

“An Introduction to Numbering”

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“NUMBERING 101”

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Introduction

The world of telecommunications, for so long a world without change, can now be best described with words such as transition and transformation. Much the same can be said about telecommunications numbering – a world within a world. There is much turbulence surrounding the subject of telecommunications numbering.

Who has not heard of area code exhaust and area code splits? But numbering goes much deeper than who gets what area code and when. It is far from just the simple ten-digit number given each customer. It is the bedrock upon which the entire telecommunications network is built. No customer can send or receive calls without a telephone number. No service provider, whether it be a phone company, Internet or cable TV company, in some instances, can open their doors to customers without numbers to assign. It is as simple as the ten-digit number we dial so many times every day. Yet, it is not simple at all.

Telecommunications numbering can be a complex world of acronyms and technical jargon. This document, Numbering 101, offered by the North American Numbering Plan Administration (NANPA), is designed to provide a backdrop for numbering as well as a general overview some of the most critical issues being faced by the telecommunications industry and consumers today. Numbering 101 assumes the reader has at least a high-level knowledge of the telecommunications industry.

The History of the NANP and NANPA

The North American Numbering Plan (NANP) began in 1947 when Ma Bell (AT&T) was the just about the only choice a customer had for telephone service. The telephone network that the industry is currently working under – in a competitive environment – was established over 50 years ago in a single-provider environment.

When the current NANP was established, it was comprised of a 10-digit dialing pattern throughout North America, with a 3-digit area code and 7-digit phone number (NNX-NXX-XXXX). There were 144 “original” area codes established, with the middle digit being a 1 or 0. Area codes were based in geographic areas, with the larger cities receiving the “smaller,” easier-to-dial area codes, such as

212 in New York City, 213 in Los Angeles and 312 in Chicago. Initially, 86 area codes were assigned in 1947, but it wasn't until 1951 when the first area code was activated: the 201 in New Jersey.

From 1947 to 1995, all area codes assigned and activated followed the original numbering scheme. A few new area codes were added each year, but it took almost 50 years before the telephone system exhausted its supply of "original" available area codes.

In 1995, the industry ran out of those area codes and the network was upgraded to accept 2 through 9 as the middle digit.¹ The first "new" area code assigned was 334 in Alabama. Because of this change, intrastate toll calls, once dialed with a one followed by the seven digit phone number now had to be dialed using the a 1 and the full ten digit phone number. Since 1995, the number of new area codes in the United States has skyrocketed: 14 in 1995, 11 in 1996, 32 in 1997, 22 in '98 and 30 will be added in 1999. It is projected that the industry will add 25-30 new area codes annually for the next few years.

North American Numbering Plan Administration (NANPA)

The North American Numbering Plan Administration (NANPA) is responsible for administering and assigning central office codes (a.k.a. prefixes), area codes, as well as facilitating the area code relief planning process for the industry in a neutral, third-party role. The current NANPA function was established by the Federal Communication Commission (FCC) in 1997, when the FCC brought the pieces of the area code relief system under one, neutral umbrella.

Prior to the establishment of the current NANPA, area code relief planning and central office code assignment functions were being administered by the incumbent RBOCs. Bellcore, which is now Telcordia Technologies, was responsible for assigning and maintaining the database of area codes.

With the advent of competition in the telecom industry, and the passage of the Telecom Act of 1996, the FCC moved to shift those responsibilities to a neutral, third-party source that had no competitive involvement in the industry. Through a competitive procurement process, Lockheed Martin IMS' Communications Industry Services (CIS) business group was selected to serve as the NANPA

¹This plan was called "Interchangeable NPAs", because NPAs and prefixes would now look the same, and would thus appear interchangeable.

through an FCC order in October 1997. CIS assumed the NANPA responsibilities in January 1998, beginning a transition period that was completed in March 1999. During this transition period, CIS/NANPA was responsible for any new area code relief planning, but any ongoing activity was still the responsibility of the incumbent code administrator/LEC. The central office code assignment responsibilities were transitioned differently and were handled on a region-by-region basis.

Through its role as the NANPA, CIS assigns central office codes to certified service providers throughout the United States. On an area code-by-area code basis, NANPA tracks and monitors the rate of CO Code assignments and uses that information to project when an area code is going to exhaust. NANPA then starts the relief planning process, which ranges from 12-30 months, depending on the state.

NANPA convenes a meeting of the telecom reps in the given area code to discuss the relief planning process and the different alternatives for area code relief. The two standard forms of relief are a geographic split and an overlay, which are discussed below.

Splits and Overlays

The geographic split relief option, which is typically the most common form, draws a line through the existing area code, assigning a new area code to telephone customers on one side of the line and retaining the existing area code for customers on the other side of the line. This requires customers to change their area code, but retains seven-digit dialing within the area code. The split can be either a two-way or three-way split.

When area code relief takes the form of an overlay, a second area code is added to the same geographic area as the existing area code. All existing numbers will retain the original area code, but new telephone customers for local phone service, cellular and paging services, and alarms, for example, assigned in the same geographic area may receive the new overlay area code. In addition, all telephone calls made in the overlay area require 1+10-digit or 10-digit dialing (this varies throughout the country) – this includes calls currently dialed with seven-digits in the same area code.

The great majority of relief efforts have used geographic splits. However, overlays have been implemented in Houston, Dallas, Atlanta, Miami, Denver, and the entire state of Maryland. The Illinois Commerce Commission (ICC) has approved overlays for 5 area codes in the Chicago suburban area, but they have not been implemented, due to number pooling trials (discussed below). In addition, the California Public Utility Commission (CPUC) has approved several overlays for that state, which are scheduled to begin in 2000 and 2001.

Local Number Portability

Another component of the ever-changing numbering world in the telecommunications industry is the advent of local number portability (LNP), which allows customers to keep their phone numbers even if they change local service providers, much the same way they have done for many years with long distance. In accordance with the Federal Telecommunication Act of 1996, on June 27 of that same year, the FCC released its First Report and Order on Telephone Number Portability requiring all LECs to provide a long-term database method for LNP in the country's 100 largest MSAs (metropolitan statistical areas).²

What Is LNP?³

LNP is a technological development that allows an end-user to retain a phone number when making changes to their local service. The changes allowed will vary depending upon the type of LNP in place. The three types of LNP are:

- 1) Service Provider Portability: Allows an end-user to change telecommunications service providers while retaining his/her telephone number, for example, from Bell South to AT&T;
- 2) Location (Geographic) Portability: Allows an end-user to change from one geographic area to another while retaining his/her telephone number, for example, from one area code to another;

² First Report and Order on Telephone Number Portability, CC Docket No. 95-116, Document No. 96-286, June 27, 1996.

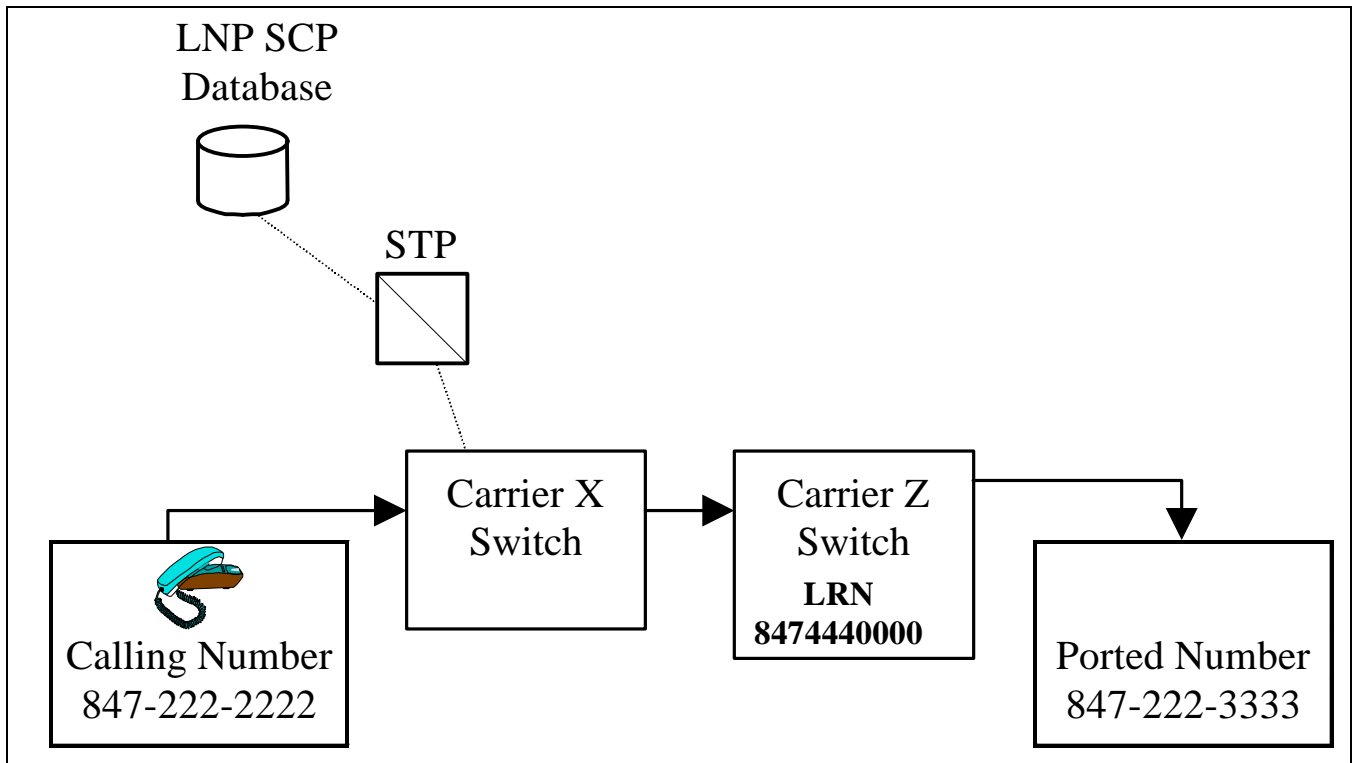
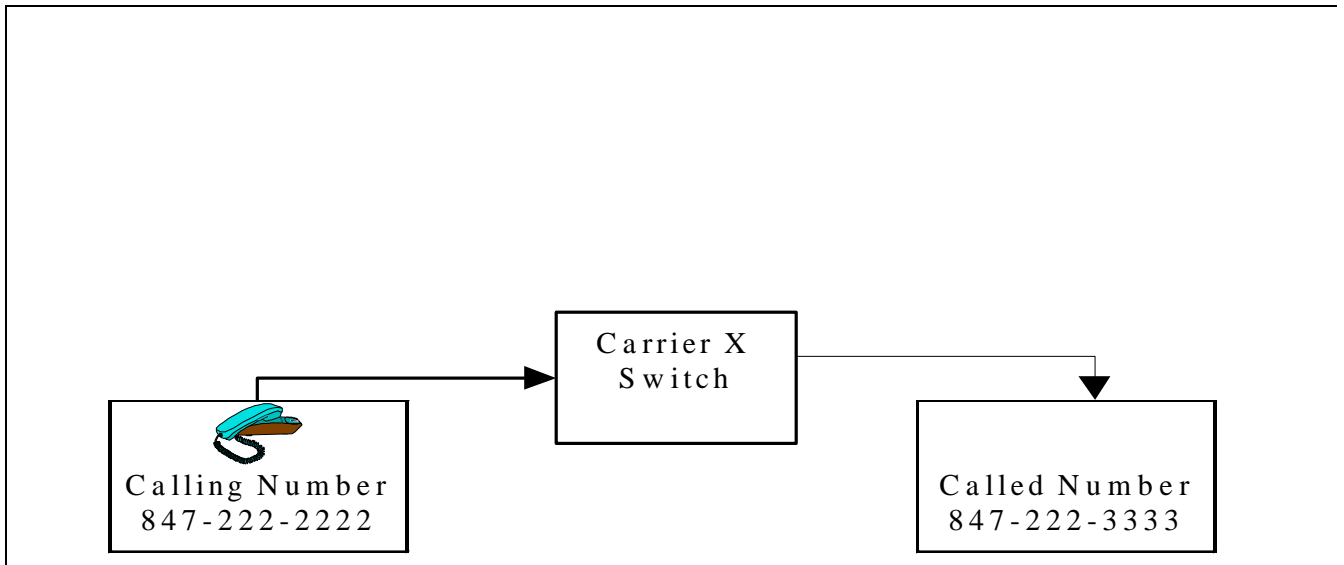
- 3) Service Portability: Allows an end-user to change service while retaining his/her telephone number with the same Service Provider, for example, from CENTREX to traditional telephone service.

Service provider portability has been and is currently being implemented across the country, therefore, the primary focus of this document is service provider portability, which we will refer to throughout simply as LNP.

Without LNP, a customer wanting to switch their local service from one carrier to another would be required to change their phone number. LNP is not available today for wireless services, such as cellular. To switch service from one cellular provider to another currently necessitates a number change. Conversely, in most of the larger markets, and even some of the smaller markets throughout the country, LNP is available for traditional home and business wireline services.

Where LNP has not been implemented, a call is routed from one carrier switch to another using the area code and prefix (NPA-NXX) to identify the proper switch to receive the call. With the implementation of service provider portability, calls to numbers that have been “ported” from one provider to another are routed from switch to switch using what is termed a Location Routing Number (LRN). The LRN is designed to be in the form of a telephone number (NPA-NXX-XXXX) so that it can be processed by current switches and actually sent in the place of the phone number.

Following are two diagrams: the first shows a call from one number to another where neither number has been ported, while the second shows a simplified version of how the call routing process occurs where a ported number is involved.



In the above diagram, the call originates from 847-222-2222 and is made to a customer at 847-222-3333, who has ported his number from Carrier X to Carrier Z. When the call to 847-222-3333 is sent to Carrier X's switch, the switch does not complete the call. Instead, the switch suspends the call and

sends a message to a database (the LNP SCP⁴) asking where the call should be delivered. The database responds back to the switch with the Location Routing Number of 8474440000, for example, which identifies the switch of Carrier Z. The message tells the Carrier X switch to send the call to the Carrier Z switch, which then completes the call to its customer at 847-222-3333.

The LNP SCP database in the above diagram belongs to Carrier X. In fact, each wireline carrier must be able to check a database – its own or that of a third party – for call routing information on all ported numbers. Because there are multiple databases, with many being owned by separate, often competing companies, a master database is required to ensure all individual databases have the correct information. That master database is located in Chicago at the Number Portability Administration Center (NPAC) and was built and is maintained by Lockheed Martin CIS under contract with the industry.

The deployment of LNP is complete across most of the major MSAs⁵ in the US for wireline carriers. Wireless carriers received a waiver from the FCC so that they are not required to implement LNP until November 24, 2002.

NUMBER CONSERVATION MEASURES

Number Pooling

In the same manner in which LNP allows a customer phone number to be transferred, or ported, from one carrier to another, number pooling, which is based on LNP, allows a block of unassigned numbers to be ported from one carrier to another. Thousand-block number pooling allows phone numbers to be allocated to service providers in blocks of 1,000, instead of the network-mandated 10,000, thus conserving numbers and providing for more efficient number utilization.

For example, without number pooling, if five carriers want to serve the same geographic area, each must be assigned an NXX, or prefix, to dedicate to that area. Since each NXX has 10,000 numbers, 50,000 phone numbers are available for assignment to that area, no matter how populous the area. With

⁴ The message is actually sent to the local number portability service control point (LNP SCP) via something called the signal transfer point (STP). For simplicity's sake the STP was eliminated from the description and the LNP SCP is referred to more generically as a database.

⁵ The FCC initially ordered deployment throughout the top 100 metropolitan statistical areas, and, thereafter, in areas outside the top 100 by carrier request.

number pooling that total of 50,000 numbers can be cut down to a minimum of 5,000 numbers serving the same geographic area and the same number of carriers.

To date, number pooling has been implemented in the 847, 630, and 312 area codes in Chicago and 212 and 718 in New York. Prior to an FCC freeze on State ordering of mandatory pooling (where all carriers are required to participate), the Illinois Commerce Commission (ICC) ordered mandatory pooling in all of Chicago's area codes. In compliance with this ICC order, pooling has or will be implemented in Chicago's 847, 312, 630, 708 and 773 area codes. The pooling implemented in New York's 212 and 718 area codes is participated in on a voluntary basis by carriers. Several other states have petitioned the FCC for state authority to mandate number pooling, which is not mandated federally.

Prior to number pooling being implemented in the 847 area code, 847 was projected to exhaust in January of 1998. The 847 area code has not yet exhausted, and number pooling is given much of the credit for extending its life.

Rate Center Consolidation

Yet another means of conserving numbers is rate center consolidation. To understand this concept, we must first explain what is a rate center and for what it is used.

Each large geographic area served by a carrier has been broken up into smaller areas, much like the country has been broken up into different zip codes. In fact, rate centers are used by carriers for the routing of calls just as the postal service uses zip codes to route mail. In other words, calls are sent between rate centers that represent a specific geographic area.

Because of the way the telephone network was originally designed, one area code will contain many separate rate centers.⁶ NXXs are assigned to carriers to be used within a single rate center. Generally speaking, a single NXX may not be used in more than one rate center. The reason for this is that carrier networks know, by looking at the NXX of the phone number that has been dialed, where to route a call as well as how much to bill for that call. Allowing, that NXX to be used in more than one rate center would force carriers to improperly bill for or route calls.

The reason for rate center consolidation can best be described using an example. Let's use the fictitious NPA 123⁷, which, for illustrative purposes, is comprised of 100 rate centers. Therefore, a carrier wanting to serve the entirety of 123 must request and be assigned 100 NXXs. Now assume a second carrier wants to come into that same 123 NPA to compete in 60 of the 100 rate centers. It must be assigned 60 NXXs, one per rate center in which it wants to compete. Assume now that, based on the first carrier having some success in NPA 123, 10 more carriers decide to enter the NPA to each compete in 60 rate centers. The 10 carriers will be assigned 60 NXXs a piece, for a total of 600 NXXs. At this rate, , 760 NXXs have already been assigned, of the approximately 792 usable NXXs within the 123 NPA. If even one more carrier decides to enter the market to compete in even one-third of the total 100 rate centers in 123, a new area code will need to be introduced.

Now assume that the first carrier in the market has 800,000 customers, the second carrier has 100,000, and the remaining eleven have only a combined total of 10,000 because they have just begun to

⁶ The number of rate centers within an area code is not consistent. Some area codes may contain hundreds of rate centers while other contain just a few.

offer service. That is a total of 910,000 assigned phone numbers, or the equivalent of 91 NXXs. In other words, although 123 is now considered exhausted (it has no more assignable NXXs), only 910,000 of the possible 7.92 million numbers have been assigned.

One way to alleviate this problem is to lessen the number of rate centers within an NPA. Using the above example, assume the number of rate centers in area code 123 has been consolidated from 100 to 10. Each new carrier can serve the entire area code with only 10 NXXs, as opposed to a portion of the area code using 60 NXXs.

Individual Telephone Number Pooling

This concept of pooling is identical to thousand-block pooling, except that numbers are doled out to carriers in blocks as small as one. While, quite obviously more efficient than thousand-block number pooling from a theoretical standpoint, a great deal more technical development is necessary before this type of pooling can be ready for use.

Unassigned Number Porting

Using the capabilities in place with LNP, this is the porting between carriers of numbers that are yet unassigned to customers. The fact that they are yet unassigned allows a carrier needing numbers to serve a customer to receive numbers from another carrier to serve its customers. Thus, they are not required to obtain larger blocks of numbering resources directly from the NANPA. This method differs from pooling in that the resources are not set aside by carriers into a pool, to be administered by a neutral third party, such as the NANPA. Instead, the numbers are transferred directly from one carrier to another using LNP.

Location Portability

As described earlier, location portability would allow a customer to move geographically and keep their phone number. With location portability, the need to limit NXXs to use within the boundaries of a rate center is eliminated. Again, using the 123 NPA example, where 123 has 100 rate centers, if

⁷ 123 is not a usable NPA because the first digit is a 1.

location portability were in place throughout the 123 NPA, a carrier could technically serve the entire NPA with one NXX. As with individual telephone number portability, a great deal more development is needed before this can be ready for use.

Mandatory 10-digit dialing and Freeing up the D Digit

This method would mandate 10-digit dialing for all local calls. The purpose of this is to free up for assignment some NXXs that have been marked as “protected” (unassignable) for purposes of allowing the continuation of 7-digit dialing. Mandatory 10-digit dialing takes a major obstacle out of the way of carriers’ abilities to free up the “D-digit.” The D-digit is the fourth number (A is the first ,B is the second, C is the third ,D is the fourth...) in the 10-number string that makes up a telephone number, or the first digit of the NXX or prefix. Currently, neither a 0 or 1 may be used as the first digit of an NXX due to network routing and billing problems it would cause. Allowing a 0 and 1 to be used as the first digit of the NXX would make available roughly 2,000 more numbers in each NXX, or 2 million in each NPA. A great deal of development is needed before this can be accomplished.

Administrative Options to Number Conservation

A number of non-technical options are available that may help to conserve numbering resources. Some of these involve changes to the industry number assignment guidelines. Following are a few of the options.

Fill Rates

The requirement of fill rates or utilization levels is one way to have carriers make a showing of need before asking for and receiving additional numbering resources. A mandatory fill rate simply means that a carrier must have assigned a certain percentage of its existing number resources prior to requesting more. For example, if a carrier has one NXX in an area with a 65% fill rate requirement, it must have 6,500 numbers assigned before it may request additional numbering resources in the same area. Today, there is no requirement to make any such showing of fill rate.

NXX Reclamation

The industry guidelines, under which the NANPA operates, specify a process to be undertaken by the NANPA to reclaim NXXs that have been assigned to carriers, but which have not been activated by those carriers. If an NXX is assigned to a carrier but is not put in use by that carrier or made available for use by other carriers by the reclamation process, it can be considered, at least temporarily, a wasted resource. Because of the rapid rate of area code exhaust being experienced across the country, many regulatory agencies and industry players feel the percentage of resources wasted should be zero. NXX reclamation by the NANPA would not eliminate wasted resources, but would ensure that no resource is continually held as unusable due to inactivation.

Utilization, Forecasts, and Audits

Parties have suggested that carriers submit more detailed supporting documentation with their request for codes and such as information on the utilization percentage of existing resources, and detailed forecasts for future resource needs. The collection and auditing of more detailed NXX usage information might allow the NANPA, the FCC, and State Commissions to scrutinize more closely NXX requests received by the NANPA. The goal of these measures is to require service providers to further justify their NXX requests.

Industry Organizations

There are a number of industry organizations that work specifically in the area of numbering. Generally, these organizations act as advisory boards or standard setting groups. While they hold no formal regulatory power, their work is very important to all within the industry and to regulators. A couple of the more visible organizations are described below.

North American Numbering Council

In October 1995, the Federal Communications Commission established the North American Numbering Council (NANC) to assist in adopting a new model for administration of the North American

Numbering Plan (NANP). Additionally, NANC was created to provide advice and recommendations to the FCC and other NANP member governments on numbering issues, select neutral NANP and local number portability (LNP) administrators, and conduct initial resolution of certain numbering disputes. The NANC membership includes representatives from the telecommunications industry, as well as members representing NANP member countries, the states, and consumers.

The NANC meets at least once per month, but also has assigned tasks to various subgroups or issue management groups (IMG) that may meet monthly or more or less often as their workload dictates. Some of the current subgroups are the Number Resources Optimization (NRO) Working Group, the Cost Recovery Task Force, the NANPA Oversight Working Group (NOWG), and the Number Pooling IMG. Generally, these groups include issue experts that work together on issues for the NANC to consider that will then be forwarded to the FCC as a NANC recommendation.

Alliance For Telecommunications Industry Solutions (ATIS)

ATIS is a North American standards body concerned with the development of telecommunications standards, operating procedures and guidelines through a number of sponsored committees and forums. ATIS members are providers of telecommunications services, and include telecommunications service providers, competitive local carriers, cellular carriers, interexchange companies, local exchange companies, manufacturers, software developers, resellers, enhanced service providers, and providers of operations support.

One particular ATIS forum that concentrates on numbering issues is the Industry Numbering Committee (INC). The INC attempts to address and resolve industry-wide issues associated with the planning, administration, allocation, assignment and use of numbering resources and related dialing considerations for public telecommunications within the North American Numbering Plan (NANP) area. The INC has a number of “workshops” that meet on a regular basis to address specific numbering issues. For example, the CO/NXX Workshop addresses issues related to the assignment and administration of central office codes (NXXs), and the LNPA Workshop attempts to resolve LNP numbering issues which

will initially include assignment and administration of Location Routing Numbers (LRN) and number pooling in a portability environment.

Often, the INC will accept issues from the NANC and be asked to provide the NANC with a recommendation just as one of the NANC subgroups might do; however the INC and the NANC are separate organizations.

Conclusion

As can be seen throughout the preceding pages, numbering goes much deeper than each customer's 10-digit telephone number. However, it does not require many years working in the industry to have a reasonable level of knowledge of numbering. The intent of this document is to provide the reader with that reasonable level of knowledge. For further study, a list of industry and other government documents is provided in Appendix 1.

Appendix 1

Materials to reference for more numbering information:

The LNP Primer at www.ported.com

Central Office Code (NXX) Assignment Guidelines at www.atis.org

NPA Code Relief Planning & Notification Guidelines at www.atis.org

Thousand Block (NXX-X) Pooling Administration Guidelines at www.atis.org

Number Resource Optimization Working Group Modified Report to the North American Numbering Council on Number Optimization Methods at www.fcc.gov

NANPA Exhaust Report at www.nanpa.com

Location Portability at www.numberpool.com/geo/Geographic%2520Portability.htm