ATIS-0300073

REPORT ON NANP D DIGIT RELEASE

January 24, 2003

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1.0   Background

The current definition of a NANP Public Switched Telephone Network (PSTN) number is two codes (an area code and a central office code) of three digits each and a station code of four digits, totaling ten digits. The 'D' digit is the fourth digit in that stream of 10 digits. It is the first digit in a central office (CO) code, e.g., in 816-342-1254 the '3' is the D digit. Currently, the value of the D digit can only be a number from 2-9; the values of 0 and 1 may not be assigned in this position. This restriction allows the assignment of 80% of the CO codes in all NPAs. D digit release is the effort required to redefine the CO portion of the NANP to allow the use of 0 or 1 in the D digit position. If the D digit restriction is eliminated, it could result in the availability of up to 200 additional CO codes for each NPA.

Service Providers (SPs) have always needed additional codes in the NANP format to perform other functions. None of these additional codes are dialable by telephone users. Since the values 000-199 are not part of the assignable NANP numbers for either of the first two codes, these values can be used for the additional functions, (e.g., Inward Operator Codes, Industry Test Codes, Emergency Services Indicator Digit, etc.). SPs have defined requirements for switching and billing systems to detect when these values appear unexpectedly. The industry has used these D-digit codes for both inter SP purposes as well as intra SP applications. Within this report these uses will be categorized. An indication will also be given if their continued use would cause a conflict to the industry even if the numbers are not dialed over the PSTN.

An underlying assumption in INC's work on the expansion of the NANP has been the release of the D digit coincident with NANP expansion. This is necessary to effect a transition in which both the existing and the expanded numbers can be dialed by using the historic D digit as a trigger. Release of the D digit would permit any digit value from 0-9 to be used in that position. The objective of this report is to identify and investigate the technical impacts of D digit release.

The FCC discussed the release of the D digit in the "Second Report and Order, Order on Reconsideration in CC Docket No. 96-98 and CC Docket No. 99-200, and Second Further Notice of Proposed Rulemaking in CC Docket No. 99-200", FCC 00-429 released December 29, 2000. The FCC directed carriers to begin identifying and eliminating specialized uses of 0 and 1 as the D digit in anticipation of the eventual release of the D digit.

2.0   Identified Industry Uses of D Digit

In order to identify the impacts of D digit release, it is necessary to have a clear understanding of the myriad ways in which NANP formatted numbers with 0 or 1 as the D-digit are used in telecommunication networks. It is useful to distinguish between intra- and inter-service provider applications. This distinction is important because, if and when the D digit is released, it will be up to individual carriers to determine how to replace D digit resources being used for intra-service provider applications. The industry must agree on how to replace D digit resources in inter-service provider applications. Within inter-service provider applications, it is also

necessary to distinguish uses that are network related from those that are operator support system related.

2.1   Network Applications

Examples of current network applications of 0/1XX Central Office codes include:

2.1.1. Test Codes

Seven-digit Test Numbers
Seven-digit test numbers that begin with the CO codes 167, 181, 182, 183, 195, 198, 199, represent an intra-service provider application using the D digit. Any number can be used for test purposes so there should be ample opportunity to migrate off of these specific codes in the future. Should these codes be maintained as is they will represent a conflict with assigned numbers once the D digit is released.

10X Test Line Codes
Three digit addresses of the form "10X" are in widespread use sending calls to standard test lines. The codes 100, 102, 105, 108 and 109 are currently the most widely used. These 10X codes are used alone as the address in either MF or SS7 trunk signaling, and are not normally, but may in some cases, be combined with an NPA code. 10X codes are normally used only when the destination switch is a tandem, and are not usually sent to local offices. In areas where D digit release would be used, a restriction prohibiting the use of 7-digit numbers would be needed for trunk groups that expect the 10X test codes. This use represents an inter-service provider application of the D digit since the testing can be conducted between two switches one being a tandem switch. Since this testing can be done on a ten digit basis, it may be best to then assign some of these numbers for test purposes within the 100, 102,105, 108 and 109 codes. This would allow all the rest of the numbers to be assigned for normal purposes. Carriers receiving CO code or thousands block assignments containing numbers reserved for testing would need to make these numbers unavailable for assignment to end users.

2.1.2. Billing Numbers

Marine Identification Numbers
CO Codes in the 0/1XX format are used as billing numbers for marine originated traffic (ship to shore). These are called Marine Identification Numbers. This use represents an inter-service provider application. If an alternative is not adopted before D digit release continued use of these codes could potentially represent an ambiguity for billing systems since there will also be assigned numbers with identical CO codes on billing tapes and call detail records.

INWATS and OUTWATS
CO Codes in the 0/1XX format are used as billing numbers for both INWATS and OUTWATS lines. These numbers are usually in the format of 00X-XXXX for INWATS and 01X-XXXX for OUTWATS. This use represents an intra-service provider application. If an alternative is not adopted before D digit release continued use of these codes could potentially represent an

ambiguity for billing systems since there will also be assigned numbers with identical CO codes on billing tapes and call detail records.

<u>Special Billing Numbers</u>
CO Codes in the 0/1XX format are used as special billing numbers for PBX/Centrex. These special billing numbers are recorded in switch Automatic Message Accounting (AMA) records and receive special treatment in downstream systems. In the case of OUTWATS they also control certain aspects of call processing that determine whether a given call can be placed. These numbers may be signaled between switches but are not passed between networks. These uses of the D digit represent a set of intra-service provider applications. If an alternative is not adopted before D digit release, continued use of these codes could potentially represent an ambiguity for billing systems since there will also be assigned numbers with identical CO codes on billing tapes and call detail records.

2.1.3   Pseudo Numbers

Pseudo numbers in the format 0XX-XXXX are sometimes assigned to Automatic Call Distributor (ACD) groups to conserve "real" numbers. These numbers are always associated with a "real" lead number and are never directly dialed by subscribers. These numbers are used within a given switch. If the switch software does not differentiate this application from actual dialed numbers, then this intra-service provider application may represent an ambiguity to the switch software and these pseudo numbers may not be identified in a different manner than actual assigned numbers that will have the same digits. Given this situation, the continued use these pseudo numbers cannot be supported.

2.1.4   Feature Group D 0ZZ and 1NX Codes

0ZZ[1] and 1NX codes appear in the first stage of MF signaling for FGD inter-exchange calls. Many Operator Services trunk groups, as well as E9-1-1 systems, still use MF signaling. Historically, the 0 and 1 were chosen as leading digits to avoid conflict with the 2-9 leading digits of both 7-digit and 10-digit telephone numbers. In areas where D digit release would be used, a restriction prohibiting the use of 7-digit numbers would be needed for MF FGD signaling. This is likely to be a significant issue only in LATAs that are single-NPA, since trunks would normally be arranged for 10-digit addresses in multi-NPA LATAs. These codes are used for both intra- and inter-service provider applications.

2.1.5   Caribbean Codes

0/1XX Central Office codes are used in the Caribbean for a variety of purposes including, USA direct dialing, international inbound 800, and some operator services**.** If these intra- or inter-service provider applications create a situation where assigned CO codes using the released D digit create conflicts, then other codes will be required that are not conflicting.

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[1] **0ZZ codes**, used for trunk group selection in MF signaling, are drawn from spare Toll Center Codes, see Telcordia Technologies™ GR-690-CORE, *Exchange Access Interconnection FSD,* Section 3.1.1.2.1 Issue 2, October 1996.

2.1.6   Emergency Services

Some wireless Emergency Services Routing Digits and Emergency Services Routing Keys (ESRD/ESRK)[2] make use of numbers with a 0/1 D digit since the intent has been to avoid use of normal assignable NANP resources for this purpose.

There may also be instances where 0/1 D digit numbers are used for routing to a Public Safety Answering Point (PSAP) in order to have a non-dialable number so as to protect the PSAP from mis-dialed or maliciously placed calls.

These applications are intra-service provider and will need to be changed. There are a number of alternatives that are already used in wireless networks that can replace this approach.

2.1.7 Virtual Private Network (VPN) Routing

The Modification of Final Judgement (MFJ) allows telephone companies to offer Central Office Based telephone systems for end users. These systems are pseudo-PBXs. Part of this service routes simulated private network traffic over the PSTN. In order to distinguish the private network traffic from the normal PSTN traffic, these systems use routing digits in the format of the Codes 000-199. These codes get routed across networks and complete in customer facilities by distinguishing the routing codes differently from normal 7 or 10 digit PSTN routing. These VPN facilities are accessed by dialing an access code which takes the end-user directly to the service provider carrier providing the VPN service. The VPN traffic is then mixed with PSTN traffic and crosses the service provider network. At the terminating end, the switching system interprets the routing digits to complete to another end-user as if the call was switched by a private network.

This is an intra-service provider application and will need to be assessed within each service provider network to determine if there is a conflict between VPN routing codes and NANP CO codes having the D digit released.

2.2   Operator Support System Applications

Examples of current operator support system applications of 0/1XX Central Office codes include:

2.2.1   Operator Services Inward Routing

The LERG shows over 1,000 telephone locations assigned in Area Codes 886 and 889 as not being dialable by any customer. These locations can only be reached via telephone company operators. Calls are completed operator-to-operator using Inward Routing.

Operators route calls to one another for functions such as inward Busy Line Verification (BLV), hard to reach numbers, non-dialable numbers, etc. The dialing pattern is NPA-TTC-OSDC,

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[2] See Telcordia GR - 145 - CORE, *Compatibility Information for Interconnection of a Wireless Services Provider and a Local Exchange Carrier Network,* Issue 2, May 1998.

where NPA is the area code (Number Plan Area), TTC is the Terminating Toll Center, and OSDC is the Operator Special Dialed Code. OSDCs are 3- to 5-digits in length. The inward calls are routed on an NPA-TTC basis when calls are placed between operator systems. An operator might not have to dial the NPA if the operator was going inward to an operator system within its home NPA.

Toll Center Codes, having the format 0/1XX, are preceded by the NPA, and are listed in the Telcordia™[3] LERG™[4]. The LERG Routing Guide shows the total number of active NPA-Access Tandem Code (ATC) combinations in service. Of those codes, it indicates how many fall into the 0XX and 1XX categories and their respective values. It also indicates how many 0/1XX values are in the different NPAs. The LERG Routing Guide also indicates the number of routing patterns that are used for active ATCs.

Whether with Non-dialable toll point NPAs (e.g., 886 and 889), or geographic NPAs, operator services rely on the existing D digit restriction of a 0 or 1 to identify that the call is from another operator service and prevent end users from fraudulently accessing operator functions. With this restriction lifted allowing NPA-0/1XX-XXXX calls to be routed from anywhere, there would be no simple method to determine that the call was from another operator. The switching systems use the D digit restriction to know that only another operator could route with a 0/1 in the D digit position. This restriction aids in preventing toll fraud since the receiving operator position does not generate a billing record for the call.

This application represents an inter-service provider type of situation and an alternative approach will be necessary to avoid a conflict with future assigned numbers that will not have a D digit restriction.

2.2.2 Special Billing Numbers for Calling Card

Operator Service Systems query the Line Information Data Base (LIDB) to determine whether certain call types may be billed to given numbers. One type of LIDB record is named a Special Billing Number (SBN)[5]. SBNs have the format NXX 0/1XX XXXX. SBNs may be used for Calling Cards not associated with line numbers by LECs and non-LECs. When offered by a LEC, the card may be known as a Revenue Accounting Office (RAO) card and with the first three digits identifying the RAO performing the billing. When offered by a non-LEC, e.g., an interexchange carrier, the card may be known as a Call Issuer ID (CIID) card, with the first six digits of the card being called the CIID.

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[3] Telcordia and LERG Routing Guide are trademarks of Telcordia Technologies, Inc.

[4] GR-1144-CORE, OSSGR: Section 6: Signaling, (Issue 2August 2001), Section 9.1 briefly describes the function of these codes, and Tables 13-3 and 13-6 in that document make it clear that routing to an OSS using Toll Center Codes populates the SS7 Called Party Number parameter – and thus must not conflict with end-user assignable NANP numbers.

[5] SBNs are referenced in several Generic Requirements documents, including: GR-1158-CORE, *OSSGR Section 22.3: Line Information Database*, Issue 5, August 2002, (GR-1149-CORE, *OSSGR Section 10: System Interfaces,* Issue 4August 2002 and GR-1177-CORE, *OSSGR: Special Billing Features (FSD 85 Series),* Issue 2, December 2000.)

The SBNs allow ICs to provide TLN-based (Telephone Line Number-based) 10+4 calling cards and wireline LECs to assign such cards when more than one person needs a distinct calling card but had no distinct telephone number, e.g., multiple people using the same phone in an apartment but needing a separate calling card account. Since there were no phone numbers assigned with a D digit of 0/1, there would be no collisions with any calling card based on a phone number. If the CO codes now used for these special cards become assignable as regular line numbers, subscribers might be assigned a phone number that is used in an already assigned RAO or CIID card. This will cause conflicts in the LIDB, carrier billing, or clearinghouse systems resulting in improper call processing or billing. This is an intra-service provider application that will need to be addressed in each circumstance where a potential conflict may arise. Since many upgrades are adopted in the LIDB system on an ongoing basis, this conflict situation needs to be addressed before D digit release occurs.

2.2.3   Fraud Prevention

Some switching and operational support systems have NANP format checks for fraud detection. One such method checks the calling-number and called-number for validity. A validity check is that the "A" and the "D" digit cannot be a 0 or 1. If the check reveals a 0 or 1 in these positions, the switch will not process the call. Billing systems will flag these records for manual checking. This method for fraud prevention will not work when the D digit is released, therefore another method will be required.

3.0   Implementation Issues

3.1   Nationwide implementation

It is necessary to implement D digit release at one point in time throughout the NANP. All subscribers within every NANP nation would need to have the ability to accommodate the dialing of a 0/1 in the fourth position in order to originate a call to an area where numbers with a released D digit are assigned. All SPs would be required to open the 0/1XX CO codes in their networks as permitted codes. This would have to be coordinated at a specific point in time, as no known method exists to enable a permissive dialing period to achieve this change.

3.2   Dialing Implications

D digit release, in certain states or areas, would mean that subscribers in those areas would have to dial the complete NANP number for all calls. This dialing may be in the form 1+ 10 digits or 10 digits with no 1 prefix. Local 7-digit dialing could be maintained in areas that did not choose to release the D digit within their own NPA(s). However, should someone in these areas dial a number to a different area where the D digit had been released, they would be required to dial a minimum of 10 digits.

3.3   Impact on Future Number Expansion Plans

The INC NANP Expansion workshop has concluded that the most viable option for expansion requires that the D digit not be released until NANP expansion since D digit values of 0/1 will be

used during permissive dialing to allow expanded format numbers to be distinguished from old format numbers. If the D digit is released prior to expansion, a different expansion option would have to be chosen. Currently, the N9X NPAs which represent approximately 10% of the remaining NANP resources are set aside for the possibility that a different but less desirable transition option may need to be employed.

3.4 Customer Premise Equipment (CPE)

Although the INC did not investigate the CPE issue, there are likely certain types of equipment that will not function correctly when the D digit is permitted to be a 0 or 1. It is recommended that owners and providers of CPE check their equipment for D digit impact(s) and determine what changes would be required.

The INC has not been able to determine the magnitude of this issue. An analogous situation occurred when Interchangeable NPAs were introduced in 1995 (i.e., when the NPA format changed from N0/1X to NXX). At that time, a significant percentage of the CPE equipment could not accommodate the opening up of the B-digit. Therefore, it could be assumed that a certain percentage of the CPE equipment may not be able to accommodate the opening up of the D digit.

3.5 Elimination of the Existing Uses of 0 or 1 in the First Position of the CO Code

Elimination can be accomplished by:
- Reassignment to valid NANP numbers other than numbers with a zero or one in the D digit
- Elimination of the function
- Technological replacement of the function.

4.0 International Concerns Outside the NANP

There are no known international concerns with respect to the D digit release since foreign carriers do not typically analyze calls down to the central office code level. There are also no restrictions on the values of the digits within the 15-digit E.164 number.

5.0 Industry Reference Documents

Many industry documents include a reference to the format of 10-digit NANP numbers that are assignable to end users as NPA NXX-XXXX (with the NPA also having an NXX format). Particular examples are:

- Telcordia Technologies, GR-690-CORE, LSSGR: Exchange Access Interconnection Feature Requirements, (Issue 2, Revision 1, November, 1996) Section 3.2.3,
- Telcordia Technologies, GR-317-CORE, *LSSGR:* Switching System Generic Requirements for Call Control Using the Integrated Services Digital Network User Part (ISDNUP)*, (*Issue 5, December 2001) Section 3.1.1.1.A.6, and

- GR-394-CORE, *LSSGR*: Switching System Generic Requirements for Interexchange Carrier Interconnection (ICI) Using the Integrated Services Digital Network User Part (ISDNUP)*, (Issue 5, December 2001), Table 3-1.
- LSSGR section 5.3.3.1 (Customer Dialed Codes) as: "In the 10-digit format, the fourth or D digit (if ABCD... sequencing is applied) must also be N. This format should be verified in every case."
- ATIS Committee T1 has evaluated the potential impacts on SS7 protocols. There are a number of parameters in SS7 protocols, specifically SCCP, ISUP, and TCAP, that transmit address information. Generally these parameters permit flexibility in the nature of the address carried, e.g. either a 10-digit national number or a 7-digit subscriber number. A number of standards and requirements refer to the format of NANP numbers as "NPA–NXX–XXXX." These standards and requirements would require revision and balloting if the D digit range was extended. The revision could raise compatibility and other issues with existing implementations of the standards. Please note: the T1 analysis was limited to the protocol capabilities for transferring information. It did not attempt to assess other signaling protocols, call control, or other nodal application capabilities for:
    1. Generating specific digit values in the D digit position of an address field, or
    2. Responding to the receipt of specific values in the D digit position of an address field.

6.0   Conclusion

As detailed in this report, releasing the D digit after expansion requires the clearance of all inter-service provider applications of the 0 and 1 in the D digit position <u>prior to</u> expansion. The network must be able to accurately and ubiquitously deal with numbers dialed when the CO code begins with a 0 or 1 NANP format (e.g., NXXX-XNXX-XXXX). It is recognized that the current uses are extensive and therefore steps must be taken to clear all current uses of codes with a 0 or 1 value of the D digit prior to the rollout of NANP expansion to ensure a successful and on-time implementation of NANP expansion. In addition, SPs should review their intra-service provider applications of the 0 and 1 in the D digit position to evaluate any internal impacts.

Again it should be noted that the FCC directed carriers to begin identifying and eliminating specialized uses of 0 and 1 as the D digit in anticipation of the eventual release of the D digit. In the meantime, SPs should ensure that no additional inter-service provider D digit functionality is added to their networks. Any specific industry efforts associated with clearing the D digit also should be addressed by parties other than the INC, e.g., OBF, NIIF, and Committee T1. Of course, regulators in NANP nations play a key role in planning for the orderly release of the D digit.