and is completely transparent to the subscriber.

Naturally, this means that each switch in the portability area must be able to route on CPCs just as it currently does on NPAs.



Subscriber B, located in a portable NPA-NXX, changes from LSP1 to LSP2 without changing DN (212) 210-1111. The new routing flow for subscriber B is as follows:

1. Subscriber A calls Subscriber B using 210-2111
2. LSP1 EO2 checks its internal Database for presence of Subscriber B. If the DN is not found, a check for ported DN is required.
3. Call is retranslated; TCAP processing prefixes 212 NPA & launches query with 212-210-1111
4. SCP searches its database for 212-210-1111, finds entry with CPC of 445
5. SCP sends query response to LSP1 EO2 with 445-210-1111
6. LSP1 EO2 translates the call using the new digits (445-210-1111) and routes the call to LSP2 EO1
7. LSP2 EO1 completes the call to Subscriber B

LEGEND

AIN	Advanced Intelligent Network
DB	Database
DN	Directory Number
EO	End Office
CPC	Carrier Portability Code
IN	Intelligent Network
ISUP	ISDN User Part
LNP	Local Number Portability
LSP	Local Service Provider
MF	Multi-Frequency
NPA	Numbering Plan Area
STP	Signal Transfer Point
TCAP	Transaction Capabilities Application Part
SCP	Service Control Print

Figure 13-3. Call Flow for a Subscriber Who Has Changed Local Service Providers

13.3.3 (c) Method of operation for intraswitch calls.

When using IN method of query the CPC solution does not require a database query for an intraswitch call (i.e., one that involves only one switch). By reducing traffic on existing 557 links without adversly affecting suscribers this solution yields a performance advantage over models that requir· database queries for intraswitch calls.

Only using the AIN 0.1 method does the end office initiate a query to the LNP database for Intraswitch calls. The database returns the CPC-NXX-XXX assigned to that end office, which then terminates the call.

13.3.4 Network Impacts

The following subsections describe the impacts of the CPC solution on various parts of the network.

13.3.4.1 Switch

The CPC solution follows the guideline of N-1 switch query to the LNP database. Depending on the call type, this query may be generated by the originating EO or AT, by the N-1 switch in the inter-exchange carrier's network, or in the Cellular carrier's network.

Originating Switch
For local calls, the originating EO switch will generate the LNP query using either the IN or AIN 0.1 method. After the query is answered, the originating switch uses the CPC-NXX-XXXX in the response message to complete the call to the LSP switch identified by the CPC-NXX.

Tandem Switch
If, for a local call, the originating switch cannot query the LNP database, the call may be routed to the Access Tandem switch that is capable of providing such queries. The AT will obtain the CPC-NXX-XXXX information from the SCP and route to the LSP accordingly.

Translation
The CPC model uses the existing 6-digit switch translation and routing mechanisms. The reponses from the LNP SCP are in the NANP form of CPC-NXX-XXXX. Calls may be routed to the appropriate LSP based on the CPC-NXX.

Signaling
Since the CPC is in the same format as the NPA in the called party number, it operates using either MF or SS7 signaling protocols for call setup. This feature offers significant cost advantages by allowing carriers to continue to use existing direct MF routes between non-SS7 capable and SS7-equipped offices can be maintained, and MF overflow trunk groups between end offices can continue to be used.

Database Capacity
The size of the LNP database is minimized by not including non-ported numbers (numbers still being served by the incumbent Local Service Provider). When a non-ported number is received in an LNP query, the SCP will simply respond by sending back the default CPC for the NPA-NXX (CPC-NXX-XXXX), and the querying end office will route the call to the current Local Service Provider using existing six-digit routing functionality.

As local number portability is widely deployed, no individual office will actually own a portable NXX. Hence, vacant number processing will be handled by the SCP.

Interworking
The CPC solution minimizes interworking with existing systems and processes by using a single number solution, by using existing standards for querying, and by supporting both SS7/ISUP and MF signaling for call setup.

Number of SCPs
The CPC solution is not dependent on any single vendor and does not require a specific number of SCPs to be deployed. The LNP SCP may be deployed centrally, regionally, or locally. There may be multiple copies of the Database may be maintained in different networks, in that case, database synchronizaton is critical. The service management system provide updates to multiple SCPs if required.

Query demand
By minimizing the number of LNP database queries, significant cost and performance advantages are obtained. The CPC model requires an LNP database query only when the dialed Intra-LATA number is not in the originating end office's database and the NPA-NXX is marked in the originating end office's routing translations as being "portable". CPC does not require an LNP database query by the originating Local Service Provider using either the Intelligent Network (TR-TSY-000533) or the AIN 0.1 implementation approach for any of the following calls :

- Local terminating calls to numbers housed in the switch database
- Any Inter-LATA call type (routed to the carrier)
- Calls from LNP-capable switches
- Calls to unpopulated Centrex intercom numbers
- Calls to NPA-NXXs where portability is not allowed
- Calls where the dialed number is SAC code or other special number.

13.3.4.2 Post Dial Delay

The TCAP response time is estimated to be 150 to 300 milliseconds for a round trip-query and response from an SSP to an SCP and back. This is the only additonal post dial time for subscribers in portable NPA-NXXs.

13.3.4.3 E911 Impacts

CPC has no impacts on existing 911 service. Ported subscribers will continue to dial 911 to reach a Public Safety Services Answering Point (PSAP). Where the operator obtains calling and location information verbally from the caller, LNP does not change this interaction.

For Enhanced 911 (E911) service, the PSAP operator must receive the correct Automatic Number Identification (ANI) for the caller in order to retrieve the correct information from the Automatic Location Identification (ALI) database. CPC leaves the ANI unchanged; it is the subscriber's NPA-NXX-XXXX. As a result, E911 calls from ported subscribers will process normally.

In an area with multiple Local Service Providers, each LSP with a PSAP must provide access between this PSAP and the ALI database. Each LSP must either serve its ported (and non-ported) subscribers using a PSAP based in its network, or make arrangements with another LSP to route E911 calls to their PSAPs.

13.3.4.4 SMS Database

The SMS solution is independent of the LNP solution, and should be evaluated with different criteria.

13.3.4.5 SCP Database Responses

The CPC model is based on current standards, requires little or no development, and supports the many different network implementations currently deployed. It offers a choice of implementation via either an IN or AIN 0.1 protocol.

The IN interface was developed as another application of the TCAP 800 protocol and requires minimal changes to switch software.

The AIN 0.1 approach utilizes the Public Office Dialing Plan (PODP), or 3/6/10, trigger. Other possible AIN 0.1 implementations to implement an alternative AIN 0.1 trigger in long term are being explored.

The LNP database is comprised of two data tables. One contains Ported and Vacant Directory Numbers (DNs); the second, is a default table that shows the CPC of the incumbent service provider. When a query is received, the SCP first uses all ten digits of the DN to search the ported/vacant DN .

As Table 13.3-1 suggests, a successful search of this database will retrieve either the CPC of the called subscriber's new Local Service Provider, or it will find that the number is not assigned, and the LNP SCP will return " Vacant Number Intercept" treatment.

Table 13.3-1 Format of the Ported Number / Vacant DN Database

Directory Number	Carrier Portability Code	Vacant (Y/N)
NPA-NXX-XXXX	XXX	N
NPA-NXX-XXXY	YYY	N
NPA-NXX-XXZZ	—	Y

13.3.4.6 Type of Number Portability Supported

The CPC solution supports Service Provider Portability, Service Portability, and Location Portability within a confined area that will be determined by the industry. The CPC solution does not dictate the confined area.

13.3.4.7 Service Interactions

CLASS Features
In an LNP environment, the NPA-NXX no longer defines the address (physical location) of a subscriber. To accommodate TCAP queries between switches for CLASS features (e.g., Automatic Callback/Automatic Recall), STPs will be required to perform 10-digit Global Title Translation (GTT) for the NPA-NXXs opened for portability.

Additionally, some triggering conflict occurs between the PODP and the AC/AR when using the AIN 0.1 based protocol to query the LNP SCP. This may be resolved by removing the restriction on the PODP trigger.

Switch Features
The CPC solution does not affect features that use the Calling Party Number and redirecting number. For calls that involve features that use a previously stored called- party number (e.g., Call Forwarding, Speed Calling), an LNP database query is necessary to ensure that the current Local Service Provider is used to route the call. Since the query is launched prior to routing the call, a query is not necessary when these features are activated. To ensure that these features work properly on the terminating side, the terminating office must change the CPC back to the corresponding NPA prior to handling the call. However, this is only required for those exceptional cases where 10 digits are delivered to the terminating office (i.e., when the switch serves subscribers in more than one NPA).

ISDN
ISDN interworking is similar to general interworking requirements previously discussed. CPC does not introduce any ISDN-specific interworking issues.

Call Forwarding
The CPC method does not affect the Calling Party Number and redirecting number. Using Called Party Number necessitates an LNP database query to ensure that the current Local Service Provider is used to route the call. Since the query is launched prior to routing the call,

a query is not necessary when this features is activated. To ensure that these features work properly on the terminating side, the terminating office must change the CPC back to the corresponding NPA prior to handling the call. However, this is only required for those exceptional cases where 10 digits are delivered to the terminating office (i.e., when the switch serves subscribers in more than one NPA).

13.3.4.8 Number Administration

The CPC solution functions using either a centralized or a de-centralized database. The industry will decide on database set-up and administration. MCImetro believes that large service providers (both LECs and IXCs) will want to have their own databases, which will be synchronized by a SMS system. A database provider may supply database services to small service providers. Although the independent database provider will not supply any proprietary information, service providers that own their own databases will likely have proprietary information along with CPC codes in their databases.

13.3.4.9 Operator Services Impact

Several possible options exist for connecting to operator centers. One possible configuration is for all Local Service Providers to be served by one operator center, which will have direct or indirect connectivity to the LSP switches. This configuration is used in the call-flow scenarios in Section 7. Another possibility is for each LSP to have its own operator center connected to their own switches. This configuration requires signaling compatibility between operator centers in order to transfer calls.

Line Information Database (LIDB) access is required for such operator services as Collect Calls and Third Party Billing Number Screening. Since the CPC model uses the actual subscriber's number (NPA-NXX-XXXX), there is no impact on LIDB-supported functions. However, as a result of local competition in some areas, each Local Service Provider may have its own LIDB that contains only information for its subscribers. The existence of multiple LIDBs in a geographical area will require 10-digit Global Title Translation at the STPs to query the appropriate LIDB. The CPC solution does not affect the format or the information stored in LIDBs, nor does it impact the format and the content of the LIDB query or response messages. The following responses assume that each LSP will have its own LIDB.

Since the CPC method does not affect the actual subscriber's number (NPA-NXX-XXXX), the impact to the existing operator center databases is minimized. The CPC solution requires the operator center to support LNP translation, which can be accomplished by querying the LNP SCP or by keeping a local copy of the LNP database.

Busy Line Verification

The lack of clear Busy Line Verification (BLV) signaling standards makes it very difficult to devise a solution for the switches to perform the LNP query. This is one of the reasons why the LNP query is to be done at the operator center.

Third Number Billing

In the CPC model, operator calls are routed to the operator center with the original dialed number intact. After the operator collects the appropriate information, the call extension leg is treated as a new call by the SSP, and may encounter an LNP query based on the Called Party Number. These services are not affected by the CPC solution.

A third party-billing call involves three call legs. The most complex situation occurs when each of the parties involved in the call is served by a different LSP, each with its own LIDB. Assume that Subscriber A initiates a third-party call by dialing 0- or 0+NPA-NXX-XXXX (1). The Local Service Provider delivers the call to the operator center (2), where an operator receives a request from Subscriber A to complete a 3rd party call to subscriber B, who is served by LSP2, and charge it to Subscriber C, who is served by LSP3. The operator performs a billing-number screening on Subscriber C by launching a LIDB query to the LSP3's LIDB. If the screening is successful, the operator then initiates a call to Subscriber C for verbal verification. The call from operator to subscriber C is treated as a new call by the serving switch and a LNP database query is performed. The LNP database returns the CPC-NXX-XXXX for Subscriber C. If subscriber C accepts the charges, the operator then releases the call to subscriber C and initiates a call to subscriber B. Again the call from the operator to Subscriber B is treated as a new call by the serving switch and it initiates an LNP database query. The LNP database returns the CPC-NXX-XXXX for Subscriber B, and the call is completed to LSP2 switch and to subscriber B.

Emergency Calls

When an operator receives an emergency call today, an emergency number database query is made based on the originator's directory number. The result is either a PSAP address or the appropriate emergency service provider such as hospital, fire station, etc.. The CPC method does not manipulate the calling party's directory number, therefore it does not impact the emergency databases. However, after location portability has been implemented, the directory number may not be linked to the location of the caller. In this case, an LNP query may be required to approximate the location of the subscriber.

0+ or 0- Calls

0+ or 0- is an access method to the operator. Typically, 0+ calls are either collect or calling-card calls. 0- calls will route directly to an operator or an operator menu and the calling party may request any available service. Using the CPC method, a calling party's directory number may be delivered to the operator for any type of necessary operator processing.

Collect or calling-card call processing requires a LIDB query to the correct LIDB provider, which requires a 10-digit Global Title Translation. Since the format of the called party number is not changed there are no impacts to the LIDB. Collect-call processing is similar to 3rd-Party billing calls; the only difference is that the billing party is the terminating party.

The CPC solution does not affect any calling-card services. For LIDB-based calling-card services, the originating operator center must query the correct LIDB database for card validation using 10-digit Global Title Translation. The format of the LIDB query and the information content of the messages is not impacted by the CPC solution. After successful LIDB query, the call is completed to the destination number. If the destination number is in a portable area, the serving operator switch must perform an LNP database query.

Directory Assistance
Directory Assistance services are provided by the originating line's serving LSP unless a different access number, (e.g., an 800 number) is dialed. In this case, the call is routed to the 800 number location based on 800 call routing. Just as with operator services centers, the LSPs may choose to have one DA center serve several LSPs, or each may have its own DA center. For efficient operation, the local DA database must contain all the numbers within a local area, regardless of the service provider.

The CPC solution does not impact the format of the DA database fields or search logic. Portability will be transparent to the DA center. If call completion is requested, a new call is initiated from the DA center to the destination number. If the destination number is a portable number, the N-1 switch will be responsible for providing an LNP query.

Public Telephone/Customer-owned Coin-operated telephone (COCOTS)
As previously discussed, CPC does not change the originating-line number information and, therefore does not change any screening requirements for coin lines. The originating lines' service provider is responsible for providing TSPS capability for public Coin phones. If the call terminates to a portable number, the N-1 switch is responsible for performing an LNP database query for translation to CPC-NXX-XXXX. As long as the portability area is within a rate center, the originating provider will be able to rate the call based on the originating and terminating NPA-NXX-XXXX, and will not require an LNP query at the originating switch.

13.3.4.10 Timing/Availability

The CPC solution has been in development since October 1994 when MCImetro assembled its multi- vendor LNP task force. Development of the Tandem SCP was completed in April 1995. The overall solution will be implemented in the NY State trial by February 1996.

No standards work is required for CPC to work in the network, but MCImetro believes that efficiencies can be gained if a dedicated trigger is allotted just for LNP and if a few other standards changes are initiated.

13.3.4.11 SS7 Impacts

The solution fully complies with the requirement of being based on the use of SS7 and an intelligent network; moreover, it provides maximum flexibility by allowing participating carriers the option of implementing the model via either an IN or AIN 0.1 architecture.

New Messages
The CPC solution maximizes the use of existing protocols, using either the TCAP 800 IN (TR-TSY-000533) or AIN 0.1 (TR-NWT-001284 and TR-NWT-001285) protocols to query the SCP for a translation of the dialed number (NPA-NXX-XXXX) to the routing number (CPC-NXX-XXXX). Since the CPC is in the same format as the NPA, it can be accommodated by either MF or SS7 signaling protocols for call setup procedure. The CPC does not require any new messages or changes to existing messages.

Capacity
Capacity impacts depend on several factors, including the topology, SCP and Switch Vendors, and number of ported NXX. The CPC solution provides an efficient method of querying the LNP SCP and minimizes unnecessary or multiple queries per call, hence it does not introduce any additional capacity constraints.

The MCImetro laboratory continues to assess capacity impacts and performance measurements.

New Standards
The CPC solution uses the following existing standards for the LNP SCP access:

- TCAP 800 IN (TR-TSY-000533) or
- AIN 0.1 (TR-NWT-001284 and TR-NWT-001285)

As a result of some prohibiting triggering mechanisms in AIN 0.1, the use of a PODP trigger for querying the LNP SCP introduces some interworking issues with the Automatic Recall and Automatic Call Back features. This interworking issues must be addressed by the standard bodies.

13.3.4.12 Relative Cost

A cost model for the CPC solution is currently under development. Results of these studies will be provided as soon as they are available.

13.3.4.13 Billing/Rating

The solution permits both the measured billing and the bulk-rate billing methods currently in use. The Carrier Portability Code (CPC) is used only for routing and does not affect the calling party's ANI. It uses AMA-record billing, with an AMA record that reflects the actual ANI of both the ported number and the dialed number.

Every possible effort will be made to minimize impacts to embedded billing and settlement processes. Depending on the capabilities of different switching systems, minor modifications may be required in some carriers' switches to create the appropriate AMA record.

13.3.4.14 End User Impact

Toll Indicator/caller confusion
The CPC solution supports LNP within a rate center.

Transparency
CPC achieves its goal of providing complete transparency to the end user. Under the CPC method, a subscriber changes LSP with no interruption of service. The CPC method does not introduce any changes to existing dialing plans, and does not affect any end-user service interactions.

Ubiquity
The CPC solution has made provisions to accommodate non-LNP capable switches in order to provide a ubiquitous service. However, true ubiquity will be dependent of the different network implementations and level of participation.

Directory Listing
Directory listing databases will continue to use the subscribers' Directory Numbers. Depending upon implementation, there may be one Directory Listing Database per LSP; however, efficiency dictates that the local Directory listing database contain all the numbers within a local area regardless of the service provider.

Repair
In order to provide a uniform Repair number, such as 611, repair calls should be routed to an automated system that determines a caller's directory number. Then the system can perform an LNP query and route the call to the appropriate LSP repair center.

An alternative is to provide LSP specific repair numbers such as an 800 number which will then directly route to the appropriate LSP repair center.

Number Change requirement
During the period when a subscriber has requested a change-number announcement, his old number will be unavailable and the last service provider before the change will be responsible for providing the Number Change treatment. Calls to the changed number will encounter LNP query as appropriate, and will be routed to the last Service Provider.

No Number Change Requirement
If a subscriber changes a number and does not request a Number change announcement, the number will become available and will be treated as a vacant number. Vacant numbers are marked in the LNP SCP, and the querying switch is responsible for providing Vacant number treatment as described herein.

13.3.4.15 Participating Carriers

The CPC solution allows Local Number Portability to be deployed in pockets, or as portability "islands," without requiring extensive changes to the existing network architecture or to the switch software.

All participating companies providing LNP-capable switches will be required to establish SS7 connectivity between their switches and the LNP SCP. Calls from non-LNP-capable switches to ported numbers can easily be accommodated by either MF or SS7 connectivity to an LNP-capable switch using existing local tandem end-office functionality, which treats the call as a local origination.

With respect to trigger location (i.e., which switch involved in a call issues the query), MCImetro's model follows the industry-accepted, N-1 local number portability network hierarchy. Under this hierarchy, participating interexchange carriers are responsible for querying the LNP database for InterLATA calls and for delivering them to the proper Local Service Provider. Participating carriers with TCAP capabilities can query the LNP database using either the IN (TR-TSY-000533) or AIN 0.1 (TR-NWT-001284 and TR-NWT-001285) protocols. Companies that do not have these industry-standard protocols deployed in their switches will need to make provisions to obtain their own copy of the LNP database.

Provisioning required to open an exchange to portability

When an exchange is opened to subscriber portability, changes are required in the following four network elements:

- each LNP-capable switch that routes on a six-digit basis to the exchange
- the donor switch (i.e. the switch that "owns" the NPA-NXX, as defined in the Local Exchange Routing Guide, or LERG)
- all network STPs
- the LNP database.

Each LNP-capable switch that routes to the newly ported exchange on a six-digit basis must mark the exchange as portable. In the AIN 0.1 case, this is done by adding the NPA-NXX to the PODP trigger list. IN variations will be platform specific; marking an NPA-NXX as portable causes the switch to begin querying all calls to the exchange.

The donor switch must begin querying intraswitch calls to the NPA-NXX. The AIN 0.1 implementation can be performed on a 6-digit or 10-digit basis. In the 6-digit case, the newly portable NPA-NXX is placed into the PODP trigger list. For 10-digit triggering, each vacant DN is added to the PODP trigger list. As DNs are ported away from a switch using 10-digit PODP triggers, each ported DN must be added to the PODP trigger list. Similarly, with IN-equipped switches, the NPA-NXX (6-digit basis) or each ported and vacant DN (10-digit

basis) must be marked as requiring LNP queries. As a fail-safe measure, all Directory Numbers that have been marked vacant in the LNP database must be set at the donor switch to query the database for terminating attempts. This will capture calls to ported numbers that should have been rerouted to another Local Service Provider but were not due to a failure at some point in the call routing.

Each STP must be prepared to support 10-digit Global Title Translation for calls to the new portable NPA-NXX. No other initialization work is required on a per-exchange basis.

Information on currently vacant DNs in the newly portable exchange must be copied into the LNP Database. The CPC solution requires no other NPA-NXX initialization work, provided the donor switch is using an interface compliant with TR-TSY-000533, TR-NWT-001285, and TR-NWT-001284.

13.4 [illegible] Proposal

13.4.1 General

This proposal uses a generic network capability - Release To Pivot (RTP) to accomplish service provider portability. Calls using RTP will attempt to complete as they presently do to a switch that is assigned a given NPA-NXX. If a dialed number has been ported from the switch, the call will be released back to a previous switch in the call path for rerouting to its new location. By releasing the call back, service providers can ensure that calls are efficiently routed in a number portability environment. When the call is released back, Rerouting Information (RI) is included so that the call can be completed to the new location. If the dialed number has not been ported from the switch, the call will complete as it does today. This functionality is accomplished by equipping switches in a network with Release and Pivot functionality. The functionalities can be resident in the same switch or can be in separate switches.

13.4.2 Architecture Description

RTP uses existing switching infrastructure and signaling network to accomplish service provider portability; an external database is not required. If the Release switch and Pivot switch are separate switches it is necessary that they, as well as any switches between them, be SS7 capable. In addition, switches between the Pivot switch and the Destination switch must be SS7 capable. Other switches in the call path need not be SS7 capable. The key network components required are switches (End Office and Tandem), interoffice facilities, STPs, and SS7 signaling links.

13.4.3 Method of Operations

The following steps describe one example of a call to a ported number using RTP. In this scenario, the customer (510-999-0000) has ported from LEC-A to LEC-B. Refer to Figure 1.

1. A switch (P) that is Pivot capable either originates a call or is in the Forward routing call path of a call. Switch P determines that the call should proceed to switch R which is Release capable. Switch P formulates an IAM for delivery to switch R which contains a Capability Indicator (CI) which informs switch R that a call can be released back to switch P to utilize switch P's Pivot functionality. The IAM + CI is sent to switch R.

2. Upon receipt of the IAM + CI, switch R tries to complete the call. Switch R determines, based on a translation table that the called number has been ported to LEC-B. Since a CI has been sent, Switch R utilizes its Release functionality and formulates a Release (REL) message for delivery back to switch P. The REL

message contains a cause value (RTP) and a Location Routing Number (LRN) which identifies a switch in LEC-B's network. The LRN is included in the REL message as the Redirection Number. The REL + RI is sent to switch P.

3. Switch P, upon receipt of the REL + RI, accesses a translation table and determines routing based on the first 6 digits of the LRN. A new IAM is formulated and the call is redirected to switch D which is in LEC-B's network with the LRN in the Called Party Number parameter, the dialed number in the Generic Address Parameter, and a Forward Call Indicator that identifies that the number has been translated and no further queries are required.

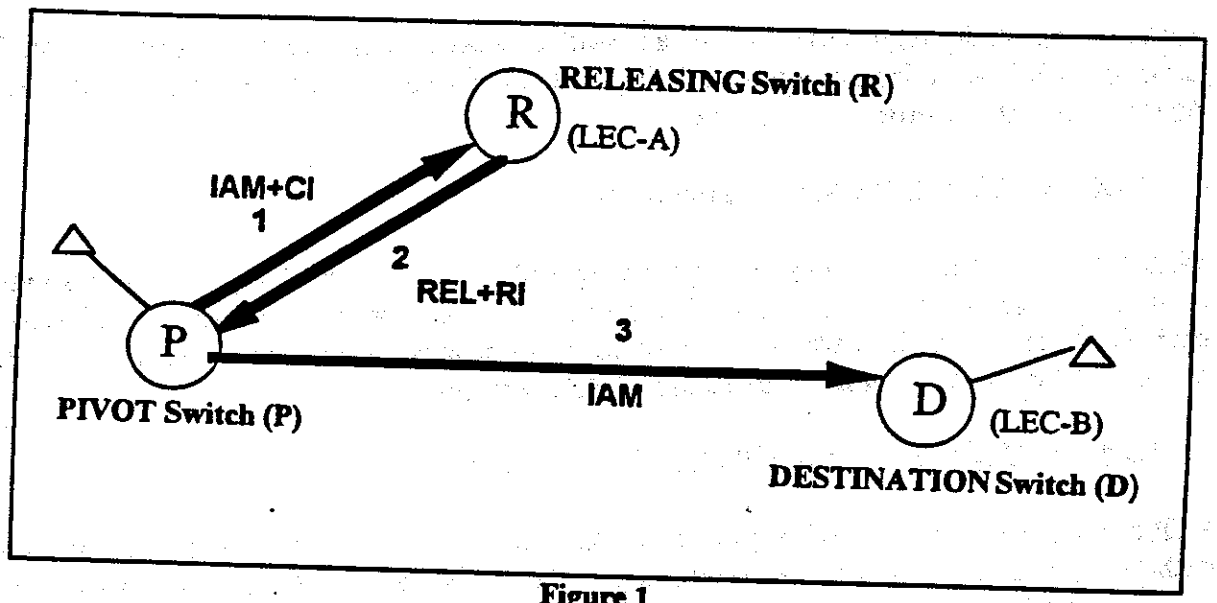


Figure 1

13.4.4 Network Impacts

13.4.4.1 Switch

There is no impact to the originating switch if it is not the Pivot or Release switch. Tandem switches may be required to be Pivot capable. Translation changes will be required in Pivot switches, Release switches, and Destination switches with RTP. SS7 signaling is required between the Pivot switch and the Release switch -- other switches need not be SS7 capable.

13.4.4.2 Post Dial Delay

RTP will not increase incremental call setup time or post dial delay for calls to non-ported numbers. The incremental call setup time and post dial delay for calls to ported numbers has not been verified in a live network but will primarily consist of the time to send an IAM (with CI), determine the number has been ported from the Release switch, formulate and send a

REL (with RI) message, and the time to translate the RI information into a new IAM (or equivalent) for forwarding to the final destination switch.

13.4.4.3 E911 Impacts

With RTP, calls will be routed to the proper PSAP. The calling number will be forwarded to the PSAP so services that use the calling party will continue to operate. There should be no impact on call set-up time and post dial delay for 911 calls from either ported or non-ported numbers. There should be no impact on 911 call completion rates from ported or non-ported numbers.

13.4.4.4 SMS Database

All LNP portability alternative require an SMS database. With RTP, the overarching SMS database will have to interface with existing switch provisioning systems so that switches can be updated with the proper information.

13.4.4.5 SCP Database Responses

With RTP, no external database is required for call setup and therefore, no SCP response is required for call setup. A database (SCP) will be required for non-call associated activities such as determining the serving network of a given number for busy line verification or possibly, 10 digit translations required for CLASS services.

13.4.4.6 Type of Number Portability Supported

RTP can support service provider portability, location portability, as well as service portability if the service uses ISUP call set messaging. The extent that RTP can reasonably support location portability is not clear and requires further study.

13.4.4.7 Service Interactions

The following sections details how existing services will be handled in a number portability environment if RTP is employed.

13.4.4.7.1 CLASS Services

CLASS services require that non-call associated SS7 messaging is employed to ensure that services such as Auto Callback and Auto Recall will work. Presently, the messaging for these services is routed based on the first six digits (NPA-NXX) of the calling or called number. With number portability it will be necessary that all 10 digits of the calling and called number be used for routing. These 10 digit translations can either be done in Signaling Transfer Points (STPs) or in an associated database such as a Signal Control Point (SCP).

13.4.4.7.2 Operator Services Impact

RTP will not negatively impact operator services. Services such as Busy Line Verification will require a query capability t o determine which network a given number is served from. This will require an external database. In addition, LIDB and ABS will require 10 digit translations (rather than the present 6 digit GTTs) to properly route messages.

13.4.4.7.3 End User Impacts

End user impacts are minimized with RTP. Calls to non-ported customers complete as they do today. Only calls to ported customers are handled differently than they are at present. In addition, since RTP using the LRN as a routing number is a single numbering solution, service such as Caller ID will continue to work as they do today.

13.4.4.7.4 Repair Services

In a number portability environment repair services and trouble reporting procedures will be available from all service providers. It may be necessary to access a database to determine the service provider for a given number. The database used for this could be the same as used for Operator Services.

13.4.4.8 Number Administration

Number portability is a generic LNP portability issue and RTP can work with number administration being handled by either a service provider or a third party.

13.4.4.9 Timing/Availability

The switch features required to support RTP are available by a least two switch vendors by 4Q97.

It should be noted however, that switch software is not the only gating issue for number portability. Other issues such as billing and the Service Management System (SMS) require resolution before number portability can be achieved. At this point it is unknown if the switch feature development is even in the critical path. Other deployment/implementation work items, such as ordering, provisioning, billing, maintenance, and tracking/reporting may take longer to analysis and put in place than development of a new switch feature.

13.4.4.10 SS7 Impacts

RTP will have minimal impacts on the SS7 network. Only ISUP messaging is required for call setup. IAMs between the Pivot switch and Release switches will require an additional octet (CI). Calls to ported numbers will also generate a Release + RI message and an additional IAM message with a Generic Address Parameter (GAP). All other SS7 traffic for call setup

will be unaffected. CLASS and ABS/LIDB traffic will require 10 digit GTTs which will affect SS7 components (e.g., STPs).

13.4.4.11 Relative Cost

RTP is expected to be the least cost alternative for service provider number portability. No external databases are required for call setup, queries are only generated for calls to ported numbers, and the additional traffic on the SS7 network will be minimal. The switch feature cost and the effect on the real-time capacity of switches is not determined and requires further study.

13.4.4.12 Billing/Rating

The RTP architecture supports the use of a one-number approach. The availability of pertinent billing information, e.g., originating number, terminating number, connect date, connect time, elapsed time, will continue to be supported. Current rating schemes will remain functional under this architecture.

RTP will not require any new AMA structure codes or call codes. Existing structure code and call code formats will be used on all call scenarios. Besides the originating recording that normally records at the Pivot switch (when a call is made from the Pivot switch), additional recordings may record at the Pivot and Releasing switches. These access records will be FGD-like recordings with no carrier identification but with special indicator(s) to mark the messages as RTP.

On Alternate Billing Services (ABS) calls billing to a ported number, the LIDB should be updated to reflect the LEC responsible for the ported number. Additional billing infrastructures may be needed to enhance this billing identification process. (This is an event that needs to be administered using local policy decisions and is considered independent of the RTP architecture.) The information gathered through these billing identification processes [i.e., LIDB and/or local billing infrastructures should be sufficient to allow CMDS (Centralized Message Distribution System) to route messages to the correct billing center].

13.4.4.13 End User Impacts

The RTP architecture allows the continued use of 1+10D dialing for toll calls. The 1+ is the toll indicator. If the NPA-NXX of the dialed number indicates toll call, and 1+10D have not been dialed, then the normal network announcement prompting the caller to first dial 1+ is given.

The RTP architecture is transparent to callers and called parties. Non-ported customers, and ported customers, will not perceive that a call has been redirected as a result of number portability call processing.

RTP would be available to all customers within a selected service area.

Directory listing is independent of the LNP solution. Directory listings and information would depend on the individual state's mechanized listing's interface(s) to its directory unit and directory listings and information strategy.

The Repair capability is independent of the LNP solution. The RTP architecture will support the policy decision and strategy for repair calls. A referral to a customer's local carrier could be made from the service provider's 611 repair bureau. This could be accomplished by storing a contact (800) number for each carrier to the Line Information Database (LIDB), for the numbers associated with each local carrier, for retrieval by the 611 repair bureau. Reciprocal arrangements could be established by all service providers.

No number change is required with the RTP architecture. It allows an end user to retain their existing telephone number.

13.4.4.14 Participating Carriers

RTP does not require that all carriers use this alternative. What is important for the industry is that a common network interface be developed so service providers can optimize their internal network for number portability.

13.5 Non-Geographic Numbering Proposal

13.5.1 General Description

A Database Architecture Using Non-Geographic Numbers

This section describes a nationwide approach to local number portability based on the use of Local Number Portability (LNP) databases utilizing non-geographic numbers (NGN). The subscriber is issued an NGN at initial subscription and continues to retain this NGN upon subsequent service provider or location changes. The use of NGNs permits the service provider to preserve existing network functions such as routing and billing. This will also allow the network to provide local number portability (LNP) to subscribers who desire this feature without having an impact on all subscribers. Finally, this architecture will be more cost effective to implement because it incorporates minimal impact on existing networks, structures, and operation.

The proposed architecture is designed to offer the LNP service to subscribers who desire this service without affecting the quality of service of the non-subscribers and having a minimal impact on existing networks. Since calls to LNP subscribers involve the number translation activity, these calls will experience longer call setup delay. The NGN architecture permits all other calls to be processed as they are today. As a result, non-subscribers can enjoy the same quality of service as they do today. This architecture does not require alteration to existing networks. It is an overlay network using the existing routing mechanism and billing methods. This also reduces the effort required to provision this service. Thus, it is possible to implement this method without having to burden the entire telephone user population with the cost and service impact of Local Number Portability. Only subscribers of the LNP service can then be charged for the service.

13.5.2 Architecture Description

When a user initially subscribes to the LNP service, a NGN is assigned to the subscriber. The NGN will be a non-geographic NANP number designated for LNP usage that may come from one of the INPA codes that have been assigned as non-geographic. LNP subscribers with an assigned NGN are free to obtain services from any service providers they choose while retaining their NGN. The administration of these numbers is assumed to be done on a centralized basis in a similar fashion as the existing 800 numbers. All LNP subscribers will have non-geographic portable numbers assigned to them in addition to their geographic numbers. The geographic number will then change if a subscriber changes their location or service provider.

The NGN contains no information (e.g., geographical location or service provider identity) about the subscriber except the user's identity. It serves as a logical address such as

customer name. The network has to translate this logical address to a physical address to locate the subscriber for call delivery and billing. Geographic numbers (GN) are physical addresses that contain location information.

The architecture illustrated by Figure 1 provides the number translation process required to support the LNP service. The LNP architecture requires LNP databases. The LNP database contains the NGN-to-GN mappings for LNP subscribers the service provider serves and SPID (Service Provider Identification) mappings for all other subscribers from the SMS. The LNP databases will probably be maintained by the service provider whereas the SMS database might be administered and maintained by an independent organization as is done for the 800 database.

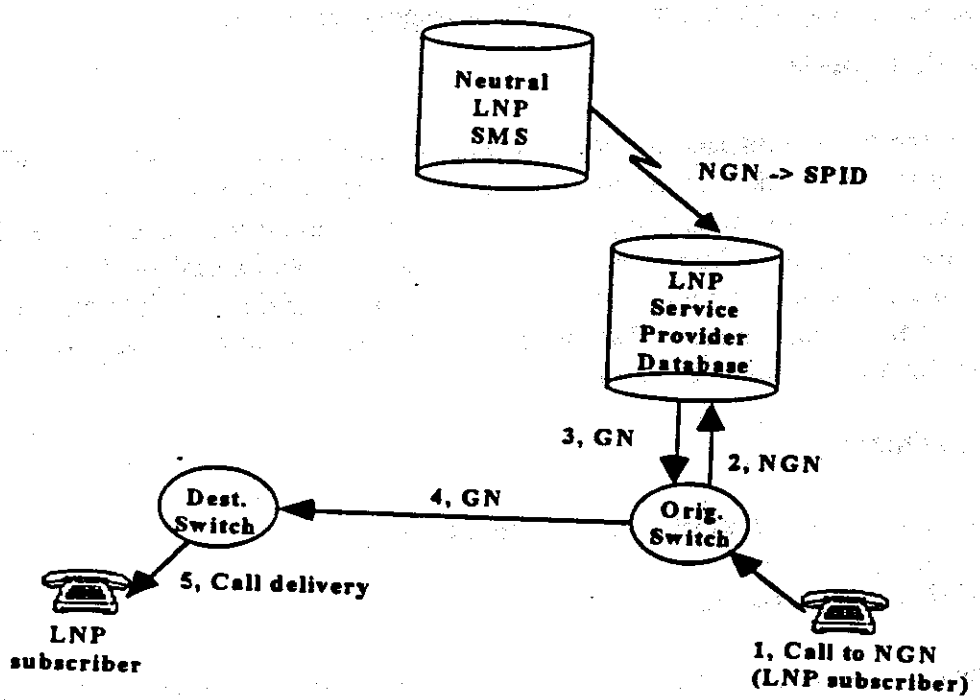


Figure 1 - Local Number Portability Architecture

13.5.3 Method of Operations

The following call flow illustrates the call delivery procedures of a call to an LNP subscriber (refer to Figure 1 above). The NGN approach requires minimal modifications to the existing call flow methodology used in today's network.

1. A caller dials the LNP subscriber's NGN.
2. When the originating switch detects a call initiation to an LNP subscriber, it sends a query to the LNP database. The LNP database is associated with the originating switch. The query request contains the dialed NGN.

3. The service provider LNP database translates the NGN to a GN and returns a response to the originating switch with the GN.
4. When the originating switch receives the GN from the LNP database, it routes the call based on the received GN using current call routing procedures.
5. When the destination switch receives the call, it terminates the call to the LNP subscriber using the GN.

The LNP architecture specifies that the originating switch queries the LNP database when it detects a call origination to a LNP subscriber. The switch-to-database interface can be IN (Intelligent Network) or AIN based. If between the switch and database interface, it is AIN based then Intelligent Network Application Part (INAP) may be employed for the query and response interactions. If the interface is based on existing IN implementations then simple query and response messages (e.g., similar to 800 messages) can be used.

13.5.4 Network Impacts

The adoption of the NGN approach for the provision of LNP does not have any significant impact on the existing network infrastructure. This statement is made based on the fact that once the database dip is performed, the geographic number clearly identifies the destination end user's serving end office. The ported number can be from an incumbent LEC to a new LEC, from a new LEC to an incumbent LEC, or between new LECs. The remainder of this section describes the various impacts that the NGN method will have on various network components and functions in today's network.

13.5.4.1 Switching

The following sections deal with different switching arangements.

13.5.4.2 Originating switch

It is a known fact that all of the proposed local number portability architectures will directly impact the switching systems. The extent that changes will have to be done are primarily determined by the type of architecture used to serve LNP, and the switching systems deployed within that area.

From a high level point of view, the NGN LNP approach, using a dedicated non-geographic NPA code to trigger the query of an LNP database, would require only minor changes to the existing switching system. This should lead to the least incremental cost for switching system modifications. Only one dip needs to be performed at the origination of a call. No terminating dip is required. No intermediate (Interexcahange Carrier IC) dip is required. This greatly improves the overall Quality of Service (QOS) by reducing post dial delay.

This solution does not require new routing software and algorithms. Since the ported numbers are non-geographic and are mapped to the existing geographic NANP numbers, opening of new NXXs for ported numbers is not required. If a new service provider requires numbers to start into business, they will follow the existing guidelines to obtain CO codes as is done today

in a non-ported environment. Switching equipment will need to recognize the non-geographic dialed number in a similar fashion that 800 numbers are interpreted today. This, function may be as simple as a data base entry in some switches to potentially adding new software to make this happen. In general the effort to accomodate this function is a minor task.

13.5.4.3 Tandem

The non-geographic LNP call model supports the existing telecommunications infrastructure and existing routing algorithms. For those calls to the non-ported numbers, the calls are routed as is currently done. For calls to the ported numbers, queries are performed to obtain the corresponding geographic numbers, the calls are then routed as currently done.

This call model provides seamless interconnections between end offices and tandem switches. If the end office is not LNP capable, the tandem switch can perform the database dip to obtain the corresponding geographic number and the call is routed accordingly.

13.5.4.4 Translations

LNP NGNs are translated to GNs allowing LNP calls to be routed as they are today.

13.5.4.5 Signaling

There is no need to modify existing signaling protocol to support the non-geographic number proposal.

13.5.4.6 Database Requirements

Most of the database requirements will be determined by the demand for LNP. In the NGN proposal, customer demand for LNP dictates the number of SCPs required. In contrast, the SCP requirement of the other proposals are not driven by customer demand but the number of subscribers within the LNP service boundary. The NGN database requirements are very similar to the 800 database since this is also a nationwide type of service. Most of the relevant issues regarding database requirements have been highlighted in section 7.1 of this report which are generic to all LNP proposals.

Note the NGN proposal only requires database dips for ported numbers. All calls to non-ported numbers proceed as they do today.

13.5.4.7 Post Dialing Delay

The NGN approach will enable easy recognition of LNP subscribers from the number that is dialed; thereby decreasing the general call-setup delay time that would be experienced if all originated calls would require screening. Only those calls to the LNP subscribers require database dips. All other originated calls should not be affected. This is an important network consideration as a longer "call setup time" may lead to an increase in call abandonments and

impact to the provisioning of new IN and AIN feature enhancements/services and other future telecommunications services.

For NGN ported calls the post-dial delay would incur additional call setup time/post dial delay in the exact same manner as today's calls to E800. The additional post dial delay for ported numbers could be covered by the 86-10 E800 requirements. These specifications could be enhanced to include LNP type calls.

For calls to non-ported numbers, no database dips are needed. Thus the call setup time/post dial delay would be the same as it exists today within the network without LNP.

13.5.4.8 Transmission Quality

The transmission quality will not be impacted due to the introduction of number portability. The transmission quality is basically determined by the type and quality of the trunking connections between the carriers involved in the call.

13.5.4.9 Blocking

The NGN LNP solution would have no impact on calls to non-ported numbers. The blocking impact to ported number calls would be as a result of the incremental amount due to LNP processing; the networking to the SCP and the associated dip. Thus local type calls to ported numbers should comply with the blocking requirements currently associated with E800 type calls. If LNP engineering guidelines are created properly there should be very minimal impact on the blocking probabilities.

Most of the other LNP solutions require a database dip for every call, whether it is to a ported number or not. Thus, more queries to the database are needed and subsequently network blocking may be increased.

13.5.4.10 Network Reliability Impact

The NGN LNP solution is the only proposed solution that does not dilute the network reliability for non-ported numbers.

The NGN solution requires that call queries be limited to only calls made to LNP subscribers. All calls to a LNP designated subscriber, whether intra-office local, toll, or inter-LATA, whether it is to a customer who has changed providers or not, go through the extra step of launching an SS7 inquiry to the LNP portable routing database to receive routing/translation instructions. Using the NGN call model only information about ported numbers is stored in the LNP database. Thus a relatively small database is required. The overall network reliability for ported numbers may be affected since their call model is more complex. But, with redundant databases and signaling links, the network reliability impact should be minimal.

13.5.4.11 Prevents "Looping"

The ported numbers are easily recognized by a specific non-geographic NPA (e.g., 333). When ported numbers are dialed, the switch will perform a query. After the query, geographic routing numbers are returned and no additional queries are needed. This guarantees that no looping will occur.

13.5.4.12 Limits Queries on Intraoffice Calls

The NGN solution requires that call queries are limited to only calls made to LNP subscribers. All calls to an LNP designated subscriber, whether intra-office local, toll, or inter-LATA, whether it is to a customer who has changed providers or not, go through an additional step of launching an SS7 inquiry to the LNP database to receive routing/translation instructions. The ported numbers are easily recognized by their specific non-geographic area code.

Intra-office calls to Non-LNP subscribers do not require that any queries be launched to complete these calls. This greatly minimizes the number of queries and any impact that the intoduction of LNP would have on the quality of service in the network.

After the query, geographic routing numbers are used in the ISUP messages and no additional queries are required.

13.5.4.13 Avoids Redundant Queries

The NGN LNP solution requires that call queries be limited to only calls made to LNP subscribers. All originating calls to an LNP designated subscriber, whether intra-office local, toll, or inter-LATA, whether it is to a customer who has changed providers or not, go through the extra step of launching an SS7 inquiry to the LNP database to receive routing / translation instructions. Since the ported number has a unique non-geographic NPA code, it is easily recognized by the network. Also, since the database dip is always executed by the originating office or the tandem switch and a geographic routing number is obtained, and presented to the network, no subsequent database dips such as intermediate or terminating are required. This avoids any redundant queries.

13.5.4.14 E911 Impacts

Calls from non-ported numbers to 911 will continue to function as they do today. Calls from ported numbers to 911 will operate as follows: Every LNP customer is effectively assigned two network identities:

The first is their non-geographic LNP directory number (e.g., 333-789-1234)

The second is their geographic number (e.g., 214-718-1234).

When an LNP subscriber makes an E911/911 type call, the calling party number displayed at the Emergency Service equipment is the second number the geographic number indicating the customer's hierarchical location. There are no network changes foreseen that would be required in this area. The only action required is of an administrative nature, i.e., to insure that the service provider of the ported number coordinated the numbering data for the database.

13.5.4.15 SMS Database

The non-geographic LNP call model recommends the use of SCP, LNP databases. Each service provider launches queries to a specific SCP database. (This database may be shared by more than one service provider). If the destination end user is served by the network of the originating service provider, this originating service provider database contains the called party geographic number. If the destination end user is served by another service provider, this database may contain the called party's service provider database address and launches a query to that database directly. This avoids 10-digit GTT at the STP.

The following figure shows the call flow of the NGN LNP call model. The numbers in this figure indicate the sequence of the call flow (See section 13.5.3).

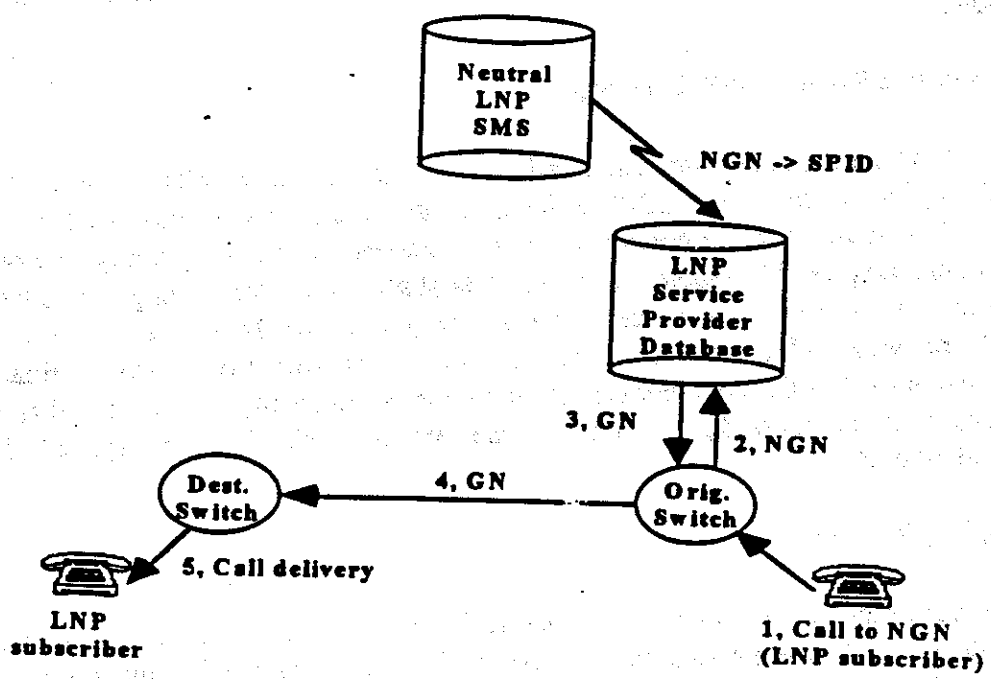


Figure 1 - Local Number Portability Architecture

13.5.4.16 SCP Database Responses

Like the 800 database, each carrier could own and maintain their own database, if desired. This would probably require a third party administrator to maintain uniform data in all systems.

Carriers would be able to share an SCP, as long as access is provided through an STP, which is a normal network configuration. The STPs would provide multiple link access to a variety of carriers. Once again, it would be assumed that the database would be managed by a third party for uniformity.

The decision to co-locate the LNP database with other AIN services will be based on the transaction handling capacity of the platform. The NGN LNP solution only requires database lookup for LNP customers, and as such will require less lookup than other LNP solutions. It will be a business decision of whether to co-locate a database or not.

13.5.4.17 Type of Number Portability Supported

Service Provider Portability

The non-geographic LNP call model fully supports service provider portability. Customers can change their service providers and retain their non-geographic numbers. The service providers are responsible for updating their customers' information in the LNP database.

Location Portability

The NGN LNP approach will support location portability. The geographic boundary can be LATA, NPA, state or even national. It is not limited by this approach but rather by industry agreement as well as government regulation.

Since non-geographic numbers do not have any geographic connotation, using the NGN approach for location portability, will not confuse customers with transported NXX codes or area codes that have moved from one location to another. The use of non-geographic numbers is supportive of location portability and comes at no additional cost.

If the ported number has moved and the call becomes a toll call, a toll indicator will be used to alert the calling customer.

Service Portability

The non-geographic LNP approach can support service portability. However, it requires that the new service provider has the capability to support the new service.

13.5.4.18 Service Interactions

If an IN trigger, such as E800, is used, there should be no feature impact on the end user because AIN triggers would not be used. If AIN is used, the PODP trigger will be utilized. Thus, no impact is anticipated.

13.5.4.19 Switch Features

The NGN LNP call model should have no conflict with any switch features that would use the 3/6/10 digit PODP trigger, because it will use a different sub-system identifier.

13.5.4.20 ISDN Features

The ISDN feature set should work as normal, because the NGN LNP approach does not break ISDN call processing triggers.

13.5.4.21 Telephone Relay Services (TRS)

The NGN LNP approach supports TRS. It will have no impact on this service.

13.5.4.22 Vertical Services

The NGN LNP solution has no impact on vertical services as they exist today.

13.5.4.23 Full Equal Access/Multiple PIC

The NGN LNP approach has no impact on equal access/multiple PIC.

13.5.4.24 Automatic Callback / Automatic Recall

After the originating switch performs the database query, the SS7 messages will contain the geographic numbers of both the calling and called customers. Automatic callback and automatic recall will work as it does today.

13.5.4.25 Screening List Editing

The LNP subscriber's geographic number should be used in the screening list. The screening list will then function as it does today.

13.5.4.26 Caller ID and Privacy

Since the non-geographic LNP proposal requires an associated geographic number, a ported customer's ANI will always be the customer's dialable geographic number. As such, the geographic number will technically work for all existing network functions that use ANI Based features. However, it may cause some minor confusion if the called parties not always

recognize the geographic numbers associated with calling parties for some services such as calling number delivery, some enhanced CLASS services (which capture the calling number), or on their toll bills when they have accepted a collect call from a ported customer.

Nonetheless, with time, customer education regarding the nature of the non-geographic numbers and their associated geographic number will overcome these minor implementation issues. For example, it should be noted that Calling Name service (which is growing rapidly) does delivers the correct name under the NGN LNP proposal, even though the calling number may not be one the customer recognizes. To technically overcome these minor issues would require expensive network changes to signaling and switches, which would identify and signal forward the non-geographic number in addition to the geographic ANI. Should standards bodies make changes to an existing ISUP parameter (e,g. the Generic Address Parameter (GAP))to transport more than one telephone number, both the geographic and non-geographic numbers will be available to support all CLASS features.

If the calling number is considered to be the ported customer's assigned geographic number, then NGN LNP proposal supports this supplementary service without any impact. If the calling number is considered to be the customer's assigned non-geographic number, then the NGN LNP proposal will display the calling customer's geographic number, and not his portable non-geographic number. The important issue here is that the called party has a number that he can reply to.

13.5.4.27 Caller ID with Name

The caller ID with name feature is not impacted by the NGN LNP proposal.

13.5.4.28 Call Forwarding

The NGN LNP proposal does not impact the call forwarding service. After the database dip, the ISUP messages carry the geographic numbers of the calling and called parties as it is done today. The call forwarding feature should function as it does today.

13.5.4.29 Calls to Ported Service Access Code Numbers (500, 800, 900, etc.)

No impact on call set-up times to SAC numbers.

13.5.4.30 ISDN Circuit Switched Voice

The calling party geographic number will be presented to an ISDN BRI/PRI in the calling party number information element. Since the non-geographic LNP proposal requires an associated geographic number, a ported customer's ANI will always be the customer's dialable geographic number. The redirecting number will be presented to an ISDN set in the redirecting number information element.

13.5.4.31 ISDN Circuit Switch Data

After the database dip, the call will be routed using the geographic numbers. The call will be routed properly.

13.5.4.32 Selective Call Acceptance

This service will work properly if the customer has programmed the geographic number of the parties he wishes to be able to reach him. However, if the customer programs the non-geographic number, then the caller would be blocked when it was desired that the caller not be blocked, because the ISUP messages contains only the geographic numbers of the calling and called parties. This could be overcome if the customer programs the geographic number of the originating caller.

13.5.4.33 Selective Call Rejection

This service will work properly if the customer has programmed the geographic number of the parties he wishes to reject. However, if the customer programs the non-geographic number, then the caller would not be blocked when it was desired that the caller should be blocked. This could be overcome if the customer programs the geographic number of the originating caller.

13.5.4.34 Customer Originated Service Order Activation/Deactivation

No impact to the customers. However, the service provider needs to use the assigned geographic number when updating the database.

13.5.4.35 Number Administration

The NGN LNP proposal operates in a manner similar to the 800 SMS database administration arrangement. Non-geographic numbers can be centrally administered or they can also be locally administered. This will depend on industry agreements.

The non-geographic LNP solution requires the reservation of a set of non-geographic NPA codes. Initially only one such code will be needed but if demand for portability grows additional codes will be necessary. Since these non-geographic numbers are both service provider and location portable the numbers will remain with the subscribers when area code splits occur.

13.5.4.36 Operator Services Impact

No changes are required to the traditional End Office or Access Tandem signaling to the Operator Service Switches (either TOPS or OSPS). Calling non-geographic customers' end

offices would signal forward their assigned geographic numbers (i.e., ANI), and called non-geographic numbers would be translated at the end office or access tandem prior to signaling to the operator switch. Billing numbers subsequently signaled by DTMF to the operator switch would use existing DTMF signaling technology.

Likewise no changes are required to the call completion signaling from the Operator Service Switches (either TOPS or OSPS) to the end offices or access tandems. All numbers used in this signaling would also be geographic numbers and all signaling would be as exists today.

The non-geographic LNP call model does not have any known impact. It does not require any changes to the network interfaces for DA systems. With the translation at the operator switch of non-geographic listings of ported numbers returning the geographic number, then rating and billing would be performed as done today. If the geographic number (or both geographic and non-geographic number) is maintained in the DA retrieval system, then translation is unnecessary for proper rating and billing of DACC calls.

Calls from non-geographic numbers would provide the associated geographic number ANI. Therefore, rating and billing for DACC calls would proceed as it does today.

13.5.4.37 Timing/Availability

The non-geographic LNP approach can be implemented in a timely fashion (less than one year) since it is very similar to the expansion of 800 service to include the use of the 888 code in addition to the 800 numbering resource. Since there are no new standards required to implement the non-geographic approach no additional timing or availability concerns or impacts are foreseen.

13.5.4.38 SS7 Impacts

No new Signaling Values are required to implement the NGN LNP solution. Proper routing and billing is possible without any modifications to the existing signaling protocol. It may be nice to enhance the protocol in the future to provide for indicators that a database dip has been performed, and to allow both the Ported number and the geographic routing number to be carried via SS7, but these enhancements are not required for the NGN LNP solution.

To separate LNP Service from other data base/service control point (SCP)Services that could be provided between the Switch and data base/SCP, a new unique SS7 SCCP subsystem number (SSN) should be assigned.

13.5.4.39 Capacity

With the non-geographic LNP solution, only those calls to the ported numbers require database queries. Thus, the impact to the signaling network capacity is minimal.

Other LNP solutions which require database queries on all calls, whether to ported or non-ported numbers, will dramatically impact signaling network's capacity.

13.5.4.40 Relative cost

Since the NGN LNP solution requires minimal changes to existing switching equipment, virtually no change to existing signaling systems, and is very closely related to the existing 800 type database the cost to implement this solution is minimal. All other proposals involve significantly more changes and upgrades to the existing equipment, signaling and network and will consequently cost much more to implement.

13.5.4.41 Billing/Rating

The general method of billing being proposed is a switch based AMA format that will be LSSGR compatible. This does not preclude the billing of LNP type calls on an AIN basis if a service provider so chooses. Billing will require the assignment (addition) of a unique call type to reflect the new LNP non-geographic NPA code (e.g., 333). It is assumed the existing record format for E800 type calls can be used for LNP by replacing the E800 entry with the LNP non-geographic NPA code entry. In a later phase of the project it may be beneficial to modify the AMA record format such that the geographical as well as the non-geographical Directory Numbers are recorded. This would allow a service provider greater flexibility in the down stream billing center as to how the call is displayed and billed.

13.5.4.42 AMA recording

The general method of billing being proposed is switch based AMA format that will be LSSGR compatible. This does not preclude the billing of LNP type calls on an AIN basis if a service provider so chooses. Billing will require the assignment (addition) of a unique call type to reflect the new LNP non-geographic NPA (e.g., 333). It is assumed the existing record format for E800 type calls can be used for LNP by replacing the E800 entry with the LNP non-geographic NPA code entry. In a later phase of the project it may be beneficial to modify the AMA record format such that the geographical as well as the non-geographical Directory Numbers are recorded. This would allow a service provider greater flexibility in the down stream billing center as to how the call is displayed and billed, but would not be required initially to provide LNP service. This enhancement would allow the network to continue to deal with the geographic number to determine the routing and rate plan, but allow the dialed ported number to appear upon the customer bill.

13.5.4.43 Transparency

Calls from non-ported numbers to non-ported numbers process exactly as they have always done with no impact at all.

The NGN LNP call model provides call rating based upon the geographic number associated with the ported number after a database query has been performed for ported numbers, in

conjunction with the originating NPA-NXX of the calling party. This allows the switching system to directly determine the rate plan that should be used, local or toll.

Calls from ported numbers to non-ported customers will use the geographic routing number of the originating party (NPA-NXX) and the NPA-NXX of the dialed number to directly determine the rate plan. Calls are rated based upon the geographic number associated with the ported number of the calling party. The NPA-NXX of the geographic number uniquely identifies the exchange and service provider of the calling party.

Calls from a non-ported number to a ported number are also rated based upon the geographic number associated with the ported number. If the customer has not moved physically, there is no impact. If the customer has moved outside the rate center, the new geographic number associated with the non-geographic number will indicate the new rate center for accurate rating and billing. In this case, a toll indicator can be provided to the caller.

Unlike other LNP solutions which port existing geographic numbers, there is no association in consumers minds that a ported number is associated with a specific rate center.

13.5.4.44 LERG Impact

No changes are required of the LERG for the LNP service.

13.5.4.45 Sent Collect

Sent collect calls from non-geographic ported numbers will always be rated properly based upon their associated geographic numbers. The AMA recording modifications discussed above for later phases of the project will capture the non-geographic number for appearance on the bill of the called party.

Sent collect calls to non-geographic ported numbers will likewise be rated based upon the associated geographic number and properly billed to the ported number of the called party. Billing information will be forwarded to the entity identified by the geographic number for customer billing and settlement for alternate billed calls.

13.5.4.46 800 Calls from Ported Number

In the NGN LNP approach, 800 calls from a ported non-geographic number are routed based upon the associated geographic number of the originator. 800 calls from a ported non-geographic number are also rated based upon the associated geographic number of the originator

13.5.4.47 Access Record

The NGN LNP call model will generate accurate access records, rated based upon the geographic numbers associated with ported numbers.

13.5.4.48 10-digit Number Recording

Since, by definition, non-geographic numbers all reside in a dedicated non-geographic NPA(s), 10 Digit recording is not a problem. All ported numbers will be 10-digit NANP numbers from one or more designated NPAs. Each ported number will have an associated 10-digit NANP geographic number associated with it, which identifies the serving central office, and thereby the V&H coordinates and carrier. There is no impact.

13.5.4.49 Carrier Identification

The proper carrier identification information will be recorded within the AMA record based on the geographic number, so that the record will be treated properly.

13.5.4.50 CMDS Message Clearing

Under the NGN number portability call model, CMDS message clearing is carried out based entirely upon the geographic number associated with each non-geographic number in concert with the CIC code of the carrier used.

13.5.4.51 End User Impacts

Toll indicator/caller confusion

The non-geographic LNP call model can provide a toll indicator to the end user . Once the switch performs the database query, the destination end user's geographic number is obtained. From the geographic number it can be determined if the call is or is not a toll call. If it is a toll call, an alert can be provided to the caller.

Transparency

Customers will not perceive a difference in call redirection when a number is ported. The calling parties dial as usual, independent of whether the called number is ported to another wireline, a cellular mobile line or a PCS line. The called or calling parties would not receive any call redirection indicator unless it is required.

Ubiquity

The non-geographic LNP approach provides a total network solution. It supports ubiquitous number portability by using databases to store information for all customers that have the specific non-geographic numbers (LNP numbers). This call model supports service provider portability, location portability, as well as service portability for any type of customer terminal (land-line, wireless or PCS).

Only calls to the specific non-geographic numbers require database queries. If a local exchange does not have the capability to perform the query, the call can be routed to another switch that has the capability. Thus, it is not necessary to deploy the LNP capability to all the switches in a network. This procedure is similar to the way that 800 service is deployed.

13.5.4.52 Directory listing

The NGN LNP approach is similar to how current 800 calls are processed. Mechanized directory listing and information would be supported as done currently.

13.5.4.53 Participating carriers

The same types of carriers that are involved in the routing and rating of 800 calls should be involved in supporting the implementation of the NGN LNP method. If certain carriers choose to not be involved in LNP then any calls to ported non-geographic numbers will be processed by the first switch (or tandem) in a network that participates in the provision of LNP.

13.5.4.54 Additional remarks / Summary

The NGN LNP proposal represents a nationwide overlay network approach to provide LNP. The NGN LNP proposal incorporates a minimal set of changes to the existing network infrastructure while supporting the ability of a telecommunication user to port their number in the context of service provider portability, location portability and service portability. This is done in the context of using non-geographic numbers which can be assigned to all customers who desire to keep their number when they either change providers, move, or change their telephone service. This is the only LNP plan that provides a permanent portability solution since all plans using geographic numbers will be subject to change if area code splits are implemented in a specific portability region. The NGN approach is ideally suited for a national solution to provide portability in an identical fashion thoughout the country. Since the NGN approach is very similar in concept to today's 800 service there will be significantly less development effort, cost and time needed to implement this approach.

14.0 Interim Solutions

It is generally recognized that the provisioning of a ubiquitous number portability capability nationwide could take several years and significant resources to accomplish. As such, it can be expected that the initial service deployment for number portability will be in geographically limited, non-contiguous areas. Such deployments may utilize unique, non-standard technologies and methodologies that may not meet all of the objectives detailed in 4.0, but provide a measure of number portability until a permanent solution is fully developed and deployed. Most near-term alternatives will probably require routing traffic through the facilities of the carrier to whom the NPA/NXX of the dialed number was originally assigned (e.g., donor switch), and redirecting such traffic at that point based upon information contained in the incumbent's internal or external data base.

14.1 Near Term Alternatives

Several different alternatives have been proposed for providing near-term number portability among service providers, including different forms of call forwarding and Direct Inward Dialing (DID). Using a call forwarding approach, the dialed number would initially be routed to the switch assigned the NPA/NXX. At that point the number would be retranslated to a new, 10-digit telephone number, which is substituted to complete the call to its intended destination. A pictorial description of this arrangement is shown as Figure 14.1-1 below.

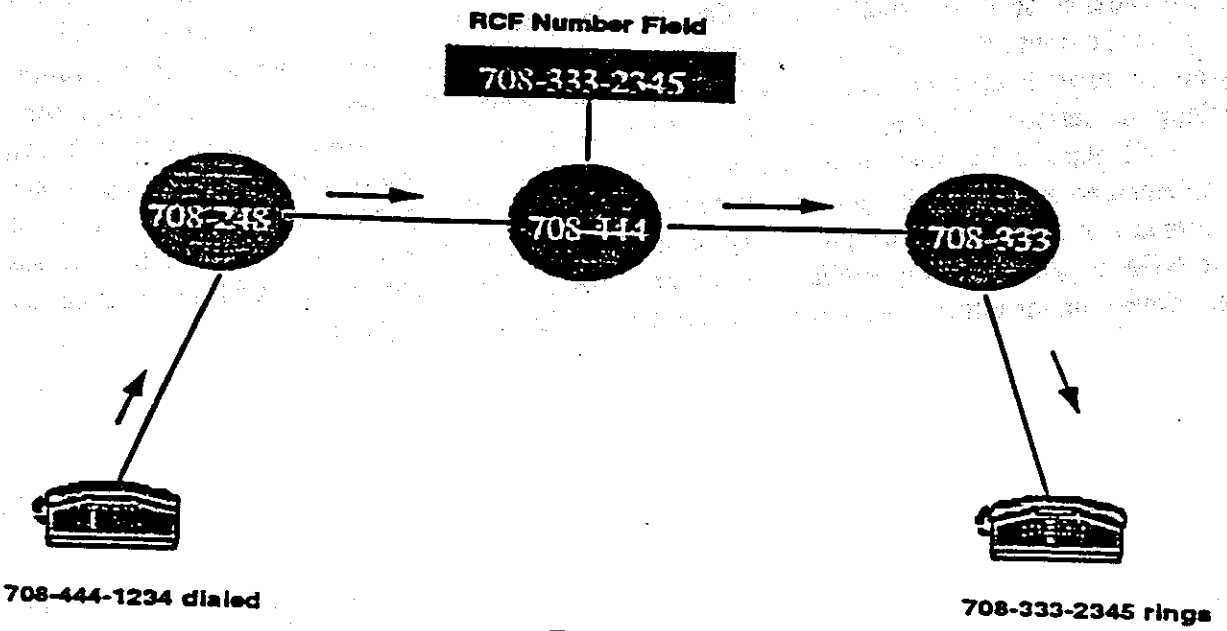


Figure 14.1-1

To avoid the need for assigning two telephone numbers to the called subscriber under this scenario, it may be possible to simply append a 10XXX/101XXXX carrier access code onto the original dialed number at the incumbent LEC's switch for rerouting over existing Feature

Group D trunks to the competing provider. A pictorial description of this arrangement is shown as Figure 14.1-2 below.

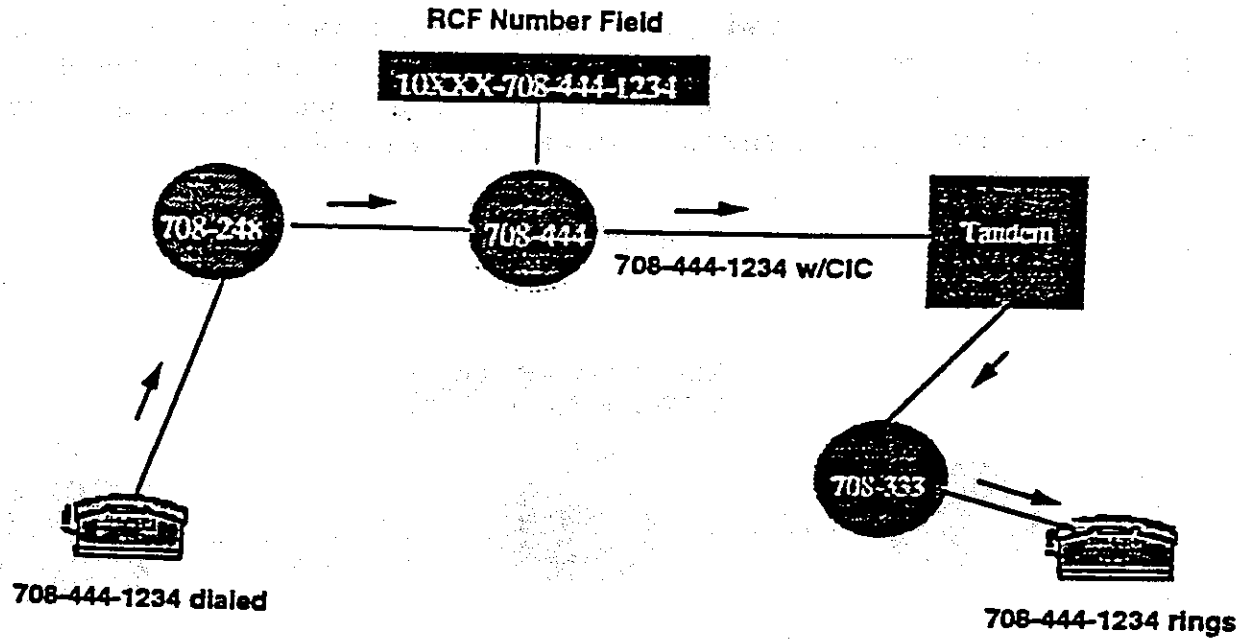


Figure 14.1-2

Another set of alternatives employ DID-type routing, which, again, requires the call to initially be routed to the switch assigned the dialed NPA/NXX. The call is thereupon placed onto a dedicated trunk group that is connected to the competing provider's switch. A pictorial description is shown as Figure.14.1-3 below

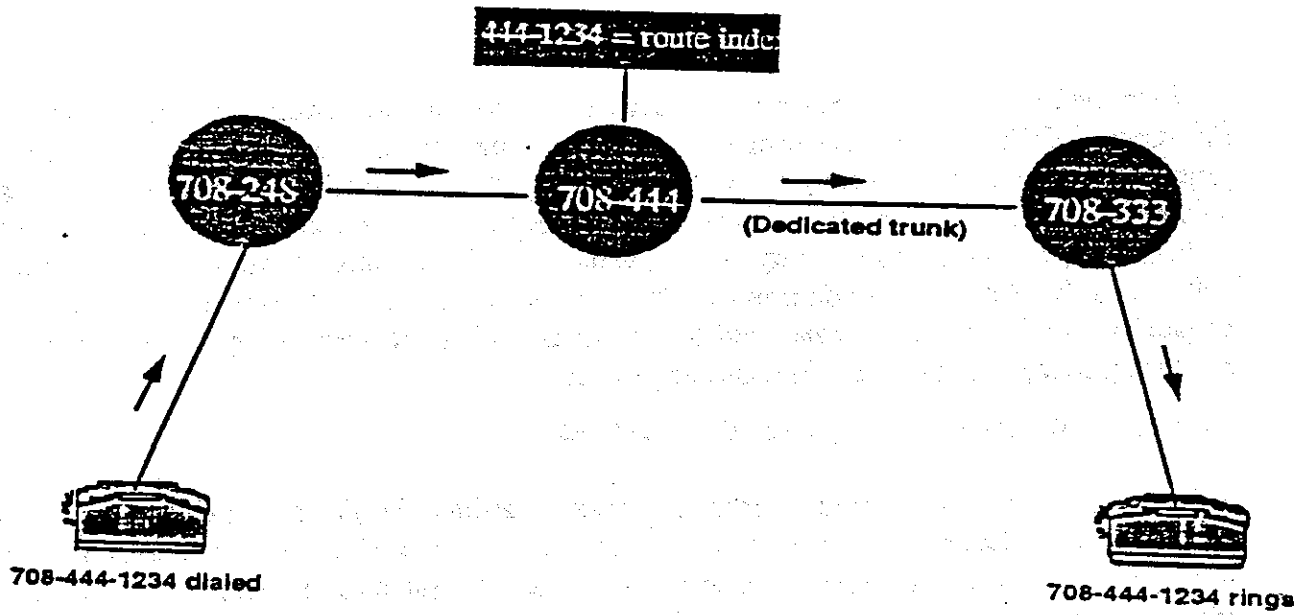


Figure 14.1-3

Figure 14.1-3

To avoid the need for dedicated trunk groups from each switch in which numbers have been ported, it may be possible to append a unique pseudo-code onto the dialed number at the incumbent LEC's switch which will identify the competing provider, and allow the call to be routed to the tandem over a common trunk group. At the tandem the pseudo-code is recognized and removed, and the call is forwarded to the appropriate competing provider. A pictorial description of this arrangement is shown as Figure 14.1-4 below.

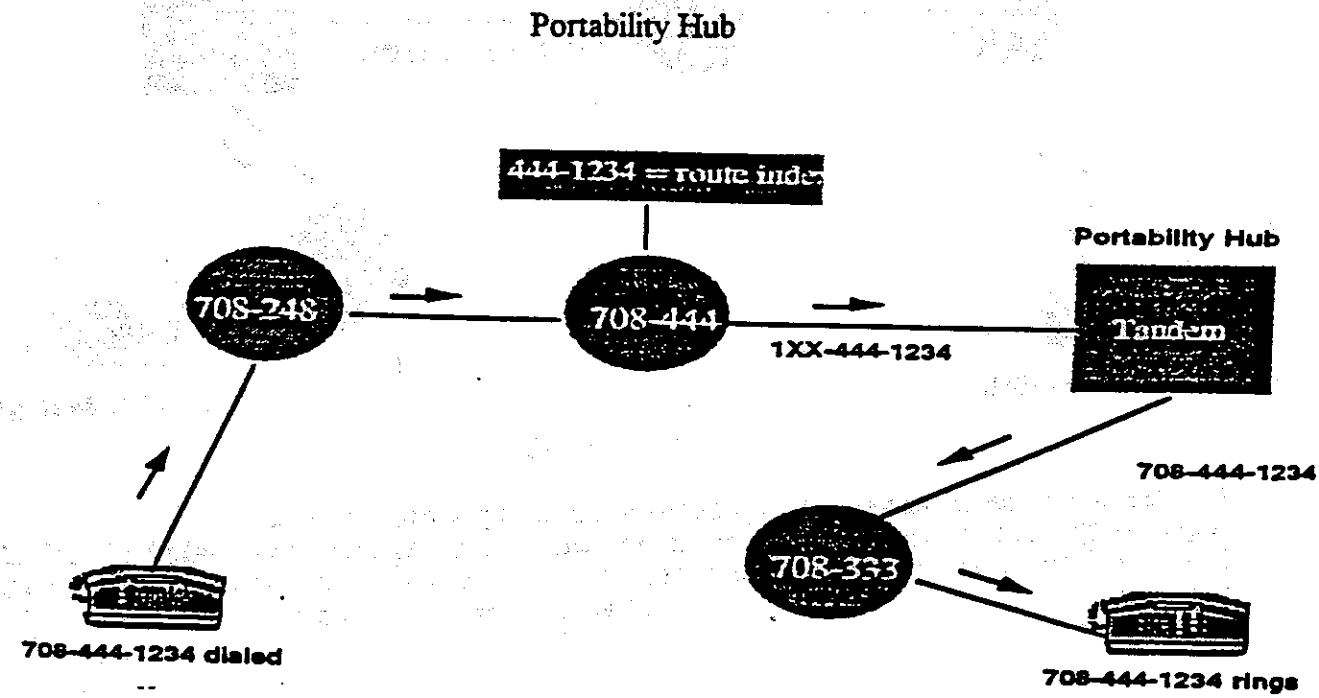


Figure 14.1-4

As described above, most near-term alternatives require an initial routing of the call into the incumbent LEC's network, performing some form of internal or external data base dip at that point, and thereupon redirecting the call to the competing provider's network. It is generally acknowledged that such methods contain certain technical inefficiencies and limitations in the provisioning of number portability that hopefully can be avoided once a more permanent solution is developed and implemented. They do, however, allow for fast deployment of the capability itself in specific locales without impacting other, non-portability service areas and don't require any commonality in technology or methods.

14.2 Limitations of Near Term Alternatives

This section provides additional technical detail regarding the inefficiencies and limitations associated with the near term alternatives described in Section 14.1 The limitations described in this section are not an exhaustive analysis, but are a high level overview of some of the more critical issues. Moreover, some of the concerns raised here may also be present and require attention for the long term solutions described in Section 13 as well.

14.2.1 Network Performance and Reliability

All near term alternatives require the call be directed through the network of the carrier that previously served the ported customer (i.e., the donor network). Such routing necessarily causes the call path to traverse additional switches and facilities, and can have a detrimental impact on performance and reliability.

Specifically, the increased number of switches adds to post dial delay. The situation is aggravated if tandem routing is used to route the call from the donor network to the recipient network and still more switches are encountered. Further, where in-band rather than out-of-band signaling is employed, call set-up will be subject to yet additional delay.

Moreover, the use of additional switches and transmission facilities raises the possibility of degradation in transmission quality and adds to the potential for increased probability of call blocking. Finally, the routing of calls through additional switches, necessary to affect call completion with the near term alternatives, may negatively impact network reliability.

It should be noted that early deployment of long term solutions will experience similar deficiencies, due to the need to accommodate traffic from non LNP-capable networks.

14.2.2 Routing Inefficiencies

Some near term alternatives require the new provider (the recipient network) to connect directly to the switch from which the customer is ported. If the volume of traffic from this switch is small, this type of direct connection is inefficient.

Other alternatives, specifically that identified in Figure 14.1-4, eliminates this concern.

14.2.3 Numbering Concerns

Alternatives which require use of another number in addition to the ported number (e.g., Remote Call Forwarding) place additional demands on scale numbering resources. Any long term solution which employs the use of two numbers to identify and route a ported number call could suffer similar deficiencies.
Excessive demand for use of local number resources may advance the need for NPA relief.

14.2.4 Capacity Concerns

Some near term arrangements cannot support large numbers of simultaneous calls, as might be required for call center, hospitality, or other applications with a single, main number. Equally important, any arrangements that only support the forwarding of blocks of numbers are not compatible with the needs of new entrants, who need the ability to port individual line numbers.

It should be noted, however, that most carriers that offer the use of Direct Inward Dialing (DID) as a near term solution have tariffed it on an individual line number basis.

14.2.5 Service Impacts

Many service features are dependent upon the transmission of the calling party number (CgPN) to the terminating networks (i.e., the recipient network associated with the ported number). To the extent that any implementation of a near term alternative which does not support SS7 (i.e., some implementations of DID) and therefore cannot support forwarding the CgPN, the dependent service features will not be available.

Further, although some alternatives identify a ported customer using the customer's number as the line number in the recipient switch, other arrangements (e.g., RCF) employ a second, "real" number to identify the customer on the switch. In these cases, this second number is forwarded as the CgPN, causing the calling party to be incorrectly identified and adversely impacting potential services (e.g., Caller ID)[6].

Near term arrangements will often be unable to support CLASS services such as Auto Callback (Repeat Call) and Auto Recall (Return Call). For example, Auto Callback following a call to a ported numberis not supported if the call involves a forwarded number. Moreover, even if call forwarding were not used, existing six digit Global Title Translations (GTT) used to route the signalling messages necessary to support these type services will - in several situations - not properly route these messages. Ten digit GTT, which is only available on a limited basis, must be used. Consequently, the service could fail completely, or work improperly. Selective call forwarding/call acceptance/call rejection, for example, could be impacted, resulting in situations where calls a customer wishes to forward will not be forwarded, calls a customer wishes to accept will be rejected, and calls the customer wishes to reject may be accepted.

Interexchange carrier services which are triggered based upon the CgPN (ANI-based services) cannot be supported on calls from a ported number if the near term alternative uses a forwarded number to identify the calling party, and that number is not known to the IC and used in the provisioning of the service. In a like manner, use of a forwarded number in the recipient network will impact routing and calling customer identification in E911 services, unless the E911 database is updated to associate the customer with the forwarded number. (Note: This becomes a non-issue as long as the originating carrier updates the E911 database with the proper number and associated addressing information.)

14.2.6 Operator Services

Operator services such as Busy Line Verification (BLV) and Emergency Interrupt require that an operator system be able to identify the switch which serves the called party and/or the

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[6] It may be possible to open the ported number on the recipient switch and provide that number so it is forwarded as the CgPN.

operator position that serves that switch. near term arrangements which route the sall using a forwarded number will not provide sufficient information to support these services. In addition, verification of calls for which "bill to third" is requested require that an operator system use NPA-NXX to query the appropriate LIDB for billing acceptance. Unless the LIDB associated with the NPA-NXX contains information for ported numbers, this capability may not be available.

GLOSSARY

DEFINITIONS

The following definitions are offered for terms contained within this document. Many of these definitions are taken verbatim from documents created in other INC workshops or industry forums.

Access Time - the time beginning when the caller completes dialing a call and ending when the call is delivered by the originating Access Provider to the Service Provider or to a Transport Provider for the Service Provider. (Note that Access Time is only one component of call set-up time.)

Advanced Intelligent Network (AIN) - a service-independent architecture which allows its service provider to create and/or modify telecommunications services.

ANI (Automatic Number Identification) - the automatic identification of the billing number associated with the calling station.

ANI (Automatic Number Identification) II Codes - ANI II digits are two digits that are sent with the originating telephone number identifying the type of originating station (for example: Plain Old Telephone Service [POTS]{00}, Hotel/Motel [06], etc.). Use of the ANI II codes in an SS7 message is referred to as the Originating Line Information Parameter (OLIP).

BTA (Basic Trading Area) - one of 487 basic areas of commerce as defined by Rand-McNally, used to define a wireless serving area.

BRIDS (Bellcore Rating Input Database System) [formerly BRADS] - a data base system that contains NANP rating data including Canada and the Caribbean, while not part of the NANP also includes Mexico due to its proximity. This system generates the Terminating Point Master (TPM) for billing purposes.

Call Set-up Time (see access time)

CIC (Carrier Identification Code) - is a numeric code which is currently used to identify an entity who purchased Feature Group B and/or Feature Group D access services. This code is primarily used for routing from the local exchange network to the access purchaser and for billing between the Local Exchange Carrier and access purchaser. CICs are assigned by the North American Numbering Plan administrator.

CO Code (Central Office Code) - the sub-NPA code in a telephone number, i.e., digits D-E-F of A 10-digit NANP area address. CO Codes are in the form OF "NNX" or "NXX", where

n is a number from 2 to 9 and X is a number from 0 to 9 . CO Codes may also be referred to as NNX codes, NXX codes or NNX/NXX codes.

Domain - a set of all possible numbering values or addresses.

Donor Switch - the switch to which the dialed NPA/NXX has historically been assigned, and from which the dialed number was initially ported.

Entity - for the purposes of obtaining a numbering resource, an entity is an applicant that meets the criteria of the guidelines and as a business, purchases telecommunication arrangements.

Geographic numbers - numbers which correspond to discrete geographic areas within the NANP area.

HLR (Home Location Register) - the location register to which the end user information is assigned for record purposes.

ICCF - the Industry Carriers Capability Forum provides an open forum under the auspices of the Carrier Liaison Committee to encourage telecommunication entities to discuss and resolve, on a voluntary basis, nationwide technical issues associated with telecommunications network interconnection, and the issues associated with the assignment and use of NANP/NANP area numbering resources.

INC (Industry Numbering Committee) - a standing committee of the Industry Carriers Capability Forum (ICCF) that provides an open forum to address and resolve industry-wide issues associated with the planning, administration, allocation, assignment and use of numbering resources within the NANP area.

Intelligent Network (IN) - a telecommunications network architecture in which processing capabilities for call control and related functions are distributed among specialized network nodes rather than concentrated in a switching system.

LATA (Local Access and Transport Area) - also referred to as service areas by some BOCs, and serve two basic purposes: to provide a method for delineating the area within the BOCs may offer services and, to provide a basis for determining how the assets of the former Bell System were to be divided between the BOCs and AT&T at divestiture.

LERG (Local Exchange Routing Guide) - contains information about local routing data obtained from the Routing Data Base System (RDBS). This information reflects the current network configuration and scheduled network changes for all entities originating or terminating PSTN calls with the NANP excluding Canada.

Location portability - the ability of an end user to retain the same geographic or non-geographic telephone number (NANP numbers) as he/she moves from one permanent

physical location to another. Location portability will involve either of the following scenarios:

1) new location is within the same wireline serving central office area.

2) new location is within a different wireline serving central office are or wireless serving area.

Regarding location portability, consideration of restrictions (within) specific geographical boundaries (e.g., NPA, LATA) may be appropriate as an interim or long term measure to miniimize potentially adverse network end user impacts.

MSA (Metropolitan Statistical Area) - sometimes known as Standard Metropolitan Statistical Areas (SMSAs), MSAs are areas based on counties as defined by the U.S. Census Bureau that are cities of 50,000 or more population and the surrounding counties, and define some cellular areas.

MTA (Major Trading Area) - one of 47 major commerce locations as defined by Rand-McNally that are used to define a wireless serving area.

N-1 - next to last network in a call path

NANP (The North American Numbering Plan) - a numbering architecture in which every station in NANP area is identified by a unique ten-digit address consisting of a three digit NPA code, a three digit central office code of the form NNX/NXX, and a four-digit number of the form XXXX where N represents the digits 2-9 and X represents any digit 0-9.

NANP AREA (NANP area) - consists of the United States, Canada, Bermuda, and the NANP Caribbean administrations .

Non-Geographic Numbers - numbers which do not correspond to discrete geographic areas, but which are instead assigned for services with attributes, functionalities, or requirements that transcend specific geographic boundaries [within the NANP area]. The common example are NPAs in the N00 format; e.g., 800, 500.

North American Numbering Plan Administration (NANPA) - with divestiture, key responsibilities for coordination and administration of the North American Numbering Plans were assigned to NANPA. .

NPA (Numbering Plan Area) - also called area code, an NPA is the 3-digit code which occupies the A, B, and C positions in the 10-digit NANP format which applies throughout NANP area. NPAs are of the form NXX, where N represents the digits 2-9 and X represents any digit 0-9. In the NANP, NPAs are classified as either geographic or non-geographic.

a) Geographic NPAs are NPAs which correspond to discrete geographic areas within NANP area.

b) Non-Geographic NPAs are NPAs which do not correspond to discrete geographic areas, but which are instead assigned for services with attributes, functionalities, or requirements that transcend specific geographic boundaries [within the NANP area]. The common example are NPAs in the N00 format; e.g., 800, 500.

Number Portability - *refers to the ability of end users to retain their geographic or non-geographic telephone number when they change any of the following:*

a) their location
b) their service provider
c) their service

PIC (Presubscribed Inter LATA Carrier) - the carrier selected by the customer if they wish to be presubscribed to an IC rather than selecting the IC on every interLATA call. The PIC is also frequently referred to as the presubscribed IC. In the context of this document PIC is also used as the Presubscribed IntraLATA Carrier .

Portability Pool - *a pool of portable numbers within an NPA/NXX administered by a neutral third party.*

Public Switched Telecommunications Network (PSTN) - the PSTN is composed of all transmission and switching facilities and signal processors supplied and operated by all telecommunications common carriers for use by the public. Every station on the PSTN is capable of being accessed from every other station on the PSTN via the use of NANP numbers (NANP application of ITU-T Recommendation E.164).

Recipient Switch - the switch to which the dialed number has been ported.

RESP ORG - the responsible organization is the entity identified by the 800 subscriber or the 800 subscriber's agent that assumes the duty of managing and administering the appropriate records in the 800/SMS system which includes data entry, record change, trouble acceptance, referral and/or clearance.

RSA (Rural Service Area) - an area, based on county boundaries, that is not included in either a Metropolitan Statistical Area or a New England County Metropolitan Area, which is used to define a cellular service area.

SCP (Service Control Point) - a network data base containing information and/or logic used in call processing to provide services. A service switching point (SSP) contacts an SCP when the SSP recognizes the need for special call handling. Use of this term does not imply any specific technology platform.

SMS (Service Management System)- an Operations Support System used to facilitate the provisioning and administration of service data required by the SCP. Use of this term does not imply any specific technology platform.

Service Portability - *the ability of an end user to retain the same geographic or non-geographic telephone number (NANP numbers) as he/she changes from one type of service to another (e.g., POTS to ISDN)*

The INC Number Portability Workshop agreed that NANP numbers (e.g., 800, 500, 555, 950) should not be service portable for applications outside of their respective industry approved service definitions or guidelines, should those definitions or guidelines exist.

SSP (Service Switching Points) - a network element that initiates a dialogue with an SCP in which the logic for the requested service resides. The SSP may communicate with more than one SCP. Use of this term does not imply any specific technology platform.

Service Profile - a record containing all the information related to a communications user in order to provide that user with communications service.

Service Profile Management - the ability to access and manipulate the service profile. Service profile management can be performed by the service user, service subscriber, or service provider.

Service Provider - any entity that is authorized, as appropriate, by local government, state, federal, or other governmental authorities within the area served by the NANP to provide communications service to the public.

Service Provider Portability - *the ability of an end user to retain the same geographic or non-geographic telephone number (NANP numbers) as he/she changes from one service provider to another.*

STP (Signal Transfer Point) - a Common Channel Signaling (CCS) network element.

SS7 (Signaling System 7) - a standardized protocol for high speed communication between intelligent network nodes.

V&H (Vertical and Horizontal) Coordinates - four digit numbers, derived from geographic latitude and longitude references, that are used to define a physical location and allow the computation of airline mile distances between two or more defined entities.

ACRONYMS

AC/AR (Automatic Callback/Automatic Ringback)
AIN (Advanced Intelligent Network)
ALI (Automatic Location Identification)

ANI (Automatic Number Identification)
ANI II (Automatic Number Identification Information Integers)
AMA (Automatic Message Accounting)
AT (Access Tandem)
BLV (Busy Line Verification)
BRIDS (Bellcore Rating Input Database System) [formerly BRADS]
BTA (Basic Trading Area)
CARE (Customer Account Record Exchange)
CDR (Call Detail Record)
CdPN (Called Party Number Parameter)
CIBER (Cellular Intercarrier Billing Exchange Roamer)
CIC (Carrier Identification Code)
CIP (Carrier Identification Parameter)
CLEC (Competitive Local Exchange Carrier)
CNA (Customer Name Address)
CO Code (Central Office Code)
COCOTS (Customer Owned Coin Operated Telephone System)
CPE (Customer Provided Equipment)
CPC (Carrier Portability Code)
CPU (Call Processing Unit)
CRIS (Customer Record Information System)
DA (Directory Assistance)
DID (Direct Inward Dial)
DN (Dialed or Directory Number)
DPC (Destination Point Code)
DPN (Dialed Portable Number)
FACS (Facility Assignment & Control System)
EC (Exchange Carrier)
GAP (Generic Address Parameter)
GN (Geographic Number)
GTT (Global Title Translation)
HLR (Home Location Register)
ISUP (ISDN User Part)
IAM (Initial Address Message)
IAO (Intra Office)
ICCF (Industry Carriers Compatibility Forum)
ISPMAP (InterService Provider Maintenance, Administration and Provisioning)
LANP (Local Area Number Portability)
LIDB (Line Information Data Base)
LNP SMS (Local Number Portability Service Management System)
LRN (Location Routing Number)
MIN/ESN (Mobile Identification Number/Electronic Serial Number
MSA (Metropolitan Statistical Area)
MTA (Major Trading Area)
MTS (Message Telephone Service)

MSC (Mobile Switching Center)
NANP (North American Numbering Plan)
NANPA (North American Numbering Plan Administration)
NGN (Non-geographic Number)
NNA (Network Node Address)
NNP (National Number Portability)
NP (Number Portability)
NPDA (Number Portability Data Base)
NNAG (NPA-NXX Activity Guide)
NNP (National Number Portability)
NPA (Numbering Plan Area)
NPDB (Number Portability Data Base)
OLIP (Originating Line Information Parameter)
OS (Operator Switch)
PIC (Presubscribed Inter LATA Carrier)
PN (Portable Number)
PODP (Public Office Dialing Plan)
POP (Point Of Presence)
PSAP (Public Safety Answering Point)
PSTN (Public Switched Telephone Network)
RCF (Remote Call Forwarding)
RDBS (Routing Data Base System)
RESP ORG (Responsible Organization)
RSA (Rural Service Area)
RTP (Release To Pivot)
SCP (Service Control Point)
SMS (Service Management System)
SPID (Service Provider ID)
SOAC (Service Order Administration & Control system)
SSP (Service Switching Point)
STP (Signal Transfer Point)
SS7 (Signaling System 7)
TACD (Telephone Area Code Directory)
TCAP (Transaction Capabilities Application Part)
TLDN (Temporary Local Directory Number)
TNA (Terminating Network Address)
TN (Terminating Network)
TOPS (Traffic Operator Position System)
TPM (Terminating Point Master)
TRA (Traffic Routing Administration)
TSPS (Traffic Service Position System)
VLR (Visitor Location Register)