ATIS-1000004

THOUSANDS BLOCK NUMBER POOLING USING NUMBER PORTABILITY

TECHNICAL REQUIREMENTS

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ATIS-1000004, *Thousands Block Number Pooling Using Number Portability*

Is an ATIS Standard developed by the **PTSC.3** Subcommittee under the **ATIS Packet Technologies and Systems Committee (PTSC)**.

Technical Requirements for

THOUSANDS BLOCK NUMBER POOLING
USING NUMBER PORTABILITY

Secretariat

Alliance for Telecommunications Industry Solutions

Approved October, 2004

Abstract

This technical requirements document defines the switching system, Number Portability Database (NPDB), and Number Portability Global Title Translation (NP GTT) requirements for thousands Block Number Pooling in Number Portability (NP) capable wireline networks.

FOREWORD

The Alliance for Telecommunication Industry Solutions (ATIS) serves the public through improved understanding between carriers, customers, and manufacturers. The Packet Technologies and Systems Committee (PTSC) -- formerly T1S1 -- develops and recommends standards and technical reports related to services, architectures, and signaling, in addition to related subjects under consideration in other North American and international standards bodies. PTSC coordinates and develops standards and technical reports relevant to telecommunications networks in the U.S., reviews and prepares contributions on such matters for submission to U.S. ITU-T and U.S. ITU-R Study Groups or other standards organizations, and reviews for acceptability or per contra the positions of other countries in related standards development and takes or recommends appropriate actions.

Number portability is a circuit switched network capability that allows an end user to move their North American Numbering Plan (NANP) number from one serving switch in a network to another switch in the same or different circuit switched network.

This technical requirements document defines the switching system, Number Portability Database (NPDB), and Number Portability Global Title Translation (NP GTT) requirements for thousands Block Number Pooling in Number Portability (NP) capable wireline networks. This uses the Location Routing Number (LRN) method for number portability. Thousands Block Number Pooling shares an NPA-NXX among carriers allocating numbers in blocks of one-thousand numbers with the same NPA-NXX-X. Number pooling is a number administration and assignment process that allocates numbering resources to a shared reservoir associated with a designated geographic area such that blocks of directory numbers (DNs) smaller than an entire NXX code are available for assignment by service providers.

Information contained in normative annexes is considered part of this technical requirements document. Information contained in informative annexes is not considered part of these technical requirements but is auxiliary to the specification. Similarly, footnotes are informative.

ANSI guidelines specify two categories of requirements: mandatory and recommendation. The mandatory requirements are designated by the word *shall* and recommendations by the word *should*. Where both a mandatory requirement and a recommendation are specified for the same criterion, the recommendation represents a goal currently identifiable as having distinct compatibility or performance advantages.

Suggestions for improvement of this document are welcome. They should be sent to the Alliance for Telecommunications Industry Solutions, ATIS Secretariat, and 1200 G Street NW, Suite 500, Washington, DC 20005.

The PTSC.3 Subcommittee was responsible for the development of this document.

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1 SCOPE AND OVERVIEW

1.1 Scope

This technical requirements document defines the Switching System, Number Portability Database (NPDB), and Number Portability Global Title Translation (NP GTT) requirements for Thousands Block Number Pooling[1] in Number Portability (NP) capable wireline networks. This uses the Location Routing Number (LRN) method for number portability. Thousands Block Number Pooling shares an NPA-NXX among carriers allocating numbers in blocks of one-thousand numbers with the same NPA-NXX-X. The pooling of numbers in blocks smaller than one-thousand (e.g., Individual Telephone Number Pooling) and the pooling of numbers outside a rate center are not addressed...

1.2 Overview

Pooling of geographic numbers in a number portability environment is a number administration and assignment process, which allocates numbering resources to a shared reservoir associated with a designated geographic area.

This document addresses the pooling of numbers within an existing rate center within a geographic Number Plan Area (NPA). The numbering resource in the shared reservoir is made available in blocks of one-thousand numbers for assignment to competing service providers participating in number pooling for the purpose of providing services to customers in that area.

The assignment of numbers to service providers in blocks of one-thousand (i.e. NPA-NXX-X) rather than the existing practice of assigning numbers in blocks of 10,000 (i.e. NPA-NXX) may improve the utilization of number resources. Further, a pool of numbers, if available to all providers serving a defined area, need only be large enough to accommodate the collective needs of those providers. Within a pooled environment, the total number of NXX codes assigned could be fewer than if a full NXX code were assigned to each service provider; therefore numbering resources may last for a longer period of time.

Existing network routing mechanisms are based upon the understanding that geographic numbers are assigned on a central office (NXX) basis and associated with a specific switch, and the recognition that the network address to which the call must be routed is embedded in the first six digits (NPA-NXX) of the called number. The use of number pooling eliminates this association of NXX to end office and demands an alternative routing mechanism for call completion. Such a mechanism is provided with the infrastructure associated with the LRN method for NP. Therefore, in December 1997, the Industry Numbering Committee (INC)

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[1] To avoid confusion with the acronym for number portability (NP), this document does not use an acronym for number pooling.

recommended that the industry proceed with thousands block number pooling supported by the LRN NP infrastructure. Accordingly, and most importantly, number pooling can only be implemented in NP-capable networks.[2] Subsequently, the Federal Communications Commission issued its Numbering Resource Optimization order, FCC 00-104, mandating the deployment of thousands block number pooling. The Order states "… we adopt the PSTC Committee Technical Requirements as the technical standard for a national thousands-block number pooling mechanism."

Similarly, non-call associated signaling messages associated with database (e.g., Line Information Database (LIDB)) queries, or the processing of certain supplementary services, are traditionally routed using six digit analysis of a designated telephone number. Again, number pooling breaks the association of NPA-NXX with the required destination and demands more granular analysis. The mechanisms available with NP also provide this capability.

Currently, call rating is derived from the geographic information embedded in the calling and called party numbers, specifically the first six digits of those numbers (the NPA-NXX). In a number pooling environment, these rating mechanisms are still supported provided that the area of pooling -- that is, the area in which numbers are assigned and shared among different service providers -- is consistent with the established rate center boundaries, and that the NPA-NXX(s) assigned to the pool uniquely identify the rate center in which subscribers assigned numbers reside.[3] Thus, the same constraints that limit current implementations of NP to areas of portability within the rate center also limit current support for number pooling to areas of number pooling within a rate center.

When number pooling is implemented in a particular geographic area, NXXs are still assigned to a single service provider (code holder) in the Local Exchange Routing Guide (LERG), but blocks of one-thousand numbers are assigned to various service providers (block holders). The block holders then determine when to put (activate) their numbers into the Number Portability Administration Center (NPAC) Service Management System (SMS) and thus service providers' NP routing databases (i.e., NPDBs).

Number pooling, like number portability, may increase the number of NPA-NXX-Xs that must be opened on the switch. While this document does not specify a requirement on the minimum number of NPA-NXX-Xs that must be supported, it is recognized that all switch types will have some limitation. Some switches reach their limitation to accept additional thousands blocks earlier than others and, thus, the ability to receive additional thousands blocks for pooling may be restricted.

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[2] Although switch based seven digit analysis and translation can conceivably be supported in many switches and could, therefore, be used to route calls in some pooled number environments, this capability is administratively burdensome and inefficient in its use of switch memory. Therefore, this document defines an NP-based approach for number pooling.

[3] The assignment of numbers to those subscribers who reside in the rate center to which a given NPA-NXX is assigned is a wireline service provider paradigm. It should be recognized that wireless service providers typically are not constrained by this assignment procedure and may assign numbers to their subscribers from a given NPA-NXX even if those subscribers reside outside the rate center with which the NPA-NXX is associated.

2 INTRODUCTION

2.1 Network Prerequisites for Number Pooling

This clause addresses network prerequisites that must be met for number pooling to function properly as defined in this document.

1) Number pooling, as defined in this document, requires functions defined in the following:
   - ATIS-1000001, *Number Portability Operator Services Switching Systems*.
   - ATIS-1000002, *Number Portability – Switching Systems*.
   - ATIS-1000003, *Number Portability – Database and Global Title Translation*.

2) All changes to GTT data that results in a GTT on greater than six digits in an NP GTT node must be initiated by an NPAC SMS download. When no NPAC information applies, default routing of GTT-routed Transaction Capabilities Application Part (TCAP) messages will be based on six digit defaults (e.g., for LIDB the 6-digit default is defined in the LIDB Access Routing Guide (LARG)). A third data source for GTT data, such as block holder information from the LERG, should not be used, since this could drastically increase the risk of looping for GTT-routed Signaling System 7 (SS7) TCAP messages.

3) All NP GTT-routed messages (e.g., LIDB queries and messages for some supplementary services) for vacant and unassigned numbers should be routed to the appropriate application system as specified in Network Prerequisite 2.

4) Call routing is generally done based on the 6-digit NPA-NXX of the Directory Number (DN) as defined in the LERG. Changes to call routing due to NP and Number Pooling will be initiated by an NPAC SMS download to the service providers NPDB, via the Local Service Management System (LSMS).

2.2 Assumptions

1) Number pooling can only be implemented in NP-capable networks.

2) The pooling of numbers is limited to the geographic area defined by existing wireline rate centers.

3) Carriers sharing a pooled NXX must have consistent rate center definitions. Block assignments will be made from NXX codes assigned and utilized within a single rate center. All carriers will pool in accordance with the number pooling industry guidelines as defined by the Industry Numbering Committee (INC).

4) A pooled NPA-NXX is assigned to a single service provider (code holder) in the LERG.

5) Thousands blocks within an NPA-NXX can be assigned to different service providers.

6) Within a service provider's network, a pooled block can be shared across multiple switches serving a rate center although only one of those switches serves as the block holder switch. This is accomplished by assigning the block to a switch and then performing intranetwork porting to other switches.

7) Only the code holder can assign an LRN from the pooled NPA-NXX. It will still be possible for billing systems to perform six-digit lookups on the LRN to determine the switch.

8) NPA-NXXs will not cross state boundaries as a result of number pooling.

9) In the event of an NPA split, all blocks within the pooled NXX will have the same NPA after the NPA split.

10) Number Pooling does not change the aging process. The disconnecting service provider will be responsible for aging the directory number prior to snapback.

11) If a pooled number is ported away from the block holder and subsequently disconnects, it snaps back to the block holder (not the code holder) after aging.

12) Unallocated number treatment will be the responsibility of the block holder after snapback.

13) There is no need for any Automatic Message Accounting (AMA) recording requirements to distinguish calls originating from or terminating to pooled numbers, as opposed to calls originating from or terminating to ported numbers.

14) Data representation in network elements performing NPDB or NP GTT functions in support of number pooling is an implementation decision for vendors and service providers. This will allow sufficient flexibility to implement efficiencies in data representation.

15) Block holders will activate their thousands block (i.e., associate their numbers with NP information) utilizing the NPAC SMS. The NPAC functionality only supports activation of an entire thousands block for pooling, not individual DNs within the block (i.e., "port-on-demand" approach to pooling).

16) The NPAC SMS to Local SMS (LSMS) interface includes a capability for distinguishing a pooled number port type from inter- or intra-service provider port types. The interface also includes a range capability.

17) Information downloaded to the NPDB from the NPAC SMS will enable appropriate processing of ported DNs that are in a pooled block. In particular, pooled block information does not override existing NP information in the NPDB and for NP GTT.

18) For a given DN in the NPAC, there will only be one active NPAC SMS LNP Type. In the NPAC, this type is derived by giving precedence to ported information over pooled information.

2.3 Acronyms and Definitions

2.3.1 Acronyms

ACG	Automatic Code Gapping
AMA	Automatic Message Accounting
ANSI	American National Standard Institute
CdPN	Called Party Number
CPE	Customer Premises Equipment
DN	Directory Number
FCI	Forward Call Indicator
GAP	Generic Address Parameter
GTAI	Global Title Address Information
GTT	Global Title Translation
IAM	Initial Address Message
INC	Industry Numbering Committee
ISDN	Integrated Services Digital Network
ISUP	ISDN User Part

LARG	LIDB Access Routing Guide
LATA	Local Access Transport Area
LERG	Local Exchange Routing Guide
LIDB	Line Information Database
LNP	Local Number Portability
LRN	Location Routing Number
LSMS	Local Service Management System
NP	Number Portability
NPA	Numbering Plan Area
NPAC	Number Portability Administration Center
NPDB	Number Portability Database
NXX	Central Office Code
SCCP	Signaling Connection Control Part
SMS	Service Management System
SS7	Signaling System 7
STP	Signal Transfer Point
TCAP	Transaction Capabilities Application Part

2.3.2 Definitions

2.3.2.1 Block Holder Switch: The switch designated by the service provider to which a thousands block (NXX-X)[4] has been assigned for use and allocation to end users.

2.3.2.2 Code Holder Switch: The switch designated by the service provider to which the NXX is assigned in the LERG.

2.3.2.3 Default Routing: The ability of the switch to continue the call based on the dialed number when the NPDB application cannot be accessed due to abnormal circumstances or when the NPDB response contains a protocol error.

2.3.2.4 Donor Switch: The switch from which a DN was originally ported. In a number pooling environment, the donor switch is the code holder switch.

2.3.2.5 End User: A user of telecommunication services. Examples are business, residential, coin, hotel/motel, etc.

2.3.2.6 Home LRN: An LRN is a *Home LRN* for a switch if the LRN may be used as a routing number to complete calls to DNs that have been pooled-in or ported-in to the switch (i.e., this LRN is associated with the DNs in the NPDB). {To qualify as a home LRN for a given switch, the NPA-NXX of that LRN must be assigned to that switch in the LERG.}

2.3.2.7 Intermediate Switch: A tandem switch.

2.3.2.8 Local Access Transport Area (LATA): A defined geographic area where equal access switches or access tandem switches can provide carrier access to the local switch.

2.3.2.9 Line (DN) Served by Switch: Any DN that is connected to the switch or subtends the switch. The DN may be a physical subscriber connection or a virtual DN.

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[4] The term NXX-X refers to the NPA-**NXX-X**XXX of the North American Numbering Plan.

2.3.2.10 Location Routing Number (LRN): A 10-digit number in the format NPA-NXX-XXXX. The first 6 digits of the LRN identify the switch.

2.3.2.11 NP-Capable Switch: A switch that has the NP capabilities described in *Technical Requirements for Number Portability – Switching Systems*.

2.3.2.12 NP Query: A request for call routing information sent from the switch to the NPDB when a call encounters an NP trigger.

2.3.2.13 NP-Reserved Marking: A switch marking on a DN or range of DNs.

2.3.2.14   Operational Users: The service provider's craft personnel.

2.3.2.15 Originating Switch: The switch serving the calling party.

2.3.2.16 Pooled Number: A number within a pooled and allocated block of DNs that is working, assignable, or aging in the block holder switch. A pooled number will have a Local Number Portability (LNP) Type[5] of POOL in the NPAC SMS.

2.3.2.17 Pooling Administrator: Entity responsible for the administration of the NXX-X blocks within an NPA.

2.3.2.18 Portable NPA-NXX: An NPA-NXX designated as "open" for portability. It may be the case that no numbers have actually ported.

2.3.2.19 Ported Number: Outside of a pooled block, a DN is ported if it is working, assignable, or aging in a switch other than the code holder switch. Within a pooled block, a DN is ported if it is working, assignable, or aging in a switch other than the block holder switch. A ported number will have an LNP Type[5] of LSPP or LISP in the NPAC SMS.

2.3.2.20 Ported Out Marking: A switch marking on a DN or range of DNs.

2.3.2.21 Rate Center: A geographic area used to distinguish rate boundaries.

> NOTE - In this document "rate center" denotes the smallest geographic area used to distinguish rate boundaries. In other contexts, rate centers may contain even smaller geographic areas used for rating (e.g., rate districts, wire centers, rate areas).

2.3.2.22 Recipient Switch: The switch to which a DN is ported.

2.3.2.23 Snapback: The event whereby the responsibility for a ported DN is returned to the block holder (if the DN is in a pooled block) or the code holder (if the DN is not in a pooled block) after disconnect and aging.

2.3.2.24 Unallocated Number: A DN is unallocated on a switch if it is not assigned to a customer on the switch.

2.3.3 References

2.3.3.1 Normative References

For non-ANSI (American National Standard Institute) documents, only specific sections referenced in the body of this technical requirements document are considered normative. The remaining sections of those documents are considered informative.

American National Standards:

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[5] The value of LNP Type is assigned in the NPAC SMS National Number Pooling Requirements

T1.113-2000, *Signaling System No. 7 (SS7) Integrated Service Digital Network (ISDN) User Part.*[6]

T1.660-1998, *Signaling System No. 7 (SS7) Call Completion to a Portable Number - Integrated Textr.*[6]

T1.667-1999, *Intelligent Network.* [6]

Other References:

ATIS-1000001, October 2004, *Number Portability Operator Services Switching Systems.* [6]

ATIS-1000002, October 2004, *Number Portability – Switching Systems.*[6]

ATIS-1000003, October 2004, *Number Portability Database and Global Title Translation.* [6]

2.3.3.2 Informative References

INC 96-06-07-013, *INC Report on Number Portability*, July 1996.[7]

INC 97-1017-019, *INC Initial Report to the North American Numbering Council (NANC) on Number Pooling*, January 1998, Revised June 1998.[7]

INC 99-0127-023, *Thousands Block (NXX-X) Pooling Administration Guidelines*, September 22, 2000. [7]

In the Matter of Numbering Resource Optimization, Report and Order and Further Notice of Proposed Rulemaking, Commission 99-122, CC Docket No. 99-200 (rel. June 2, 1999). FCC 00-104. [7]

INC 95-0407-008, *Central Office Code (NXX) Assignment Guidelines*, September 22, 2000. [7]

3 USER PERSPECTIVE

3.1 End User Perspective (Human Interface)

The end-user procedures related to number portability are unchanged by number pooling. The end user is not responsible for initiating the use of the number pooling capability. Use of the number pooling capability is determined by the service providers or an appropriate regulatory agency.

3.2 Service Provider Perspective

Service providers are responsible for providing administration, provisioning, maintenance, and billing for customers whose numbers are in a pooled number range. These processes should be as transparent as possible to the end user and should be similar to the corresponding processes for customers whose numbers are not within a pooled number range. Service providers or third-party administrators will be responsible for updating the databases efficiently in a number pooling environment.

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[6] This document is available from the Alliance for Telecommunications Industry Solutions. < http://www.atis.org >

[7] This document is available from the Federal Communications Commission. < http://www.fcc.gov/Bureaus/Common_Carrier >

3.3 Call Flows

The call flows in the following clauses illustrate the use of the Ported Out and NP-Reserved markings in a number pooling environment. These call flows are provided to aid in the understanding of number pooling and are not meant to cover all possible scenarios. No network boundaries should be assumed or implied unless specifically stated. Both the Ported Out and NP-Reserved markings are described further in subsequent clauses of this document.

Note that the call flows for number portability, as described in ATIS-1000002, also apply to number pooling.

3.3.1 NP-Reserved Marking

This clause provides call flows to demonstrate the need for the use of NP-Reserved marking to support number pooling.

3.3.1.1 Call Flow without NP-Reserved Marking

The following call scenario is illustrated in Figure 1. Switch X is the code holder switch for the NPA-NXX 630-224. Switch X is also the block holder switch for the NPA-NXX-X = 630-224-1. However, switch Z is the block holder switch for the NPA-NXX-X = 630-224-3.

Once the 630-224-3 block has been removed from switch X and assigned to switch Z, then each DN in that block is assigned the LRN of switch Z in the NPDB, and calls must be LRN-routed to these DNs. Because the NPDB is populated with the LRN corresponding to the pooled block at the time the block is allocated, LRN-routing to these DNs may occur before individual DNs within the block are assigned to customers.
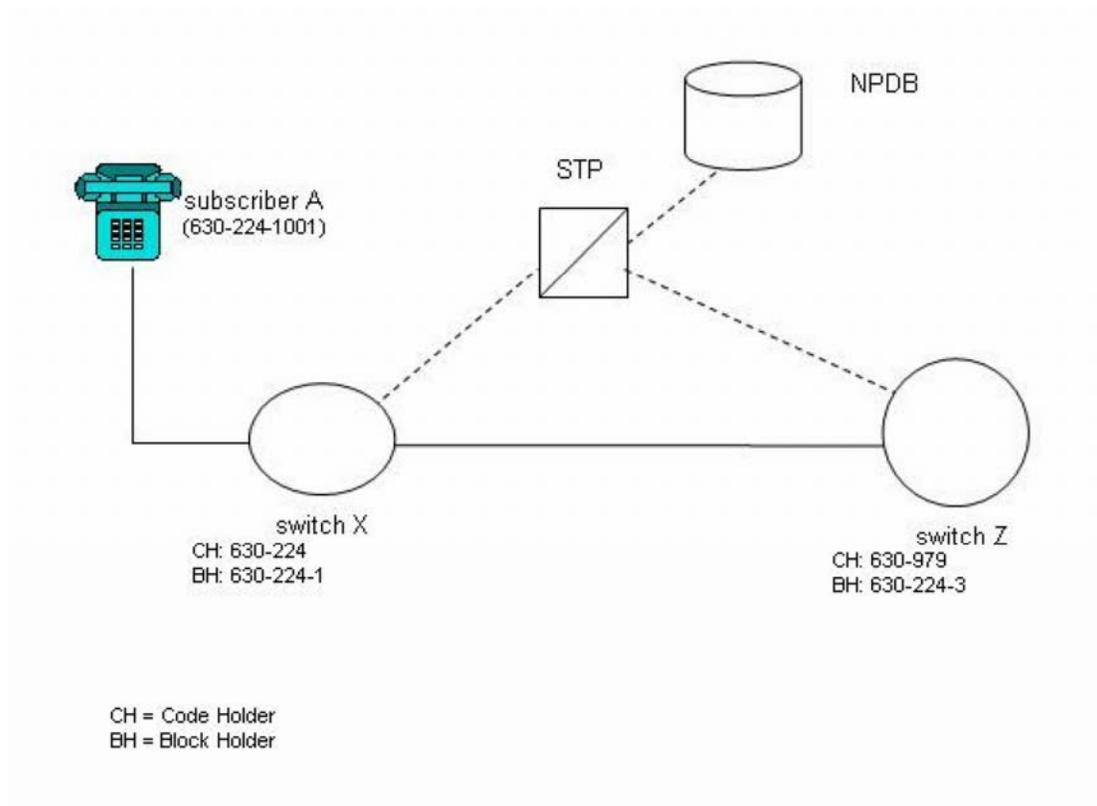
Figure 1: Network Configuration for NP-Reserved Marking

Subscriber A on switch X makes a call to 630-224-3005, an unassigned number. (See Figure 1 and Figure 2.) Switch X queries the NPDB and the LRN of switch Z is returned. Switch X routes the call based on the LRN to switch Z. Switch Z receives the call and determines the LRN is a home LRN. However, the number in the Generic Address Parameter (GAP) (630-224-3005) is not allocated on the switch, and therefore, per NP capabilities, switch Z releases the call with ANSI cause code 26. Since cause code 26 is returned, the service providers of switches Z and X will conclude that there is a misrouted LRN call and must investigate the problem. However, the call was routed correctly.
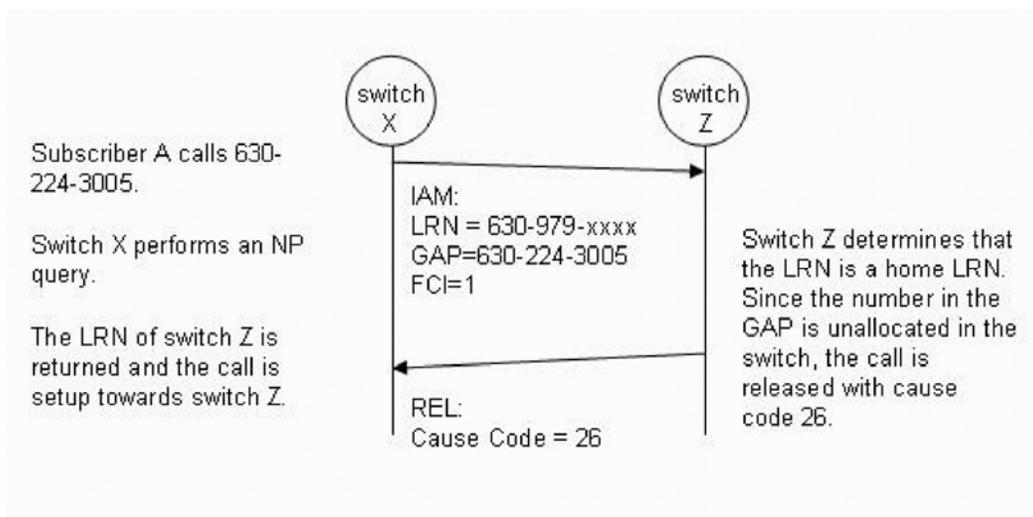
Figure 2: Call Flow without NP-Reserved Marking

3.3.1.2 Call Flow with NP-Reserved Marking

To address the problem of returning cause code 26 (as identified in Clause 3.3.1.1), the assigned block can be marked as NP-Reserved on switch Z. With the number 630-224-3005 marked as NP-Reserved, when switch Z receives the call with a home LRN and the number in the GAP marked as NP-Reserved on the switch, switch Z will suppress cause code 26 treatment and provide unallocated number treatment. (See Figure 1 and Figure 3).
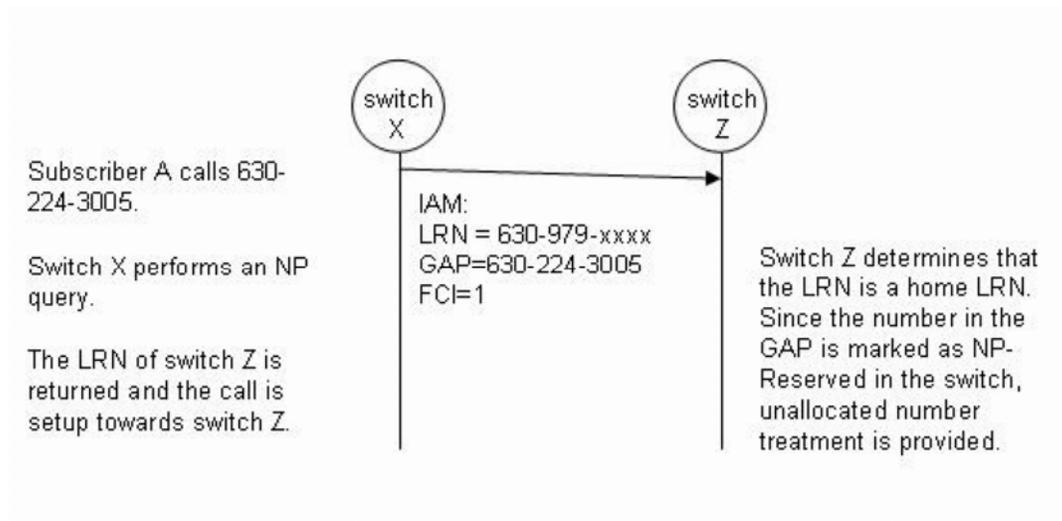
Figure 3: Call Flow with NP-Reserved Marking

3.3.2 Ported Out Marking for LRN-Routed Calls

For the following call flow, the service provider of switch Z has assigned 630-224-3005 to subscriber E. Subsequently, subscriber E is ported from switch Z to switch Y. (See Figure 4.)
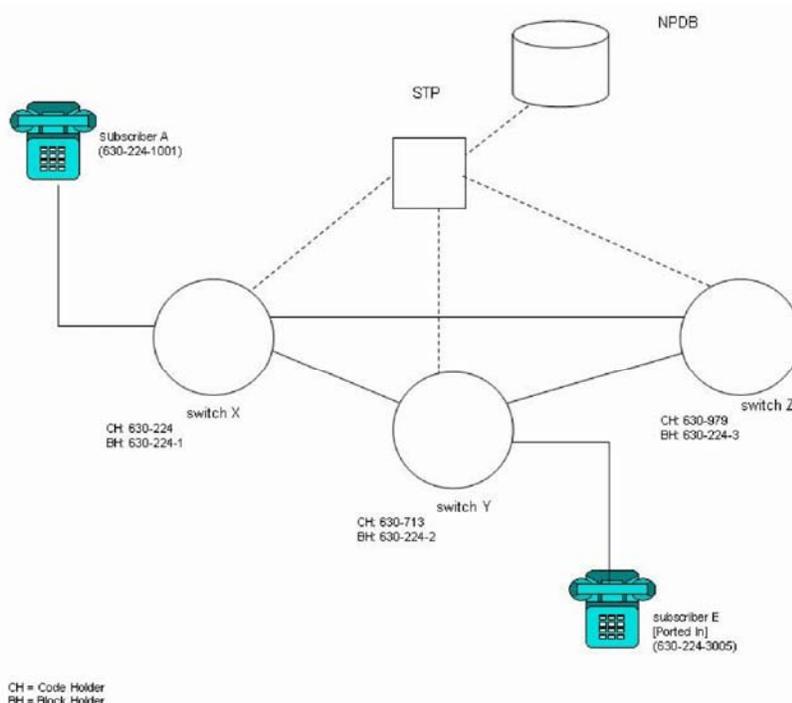
Figure 4: Ported Out Marking Network Configuration

When subscriber E ports from switch Z to switch Y, the LRN of switch Y is entered into the NPAC SMS and is then downloaded into all service providers' NPDBs. However, if the service provider of switch X had a problem either with getting the update or updating its NPDB, then its NPDB would still show the LRN of switch Z associated with subscriber E's number. Under this scenario, when subscriber A tries to call subscriber E, the call flow is the same as described in Figure 3. Switch X routes the call to switch Z per the LRN received from the NPDB. Switch Z detects a home LRN, and because the number in the GAP is marked as NP-Reserved on the switch, switch Z provides unallocated number treatment. However, in this case, the call is a misrouted LRN call and switch Z should have released the call with cause code 26.

To handle the situation above, the number can be marked as Ported Out on switch Z when subscriber E ports. Then when switch Z receives the call with a home LRN and the number in the GAP is marked as Ported Out on the switch, switch Z will provide cause code 26 treatment. (See Figure 5.)
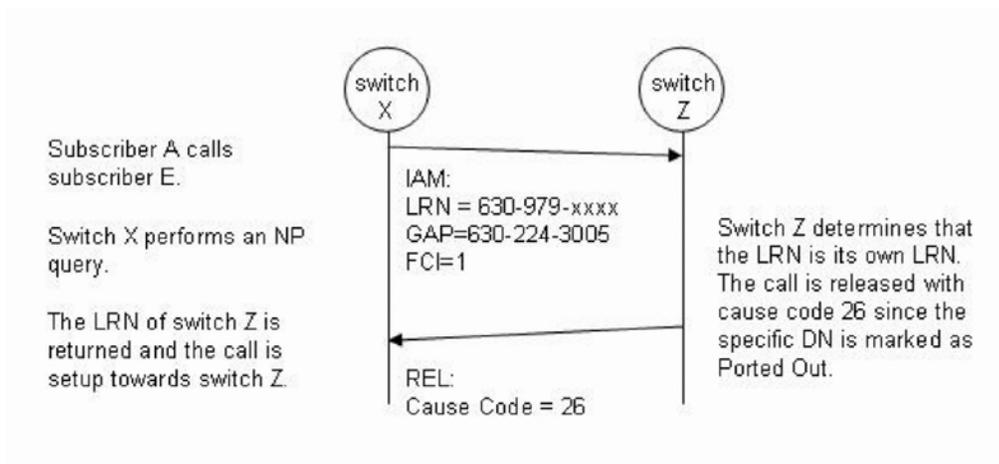
Figure 5: Call Flow with Ported Out Marking

In addition, if subscriber E disconnects service, the number is snapped back to the service provider of switch Z. The number will be associated with switch Z's LRN. Since calls to this number will be routed to switch Z via the LRN, the Ported Out marking needs to be removed. If the block is marked NP-Reserved, no further action is required; otherwise the NP-Reserved marking should be reinstated for this DN on switch Z. Calls will then receive unallocated number treatment. The call flow is the same as described in Figure 3.

4 NUMBER POOLING REQUIREMENTS

This clause defines the capability requirements for Number Pooling. The requirements are highlighted in "tags" to facilitate requirements traceability. Each tag in the document has a label containing a unique number (e.g., <REQ-00090> where REQ is the type of requirement, and 00090 is the number) which identifies the specific requirement. Bold text within the tag identifies the specific requirement. Non-bold text provides supplementary explanation of the requirement. Non-bold text does not contain additional requirements.

This document uses the following terminology:

♦ **Requirement** - Feature or function that is necessary to satisfy the needs of a typical service provider. Failure to meet a requirement may cause application restrictions, result in improper functioning of the product, or hinder operations. A requirement is flagged by the letters "**REQ**".

♦ **Conditional Requirement** – Feature or function that is needed by some but not all service providers and as such is left for an individual service provider to choose. A conditional requirement is flagged by the letters "**CR**".

4.1   Switching System Requirements

Several aspects of number portability are of particular importance in a number pooling context. These are highlighted in the clauses below.

4.1.1 Default Routing

In a NP environment, calls to portable numbers that do not have access to the NPDB receive default routing and are directed towards the donor network. In a number pooling environment, this is equivalent to the calls being routed towards the code holder switch for that NPA-NXX. These functions should be maintained since default routing allows the possibility of NPDB access at another node in the call path. Allowing default routing to the code holder switch maintains the existing routing procedures based on the NPA-NXX.
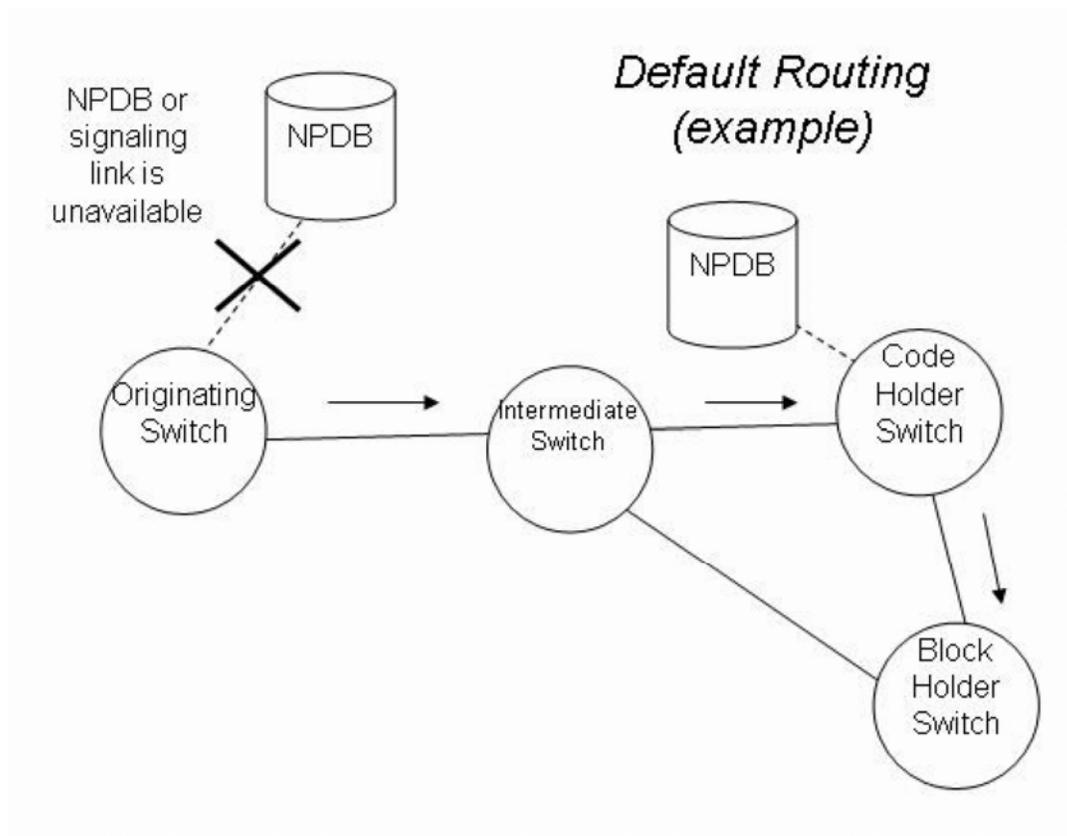
Figure 6: Default Routing

Figure 6 provides an example where a call is placed to a pooled (and not ported) number and the originating switch does not have connectivity with the NPDB. For this case, the originating switch would default route towards the code holder switch. If the code holder switch has access to the NPDB, then the call could route to the block holder switch. In this example, the DN may not actually be allocated to a subscriber but, as long as the NPDB has an entry, the call will route based on the LRN to the block holder switch.

<REQ-00100>

In a number pooling environment, when a switch performs default routing, that switch shall default route towards the code holder switch.

Default routing to the code holder switch for number pooling is consistent with the default routing procedures described for number portability in ATIS-1000002.

<End of REQ-00100>

4.1.2   LRN Routing to Unallocated Numbers

ATIS-1000002 provides requirements to address the scenario in which the NPDB view is not synchronized with the switch view of DNs resident on the switch, a scenario that may cause a call to be LRN-routed to a switch on which the called DN is unallocated. These requirements specify that such calls may be released using a distinct release cause value, and that an appropriate notification be generated. Specifically, ISDN User Part (ISUP) Release Message containing cause code 26, "misrouted call to a ported number," may be returned when an LRN-routed call attempts to terminate to an unallocated number. While this treatment was generally appropriate in a normal number portability environment, this treatment is inappropriate in a number pooling environment for calls that are LRN-routed to numbers in a pooled block that have not yet been assigned to a customer. Such calls are not misrouted; the NPDB correctly contains the LRN for the block holder switch. Therefore when the office option of sending cause code 26 is enabled, the requirements for sending cause code 26 in a number pooling environment must ensure that the cause value, is sent only when the call is misrouted, and that another type of treatment is provided for calls to unallocated numbers within a pooled block (i.e., unassigned number announcement).
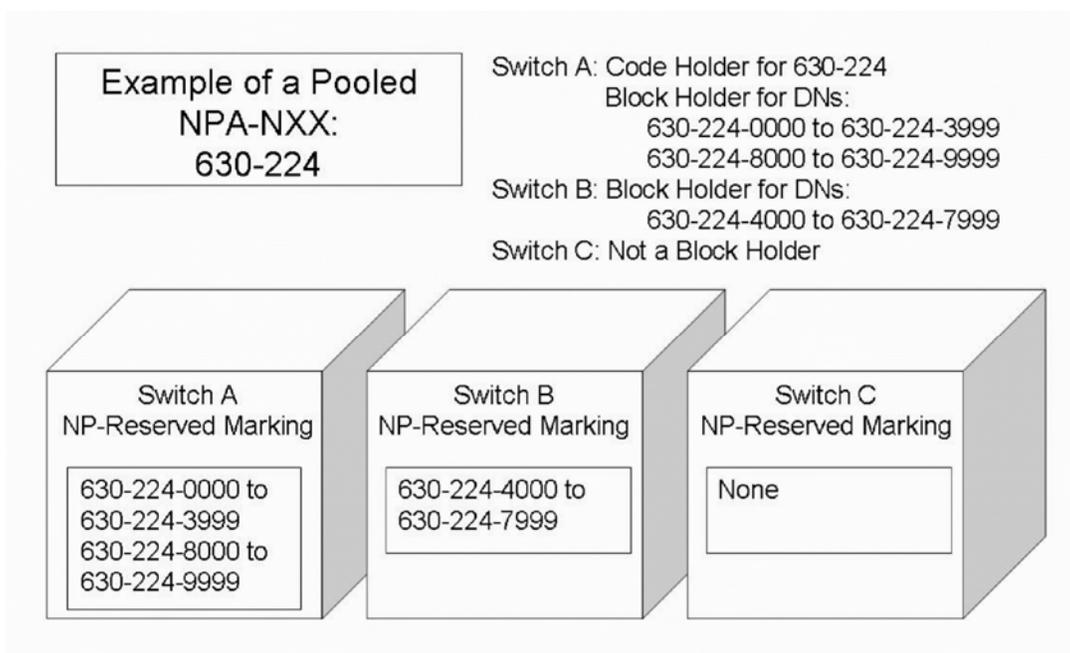
Figure 7: NP-Reserved Marking for Number Pooling

Figure 7 is an example for using the NP-Reserved marking in a pooling environment. In this example, the switch is either the code holder switch, block holder switch, neither, or both. The NP-Reserved marking is used to identify the DNs on the switch that are allowed to be unallocated without providing cause code 26 treatment.

When a pooled number that was marked as NP-Reserved ports away from the block holder switch and a call to that ported number is erroneously routed to the block holder switch, the block holder switch should provide cause code 26 treatment. To accomplish this, the block

holder should mark the number as Ported Out. Subsequently, if the number is disconnected and snaps back to the block holder switch, the Ported Out marking should be removed and the NP-Reserved marking reinstated until assignment to a customer.

Specifically, in a number pooling environment, ISUP RELease cause code 26 procedures may be engaged when:

♦ The ISUP Forward Call Indicator (FCI) M bit indicates that an NP query has been performed, and

♦ The terminating switch is identified by its Home LRN in the Called Party Number (CdPN) (the Initial Address Message (IAM) contains a Ported Number GAP), and

♦ The call cannot be completed by the terminating switch because the DN is not assigned on the switch, and

♦ Either:

  o The DN is marked Ported Out on that switch, or

  o The DN is marked not marked Ported Out and is not within an NP-Reserved range on that switch.

4.1.2.1 *Provisioning and Administration of NP-Reserved and Ported Out Markings*

This clause provides requirements for provisioning and administration of the NP-Reserved and Ported Out markings.

\<REQ-00200\>

The switch shall provide the capability to mark a DN and a range of DNs as NP-Reserved. DNs or ranges of DNs are not NP-Reserved unless specifically marked as such.

\<End of REQ-00200\>

\<REQ-00300\>

The switch shall not allow the NP-Reserved marking on an allocated DN on an individual DN basis.

\<End of REQ-00300\>

In addition to the ability to set the NP-Reserved marking on individual DNs, the marking may be set on any collection of ranges of DNs up to and including all ranges of DNs opened in the switch. Setting the marking on all DNs in the switch, without the use of the Ported Out marking on a individual DN basis, will suppress cause code 26 even when it should appropriately be sent. When cause code 26 procedures are suppressed, errors in markings are not easily detected because error codes are not sent.

\<REQ-00400\>

The switch shall be able to display a listing of all the DNs marked as NP-Reserved. The switch shall allow this report to be requested by the operational user and output via existing mechanisms (i.e., office records).

\<End of REQ-00400\>

<REQ-00500>

The switch shall provide the capability to mark a DN and a range of DNs as Ported Out. DNs or ranges of DNs are not Ported Out unless specifically marked as such.

<End of REQ-00500>

<REQ-00700>

The switch shall allow the Ported Out marking to be provisioned when the directory number is unallocated. In addition, the switch shall allow the Ported Out marking to be removed when the directory number is allocated.

<End of REQ-00700>

<REQ-00800>

The switch shall not allow the Ported Out marking on an allocated DN on an individual DN basis.

<End of REQ-00800>

<REQ-00850>

The switch shall not permit administrative assignment of the NP-Reserved and Ported Out markings such that both markings apply simultaneously to a single DN on an individual DN basis.

<End of REQ-00850>

<REQ-00900>

The switch shall support administrative commands to remove the Ported Out marking for a DN or range of DNs. After the marking is removed, the DN becomes either unallocated or NP-Reserved, as appropriate.

<End of REQ-00900>

<REQ-01000>

The switch shall be able to display a listing of all the DNs that are marked as Ported Out. The switch shall allow this report to be requested by the operational user and output via existing mechanisms (i.e., office records).

<End of REQ-01000>

4.1.2.2 Call Processing Associated with NP-Reserved and Ported Out Markings

This clause provides requirements for call processing associated with the NP-Reserved and Ported Out markings.

<REQ-01100>

If a call to a number is received by the switch with its Home LRN and the address digits in the GAP specify a number that is unallocated on the switch, the call shall receive treatment as defined in Table 1, based on the use of the NP-Reserved and Ported Out markings.

Table 1: Call Treatments

INDIVIDUAL		RANGE		
Setting of the NP-Reserved Marking	Setting of Ported Out Marking	Setting of the NP-Reserved Marking	Setting of Ported Out Marking	Call Treatment
Off	Off	**Off**	**Off**	**Cause code 26 treatment**
On	Off	**Off**	**Off**	**Unallocated number treatment with cause code 26 suppressed**
Off	On	**Off**	**Off**	**Cause code 26 treatment**
On	On	**Off**	**Off**	**Not allowed**
Off	Off	**Off**	**On**	**Cause code 26 treatment**
On	Off	**Off**	**On**	**Unallocated number treatment with cause code 26 suppressed**
Off	On	**Off**	**On**	**Cause code 26 treatment**
On	On	**Off**	**On**	**Not allowed**
Off	Off	**On**	**Off**	**Unallocated number treatment with cause code 26 suppressed**
On	Off	**On**	**Off**	**Unallocated number treatment with cause code 26 suppressed**
Off	On	**On**	**Off**	**Cause code 26 treatment**
On	On	**On**	**Off**	**Not allowed**
Off	Off	**On**	**On**	**Not allowed (see note)**
On	Off	**On**	**On**	**Not allowed (see note)**
Off	On	**On**	**On**	**Not allowed (see note)**
On	On	**On**	**On**	**Not allowed (see note)**

NOTE - Table 1 is based on a single range for the NP-Reserved and Ported Out markings.

<End of REQ-01100>

4.2   NPDB and NP GTT Requirements

Number Pooling may (or may not) impact a vendor's implementation of the NPDB and NP GTT. The impacts are dependent on the design of a vendor's NPDB and NP GTT database structure.

For example, an NPDB and NP GTT implementation may choose to store a single record per affected DN. In this approach, there is only one record for the DN in the database. The record represents one DN that may be a pooled DN, a ported DN, or both. This implementation does not need to be concerned whether the DN is pooled, ported, or both.

Another NPDB and NP GTT implementation may choose to logically or physically separate pooled and ported information. If an NPDB and NP GTT implementation represents pooled data separately from ported data such that there may be a representation of two information sets for a single DN, then a precedence must be established for successful call completion. For this example, the NPDB and NP GTT implementation first looks for a ported record. If a ported record is found, then that information is returned. If ported information is not found, then the

pooled information is returned if available. If neither is found, existing NPDB and NP GTT procedures apply.

Other implementations where the NPDB contains both pooled and ported information are also possible.

<REQ-01200>

When a DN is both ported and pooled, the NPDB response message shall provide the LRN associated with porting.

<End of REQ-01200>

<REQ-01300>

When the DN represented by the Global Title Address Information (GTAI) is both ported and pooled, the NP GTT function shall perform the translation, resulting in SCCP routing information associated with porting.

<End of REQ-01300>

For a given DN in the NPAC, there will only be one active NPAC SMS LNP Type. In the NPAC, this type is derived by giving precedence to ported information over pooled information.

4.3   Signaling and Protocol Requirements

No new requirements have been identified.

4.4   Feature Interactions

<REQ-01400>

The switch shall allow the assignment of any DN served by the switch in the same intra-switch multi-DN group.

For example, existing customers shall be able to add lines to their business group from "ported-in", pooled blocks of numbers even if the embedded customer numbers are assigned from a home NXX. In addition, business groups assigned originally out of a "ported-in" pooled block shall be able to add numbers from home NXXs.

<End of REQ-01400>

4.5   Operations, Administration and Provisioning Requirements

4.5.1   Measurements

No new requirements have been identified.

4.5.2   Network Management

No new requirements have been identified. In accordance with ATIS-1000002, the call may be default routed when Automatic Code Gapping (ACG) blocks the NP query.

4.5.3 Billing

The AMA requirements defined in ATIS-1000001, ATIS-1000002, and ATIS-1000003 remain applicable in a Number Pooling environment.

Thousands Block Pooling does not introduce any additional AMA requirements beyond those required for Number Portability. AMA recording to calls originating from or terminating to pooled numbers shall be generated using the same requirements as calls originating from or terminating to ported numbers. When the block holder is not also the code holder, the block holder switch must treat the DNs in the block as ported in numbers.

4.6 Maintenance Requirements

No new requirements have been identified.

4.7 Capacity, Performance and Reliability Requirements

No new requirements have been identified.

5 OTHER NETWORK IMPACTS

This clause highlights any known impacts to other network elements as a result of number pooling. Requirements to address these impacts are outside the scope of this document.

5.1 Customer Premises Equipment (CPE)

No CPE impacts have been identified.

5.2 Signal Transfer Point (STP)

No new STP impacts have been identified.

5.3 Service Management System (SMS)

The identification of impacts to the SMS is outside the scope of this document.

5.4 Operations Systems

The identification of operations systems impacts is outside the scope of this document.

5.5 Operator Services Network Elements

No new impacts to operator services network elements have been identified.

5.6 Non-NP-Capable Network Elements

No new impacts have been identified for non-NP-capable network elements.

5.7 Wireless Service Providers

This document does not address any additional requirements for wireless pooling and pooling between wireless and wireline service providers.

5.8 Toll Network Interface

No new impacts have been identified.

ANNEX A   NP-RESERVED AND PORTED OUT MARKINGS

In order to support the requirements in Clause 4.1.2 for NP-Reserved and Ported Out markings, the following tables provide administrative guidelines for the appropriate settings of these markings. These scenarios do not address porting of unallocated numbers. Each scenario is given a letter designation (i.e., A, B, C, etc.) to assist the reader.

The following terms are used in Table 2:

♦ Not applicable to this scenario: A non-existent switch given the scenario.

♦ Do not make any changes: An existing switch is impacted by the scenario but need not modify the marking.

♦ This switch is not involved: An existing switch is not impacted by the scenario.

Parenthetical remarks provide additional information to explain a scenario.

Table 2: Suggested Settings for NP-Reserved and Ported Out Markings for Given Scenarios

Scenario	At the block holder (not code holder) switch		At the block holder (and code holder) switch		At the code holder (not block holder) switch		At a switch that is not the block holder nor the code holder switch	
	NP-Reserved marking	Ported Out marking	NP-Reserved marking	Ported Out marking	NP-Reserved marking	Ported Out marking	NP-Reserved marking	Ported Out marking
BLOCK ACTIVATION SCENARIOS								
A Block holder (not code holder) activates an assigned block in NPAC	Set to On.	If block is uncontaminated[8], do not make any changes. (Ported Out marking left Off for all DNs in block.) If block is contaminated [7], Ported Out marking is set to On for those DNs that are not the block holder's.	Not applicable to this scenario.	Not applicable to this scenario.	If block is uncontaminated, NP-Reserved marking is left Off for the entire block. If block is contaminated, NP-Reserved marking is applied to any DNs retained by the code holder that are unallocated (e.g., aging).	Do not make any changes. (If ported out markings are used for administrative purposes, set to On.)	Do not make any changes.	Do not make any changes.
B Block holder (and code holder) activates an assigned block in NPAC	Not applicable to this scenario.	Not applicable to this scenario.	NP-Reserved marking is set to On for this block.	If any DN in this block was ported away, Ported Out marking must be set to On for this DN.	Not applicable to this scenario.	Not applicable to this scenario.	Do not make any changes.	Do not make any changes.
DN ASSIGNMENT SCENARIO								
C Block holder assigns a DN from pooled block	At block level, do not make any changes (NP-Reserved marking remains set to On). At DN-level, NP-Reserved marking is set to Off.	Do not make any changes. (Should be Off, because Ported Out marking would not have been set to On for this DN.)	Do not make any changes. (NP-Reserved marking at the block level is already set or not, depending on whether this block is NPAC-activated or not.) At the DN-level, NP-Reserved marking is set to Off if block is NPAC-activated.	Do not make any changes. (Should be Off, because Ported Out marking would not have been set to On for this DN.)	Do not make any changes. (This switch is not involved in this scenario.)	Do not make any changes. (This switch is not involved in this scenario.)	Do not make any changes. (This switch is not involved in this scenario.)	Do not make any changes. (This switch is not involved in this scenario.)

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[8] See INC 99-0127-023, *Thousands Block (NXX-X) Pooling Administration Guidelines*, September 22, 2000 for the official definitions:

♦ Uncontaminated Block: A thousand block(s) in which all 1,000 DNs within that block are available for assignment.

♦ Contaminated Block: A thousands block(s) in which at least one DN is not available for assignment by the block holder.

Scenario	At the block holder (not code holder) switch		At the block holder (and code holder) switch		At the code holder (not block holder) switch		At a switch that is not the block holder nor the code holder switch	
	NP-Reserved marking	Ported Out marking	NP-Reserved marking	Ported Out marking	NP-Reserved marking	Ported Out marking	NP-Reserved marking	Ported Out marking
DN PORTING SCENARIOS								
D A working, assigned DN at block holder ports away to another switch	At block level, do not make any changes (NP-Reserved marking remains set to On). At DN-level, NP-Reserved marking is set to Off.	Ported Out marking for this DN set to On (so that misrouted LRN calls will receive Cause Code 26).	Do not make any changes. (NP-Reserved marking is already set or not, depending on whether this block is NPAC-activated or not.)	If block is NPAC-activated and NP-Reserved marking is On, then Ported Out marking is set to On. (For administrative purposes, Ported out marking may be set to On.)	Do not make any changes.	If the recipient, and if marking is On, set to Off. Otherwise, do not make any changes.	Do not make any changes.	Do not make any changes.
E DN ports to block holder	At block level, do not make any changes (NP-Reserved marking remains set to On). At DN-level, NP-Reserved marking is set to Off.	Set to Off.	Do not make any changes. (NP-Reserved marking is already set or not, depending on whether this block is NPAC-activated or not.)	If block is NPAC-activated and NP-Reserved marking is On, then Ported Out marking is set to Off. (If the Ported Out marking was previously set to On for administrative purposes, then change the setting to Off.)	Do not make any changes.	Do not make any changes. (If this is the disconnecting switch, and if ported out markings are used for administrative purposes, set to On.)	Do not make any changes.	Do not make any changes.
F DN on code holder (and not block holder) switch ports away	If the recipient, at block level, does not make any changes (NP-Reserved marking remains set to On). At DN-level, NP-Reserved marking is set to Off. Otherwise, do not make any changes.	If the recipient, set to Off. Otherwise, do not make any changes.	Not applicable to this scenario.	Not applicable to this scenario.	Do not make any changes. (Should already be set to Off.)	Do not make any changes. (If ported out markings are used for administrative purposes, set to On.)	Do not make any changes. (Should already be set to Off.)	Do not make any changes. (Should already be set to Off.)

Scenario	At the block holder (not code holder) switch		At the block holder (and code holder) switch		At the code holder (not block holder) switch		At a switch that is not the block holder nor the code holder switch	
	NP-Reserved marking	Ported Out marking	NP-Reserved marking	Ported Out marking	NP-Reserved marking	Ported Out marking	NP-Reserved marking	Ported Out marking
DN DISCONNECT SCENARIO								
G Block holder-assigned DN from pooled block is disconnected	At block level, do not make any changes (NP-Reserved marking remains set to On). At DN-level, NP-Reserved marking is set to On.	Do not make any changes.	Do not make any changes. (NP-Reserved marking is already set or not, depending on whether this block is NPAC-activated or not.) At the DN-level, NP-Reserved marking is set to On if block is NPAC-activated.	Do not make any changes.	Do not make any changes. (This switch is not involved in this scenario.)	Do not make any changes. (This switch is not involved in this scenario.)	Do not make any changes. (This switch is not involved in this scenario.)	Do not make any changes. (This switch is not involved in this scenario.)
DN SNAPBACK SCENARIO								
H Ported DN snaps back to block holder after aging	At block level, do not make any changes (NP-Reserved marking remains set to On). At DN-level, NP-Reserved marking is set to On.	Set to Off.	Do not make any changes. (NP-Reserved marking is already set or not, depending on whether this block is NPAC-activated or not.)	If block is NPAC-activated and NP-Reserved marking is On, then Ported Out marking is set to Off. (If the Ported Out marking was previously set to On for administrative purposes, then change the setting to Off.) At the DN-level, NP-Reserved marking is set to On if block is NPAC-activated.	If this is the disconnecting switch, and the NP-Reserved marking is On (during aging), set to Off. Otherwise, do not make any changes.	Do not make any changes. (If this is the disconnecting switch, and if ported out markings are used for administrative purposes, set to On.)	If this is the disconnecting switch, and the NP-Reserved marking is On (during aging), set to Off. Otherwise, do not make any changes.	Do not make any changes.

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**Table 3: Suggested Settings for NP-Reserved and Ported Out Markings
for Intercept and Aging Scenarios**

What if… (read down this column)	Then, at the switch where this event occurs…		At all other switches…	
	The status of the NP-Reserved Marking is…	The status of Ported Out Marking is…	The status of the NP-Reserved Marking is…	The status of Ported Out Marking is…
a pooled or ported or both DN disconnects from a switch, and "route to intercept" treatment is to be provided?	Set to On	Unchanged (should be Off).	Unchanged.	Unchanged.
a pooled or ported or both DN disconnects from a switch, and aging treatment is to be provided?	Set to On.	Unchanged (should be Off).	Unchanged.	Unchanged.