ATIS-1000003

NUMBER PORTABILITY – DATABASE AND GLOBAL TITLE TRANSLATION

TECHNICAL REQUIREMENTS

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ATIS-1000003, *Number Portability – Database and Global Title Translation*

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

Technical Requirements for

NUMBER PORTABILITY – DATABASE AND GLOBAL TITLE TRANSLATION

Secretariat

Alliance for Telecommunications Industry Solutions

Approved October, 2004

Abstract

This document defines the Number Portability Database and Global Title Translation technical requirements for number portability (NP) using the Location Routing Number (LRN) Method.

FOREWORD

This document defines the Number Portability Database and Global Title Translation technical requirements for number portability (NP) using the Location Routing Number (LRN) Method.

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. NP is transparent to all end users. Requirements provided in this document address number portability using the LRN obtained from a centralized database to identify the recipient switch when numbers are ported. This document does not address number portability for subscribers with directory numbers that are also used for packet switched data.

This document provides the requirements for service provider portability, and location portability within a rate center. Number portability outside a rate center is beyond the scope of this document. This document does not address resale or unbundling. Information contained in normative annexes is considered part of this technical requirements document. Information contained in informative annexes is not considered part of this technical requirements document but is rather 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 document defines the necessary capabilities and functions which must be performed by a Number Portability Data Base (NPDB) application and a Number Portability (NP) Global Title Translation (GTT) function in support of number portability between wireline networks, using the Location Routing Number (LRN) Method. Items not addressed by this document are left to be defined by the service provider and vendor. Additional assumptions and limitations are detailed in Clause 1.3.

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 serving switch in the same or different network while retaining their NANP number. NP is transparent to all end users. Requirements provided in this document address number portability using the LRN obtained from a centralized database to identify the recipient switch when numbers are ported. This document does not address number portability for subscribers with directory numbers that are also used for packet switched data.

The requirements identified in this document are highly dependent on the service provider's network architecture and network capabilities. They are based upon reasonable assumptions about the capabilities and architectures for public switched telephony networks (PSTNs). They may be inappropriate for highly unique network architectures. It is the responsibility of the service provider to determine the applicability of these requirements for their network and to identify any additional or different requirements to their vendors.

The term NPDB system is used in this document in a generic sense to imply an element in the network that runs the NPDB application. It does not imply that any specific platform requirements must be met, other than what is explicitly specified in this document. Specific platform requirements are left to the service provider and vendor to define.

This document supports NP for geographic numbers within the North American Numbering Plan (NANP). It does not support portability of non-geographic numbers (e.g., NPA 800), nor does it support portability of numbers outside the NANP.

This document provides the NPDB application and NP GTT function requirements for service provider and location portability within a rate center. Number portability beyond a rate center and service portability is beyond the scope of this document.

This document does not fully address requirements for porting between wireless networks, nor requirements for porting between wireless and wireline networks. For requirements related to porting between wireless networks, see references in Clause 2.4.2. The wireless switches follow

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the same network interface (i.e., signaling the LRN, TCAP messaging, etc.) as wireline switches in accordance with the signaling standards defined in "Call Completion to a Portable Number," reference Clause 2.4.2. The wireless switches can access the NPDB information using signaling protocol described in IS-756 or T1.708 (see *References*, Clause 2.4.2). No additional requirements have been identified for porting between Wireless Service Providers and Wireline Service Providers

This document does not address the billing issues associated with identifying multiple service providers on the same switch (no service provider line attribute), especially when the number ports from one service provider to another on the same switch.

1.2 Overview

This requirements document defines the NPDB application requirements for the LRN method. The document also defines the NP GTT function which must exist in a network that supports NP to properly route Signaling System No. 7 (SS7) messages that had previously relied on six-digit (NPA-NXX) GTT routing. The NP GTT function may be provided by a system that also provides the NPDB application, or the NP GTT function may reside elsewhere in the network.

Information about ported numbers will be made available to platforms supporting the NPDB application from the Number Portability Administration Center (NPAC). The NP GTT function will also receive information about ported DN from the NPAC. The NPDB and NP GTT are supported by a Local Service Management System (LSMS) function that provides the interface to the NPAC. The LSMS function supports a vendor's NPDB application, a vendor's NP GTT function, and possibly other internal processes of the service provider. As such, the requirements for the LSMS are to be determined by the vendor and the service provider, and are not addressed by this document. This LSMS function may be part of the NPDB application and NP GTT function, or may reside elsewhere. A single LSMS may support multiple NPDB applications or NP GTT functions or both. A service provider may also use more than one LSMS to serve a given NPDB application or NP GTT function, in order to provide greater reliability. Specific configurations between LSMS systems, NPDB applications, and NP GTT functions are up to each individual service provider and their vendors. The following diagram shows some of the ways in which the NPAC may connect to different service providers. For purposes of this document, a reference to the NPDB application or NP GTT function includes the appropriate supporting LSMS function.

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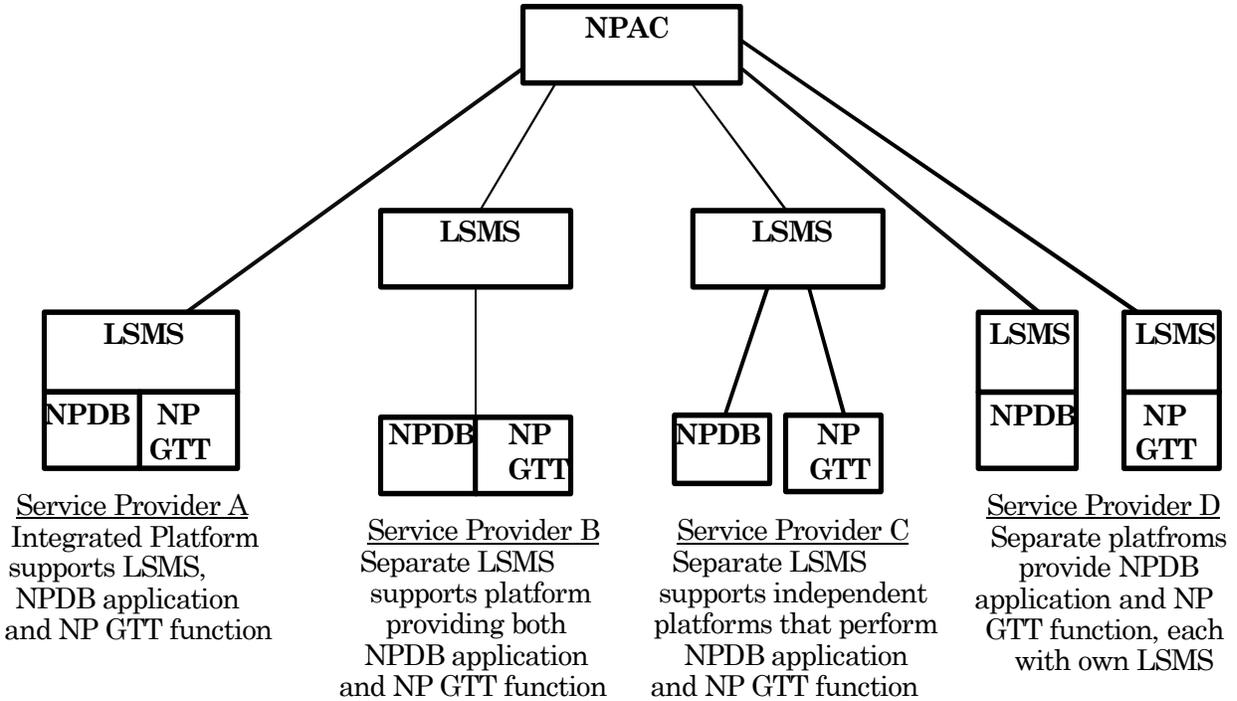
Figure 1: Some possible relationships between NPAC, LSMS, NPDB application, and NP GTT function

When a platform supporting the NPDB application receives an NP query, it will respond with appropriate information, based on stored information about ported users. The type of response will vary depending on the type of query received.

This document also defines procedures for GTT functions which may be used to support services that use SS7 signaling and are impacted by NP. The GTT procedures can be used to accurately route messages for various services to the appropriate network elements (e.g., the current service switch or Service Control Point (SCP) application), when an NPA-NXX of a dialed number no longer uniquely identifies the targeted network element. The GTT procedures to support NP can be implemented in systems other than the system that supports the NPDB application. The GTT function to support NP can be independent of the NPDB application.

> NOTE - The NP GTT function may only be needed when services that rely upon SS7 signaling are to be supported between networks, or whenever more than one switch supports a given NPA-NXX. The support of services between two networks is dependent on bilateral business agreements.

2 INTRODUCTION

2.1 Network Prerequisites for Number Portability

This clause addresses network prerequisites that must be met for Number Portability to function properly.

1. Each end office switch supporting number portability shall have at least one NPA-NXX that is "homed" to the switch (assigned in the Local Exchange Routing Guide (LERG)). This NPA-NXX may be an existing NPA-NXX or newly assigned NPA-NXX. Violation of this network prerequisite would preclude the ability to use six-digit routing to reach the serving switch.

2. All changes to GTT data that result 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 defined in the LIDB Access Routing Guide (LARG)).

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 per Network Prerequisite 2.

2.2 Assumptions

General Items

1. Only Directory Numbers (DNs) associated with circuit-switched voice or data calls are portable. The porting of packet addresses is not supported by the NP capability. For example, DNs assigned to ISDN B-channels carrying either voice or circuit-switched data can be ported; however, if the B or D channels are carrying packet data, the channels have packet addresses, which are not portable.

2. The NP capability addresses the requirements necessary for location portability and service provider portability within a rate center. Service portability is not explicitly addressed by this document.

3. It is assumed that NP will not be "flash cut" into a network(s).

4. Ported numbers that become vacant will be returned to the donor switch.

5. Systems that support NPDB queries or the NP GTT function, along with their supporting LSMS, must be able to support NPA splits.

   NOTE - The NPAC system will not download data changes due to NPA splits. Updates to records affected by an NPA split must be performed by the service provider's systems. Also, the NPDB application and the NP GTT function must be able to support both old and new NPAs during permissive dialing periods.

Location Routing Number (LRN)

6. Each switch has at least one NPA-NXX that is "homed" to the switch (assigned in the LERG) and this NPA-NXX can be used for the LRN. This may be an existing NPA-NXX or newly assigned NPA-NXX to the switch.

7. Only one NPA-NXX is needed for the first 6 digits of an LRN per LATA to identify the switch.

8. LRNs may also be DNs assigned to customers and these DNs may also be portable.

Systems that Make NPDB Queries

9. Switches from which numbers have been ported ("donor" switches) must be configured to perform NP queries for calls to those DNs which have not encountered NP triggers in previous portions of the call path.

General Items about Platforms Supporting NP Queries

10. An NPDB application only needs to support receiving the types of NP queries that are generated by the switches served by that NPDB application. Similarly, an NPDB application only needs to support sending the NP responses recognized by the switches served by that NPDB application.

11. Nothing in this document restricts the NPDB application platform from running other applications in addition to the NPDB application described by this document, including other NP applications.

12. These requirements make no assumptions about the deployed architecture of the NPDB application platforms which provide the NPDB application, or the method by which the NPDB application platforms are connected to the SS7 network. NPDB application platforms may be deployed in simplex, mated (duplex), N+1, or any other configuration, and can be connected to the SS7 network using simplex or mated (duplex) Signaling Transfer Points (STPs). Selecting an appropriate network architecture is an exercise for each service provider, based on their requirements for reliability, survivability, performance under failure conditions, etc.

13. These requirements make no assumptions about the NPDB application platform software or hardware platform which supports the NPDB application.

14. These requirements make no assumptions about the way in which NP data may be distributed among multiple instances of NPDB applications used by a single service provider.

15. An NP GTT function is available to each service provider's network. The NP GTT function can be supported in an STP, SCP, or other suitable platform. It is assumed that SS7 translations throughout the service provider's network are configured to route SS7 messages requiring the NP GTT function to the system performing the NP GTT function.

16. If a single platform supports both the NPDB application and the NP GTT function, then addressing resource and capacity conflicts between the two functions is a matter to be resolved between service providers and their vendors, and is not addressed by this document.

Miscellaneous Coding and Routing Items

17. Translation Type (TT) 11 has been defined for internetwork NP Queries. Therefore, this TT value can be provisioned for NP queries as distinct from other American National Standards Institute (ANSI) Intelligent Network (IN) or pre-IN (IN/1) queries.

18. Service Codes (e.g., 411) or numbers with Service Access Codes (e.g., 800) are not subject to NP triggers.

19. These requirements assume that SS7 translations in the switch and STP are configured to route NP queries to the NPDB application containing data to process the specific NP query.

20. It is assumed that no changes to SS7 gateway screening requirements (GR-82-CORE, Appendix C) are necessary to support NP. Any interactions between existing gateway screening capabilities and NP are not addressed by this document. At this time, no need for gateway screening following the NP GTT has been identified.

21. The interactions between Automatic Code Gapping (ACG) procedures, various NPDB application deployment configurations (mated pairs, N+1), different SS7 addressing

methods (point code, alias point code), and traffic balancing methods (load sharing, primary and secondary routing) are not addressed by this document. These issues are left to each carrier to resolve based on their specific network architecture and system capabilities.

22. Query messaging traffic controls (such as ACG for ANSI IN and pre-IN (IN/1), and similar controls for LIDB queries) currently are often based upon 6 digits (NPA-NXX). Now that a given NPA-NXX may be shared among multiple service providers, controls issued from one NPDB application on an NPA-NXX basis may also restrict queries that affect other service providers that share the same NPA-NXX. Resolution of the multiple service provider interactions of query messaging traffic controls is not addressed by this document.

23. The definition of any requirements necessary to support Operations Maintenance Application Part (OMAP) message routing as a result of NP impacts is for future study, and is not addressed by this document.

2.3 Acronyms and Definitions

2.3.1 Acronyms

AC	Automatic Callback
ACG	Automatic Code Gapping
AIN	Advanced Intelligent Network
AMA	Automatic Message Accounting
ANI	Automatic Number Identification (a.k.a. Billing Number)
ANSI	American National Standard Institute
ANSI IN	American National Standard Institute Intelligent Network
AR	Automatic Recall
BAF	Bellcore AMA Format
BLV	Busy Line Verification
CAC	Carrier Access Code
CAMA	Centralized Automatic Message Accounting
CdPA	Called Party Address
CdPN	Called Party Number
CDR	Call Detail Record
CgPA	Calling Party Address
CgPN	Calling Party Number
CIC	Carrier Identification Code
CNAM	Calling Name
CPE	Customer Premises Equipment
CRC	Cyclic Redundancy Check
CSD	Circuit Switched Data
CSV	Circuit Switched Voice
DN	Directory Number
DPC	Destination Point Code

FCI	Forward Call Indicator
GAP	Generic Address Parameter
GT	Global Title
GTAI	Global Title Address Information
GTT	Global Title Translation
IAM	Initial Address Message
IC	Interexchange Carriers
IN	Intelligent Network
INC	Industry Numbering Committee
ISDN	Integrated Services Digital Network
ISUP	ISDN User Part
ISVM	Interswitch Voice Messaging
IXC	Interexchange Carriers
LARG	LIDB Access Routing Guide
LATA	Local Access Transport Area
LEC	Local Exchange Carrier
LERG	Local Exchange Routing Guide
LIDB	Line Information Database
LNP	Local Number Portability
LRN	Location Routing Number
LSMS	Local Service Management System
LUDT	Long Unit Data
MDR	Message Detail Recording
MF	Multiple Frequency Signaling
MRVT	MTP Routing Verification Test
MTP	Message Transfer Part
MWI	Message Waiting Indicator
NP	Number Portability
NPA	Numbering Plan Area
NPAC	Number Portability Administration Center
NPDB	Number Portability Data Base
NP GTT	Number Portability Global Title Translation
NRIC	Network Reliability Interoperability Council
NXX	Office Code
OAM	Operations, Administration and Maintenance
OCN	Operating Company Number
OHD	Off-Hook Delay
OMAP	Operations Maintenance Application Part
OPC	Originating Point Code
OS	Operations Systems
PC	Point Code
PIC	Pre-subscribed Interexchange Carrier

PODP	3, 6, or 10 Digit Public Office Dialing Plan Trigger, (used by AIN and replaced by SDS in this document)
POTS	Plain Old Telephone Service
PRE-IN (IN/1)	Pre-Intelligent Network (Bellcore TR-NWT-000533)
PSTN	Public Switched Telephone Network
SCCP	Signaling Connection Control Part
SCP	Service Control Point
SDS	Specific Digit String Trigger (Used by ANSI IN and replaces PODP as the term used for this document)
SLE	Screen List Editing
SLS	Signaling Link Selection
SMS	Service Management System
SOAC	Service Order Analysis and Control
SRVT	SCCP Routing Verification Test
SS7	Signaling System No. 7
SSN	Subsystem Number
SSP	Service Switching Point
STP	Signaling Transfer Point
TAT	Termination Attempt Trigger
TCAP	Transaction Capability Application Part
TFA	Transfer Allowed
TFP	Transfer Prohibited
TID	(TCAP) Transaction Identifier
TT	Translation Type
TTN	Translation Type Number
WATS	Wide-Area Telephone Service
XUDT	Extended Unit Data

2.3.2 Definitions

2.3.2.1 Automatic Code Gapping: Network management controls imposed on the switch by an SCP or NPDB application to throttle query traffic on a three-digit, six-digit or ten-digit basis.

2.3.2.2 Alias Point Code: A SS7 address which is shared by more than one system supporting the same GTT function (or other SS7 function). Allows other systems to address the function generally, instead of needing to maintain the status of multiple separate point codes.

2.3.2.3 CLASS[1]: The set of CLASS features: Automatic Recall, Automatic Callback, and Screening List Editing. These features require TCAP messages to be passed between end offices to support these features.

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[1] CLASS is a Service Mark of Bellcore.

2.3.2.4 CNAM: The CLASS feature Calling Name. This feature requires TCAP messages to be passed between end offices and CNAM databases (SCPs). The messages are defined in TR-NWT-001188.

2.3.2.5 Conditional Trigger: The trigger is encountered after additional criteria is satisfied

2.3.2.6 Donor Switch: The switch from which a DN was originally ported. More specifically, the switch that is considered the default destination for the NPA-NXX of the DN.

2.3.2.7 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.

2.3.2.8 GT (Global Title): A "logical" or "virtual" address used for routing SS7 messages using the Signal Connection Control Part (SCCP) capabilities. To complete message routing, a GTA must be converted to a SS7 point code and subsystem number.

2.3.2.9 GTAI (Global Title Address Information): The address digits contained in the GT. Examples include NPA-NXX, a DN or an LRN.

2.3.2.10 GTT (Global Title Translation): Process by which a GT is converted either into a SS7 point code and subsystem number (final GTT) or another SS7 destination which will perform the GTT (non-final GTT or final GTT).

2.3.2.11 ConnectionControl:Connect Message: The NP response associated with the pre-IN (IN/1) -based NP trigger.

2.3.2.12 ProvideInstructions:Start message: The NP query (TC Component Portion) associated with the pre-IN (IN/1) -based NP trigger.

2.3.2.13 ISVM: InterSwitch Voice Messaging capabilities (e.g., control of MWI) requiring TCAP messages to be passed between messaging systems and end offices.

2.3.2.14 LATA: A defined geographic area where equal access switches or access tandem switches can provide carrier access to the local switch

2.3.2.15 LIDB: Line Information Database, which supports Alternate Billing Services, OLNS, and GetData queries.

2.3.2.1.6 Location Portability: Allows the end-user to retain the same DN when changing physical locations.

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

2.3.2.17 NPAC: In this document Number Portability Administration Center (NPAC) refers to NPAC Services Management System that can be used as a central database for subscriber information and downloading NPDBs and GTT servers.

2.3.2.18 NP Capable Network: For purposes of this document, a network that supports telephone numbers ported to another network, as well as numbers ported into itself from another network, for circuit switched services.

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

2.3.2.20 Non-Ported Number: A DN that may or may not be in a portable NPA-NXX, but resides on the switch to which it is assigned in the LERG.

2.3.2.21 Originating Switch: The switch serving the calling party.

2.3.2.22 Point Code: Also "Signaling Point Code." Address that specifically identifies one network node (system) in a SS7 network.

2.3.2.23 Portable NPA-NXX: An NPA-NXX designated as "open" for portability. No numbers may have actually ported.

2.3.2.24 Ported Number: A DN in a portable NPA-NXX that resides on a switch other than the switch to which it is assigned in the LERG.

2.3.2.25 Rate Center: A rate center denotes a geographic area used to distinguish rate boundaries.

2.3.2.26 Recipient Switch: The switch to which the DN is ported.

2.3.2.27 Service Portability: Allows an end user to retain the same DN when changing services.

2.3.2.28 Service Provider Portability: Allows an end user to retain the same DN when changing service providers.

2.3.2.29 Wire Center: The location of one or more local switching systems. A point at which customers' loops converge.

2.4 References

2.4.1 Normative References

For non-ANSI documents, only specific sections referenced in the body of this technical requirement are considered normative. The remaining sections of those documents are considered informative.

American National Standards

T1.111-1996, *Signaling System No. 7 - Message Transfer Part (MTP).*[2]

T1.112-1996, *Signaling System No. 7 - Signaling Connection Control Part (SCCP).*[3]

T1.113-1995, *Signaling System No. 7 - Integrated Service Digital Network (ISDN) User Part.*[3]

T1.114-1996, *Signaling System No. 7 - Transaction Capability Application Part (TCAP).*[3]

ATIS-1000631.2005, *Signaling System No. 7 (SS7) – High Probability of Completion (HPC) Network Capability.*[3]

T1.667-1997, *American National Standards for Intelligent Networks.*[3]

T1.708-1998, *PCS 1900 Service Provider Number Portability.*[3]

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[2] This document is available from the Alliance for Telecommunications Industry Solutions (ATIS), 1200 G Street N.W., Suite 500, Washington, DC 20005. < https://www.atis.org/docstore/default.aspx >

Bellcore References:

TR-NWT-001050, *Expansion of Carrier Identification Code Capacity for Feature Group D*, Issue 1, April 1991 (Bellcore), Section 3.2, Appendices A and B.[3]

TR-NWT-000533, *Database Services SSP Toll-Free Service*, Issue 3, Supplement 1, April 1995 (Bellcore), Sections 3.1.3, 3.1.4, 3.1.7, 3.5.7, and Appendix B.[4]

Other References:

ATIS-1000001, October 2004, *Number Portability Operator Services Switching Systems.*[3]

ATIS-1000002, October 2004, *Number Portability Switching Systems.*[3]

2.4.2 Informative References

American National Standards

T1.660-1997, *Signaling System No. 7 (SS7) Call Completion to a Portable Number.*[3]

TIA/EIA-41-D, *Cellular Radiotelecommunications Intersystem Operations*, Telecommunications Industry Association, December 1997[4]

Bellcore References:

GR-82-CORE, *Signal Transfer Point Generic Requirements*, Issue 1, June 1994, Revision 3, December 1995 (Bellcore).[4]

GR-246-CORE, *Bell Communications Research Specification of Signaling System Number 7* - Issue 2, December 1997.[4]

GR-606-CORE, *LSSGR Common Channel Signaling Section 6.5*, Issue 1, June 1994, Revision 2, December 1995 (Bellcore). [4]

GR-866-CORE, *ISDN Message Service Generic Requirements*, Bellcore, Issue 1, July 1995.[4]

GR-929-CORE, *Reliability and Quality Measurements for Telecommunications Systems (RQMS)* (A module of RQGR, FR-796)", Issue 4, December 1998 (Bellcore). [4]

GR-1100-CORE, *Bellcore Automatic Message Accounting (BAF) Requirements,* Issue 2, December, 1997.[4]

GR-1149-CORE, *OSSGR Section 10: System Interfaces*, Issue 1, October 1995, (Bellcore). [4]

GR-1280-CORE, *AIN SCP Generic Requirements*, Issue 1, August 1993 (Bellcore). [4]

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[3] Telcordia documents are available from Industry Direct Sales, Telcordia, 8 Corporate Place, PYA 3A-184, Piscataway, NJ, 08854-4156, or: < http://telecom-info.telcordia.com >.

[4] This document is available from the Telecommunications Industry Association (TIA). < http://www.tiaonline.org/standards/overview.cfm >

GR-1299-CORE, *Advanced Intelligent Network Generic Requirements: Switch-Service Control Point (SCP)/Adjunct Interface* (A Module of AINGR, FR-15), Issue 4, September 1997 (Bellcore). [4]

GR-2938-CORE, *SCP Network Traffic Management* (A Module of AINGR, FR-15), Issue 1, December 1996 (Bellcore). [4]

TR-NWT-000215, *CLASS^{SM} Feature: Automatic Callback*, Issue 3, June 1993, (Bellcore). [4]

TR-NWT-000220, *CLASS^{SM} Feature: Screening List Editing*, Issue 3, December 1993, (Bellcore). [4]

TR-NWT-000227, *CLASS^{SM} Feature: Automatic Recall*, Issue 3, June 1993, (Bellcore). [4]

TR-NWT-000533, *Database Services SSP Toll-Free Service*, Issue 3, Supplement 1, April 1995 (Bellcore). [4]

TR-NWT-001050, *Expansion of Carrier Identification Code Capacity for Feature Group D*, Issue 1, April 1991 (Bellcore). [4]

TR-NWT-001188, *CLASS^{SM} Feature: Calling Name Delivery*, Issue 1, December 1991, (Bellcore). [4]

Interim Standards:

TIA/EIA/IS-756, *Enhancements for Wireless Number Portability*, April 1998. [5]

TIA/EIA/IS-756A, *Enhancements for Wireless Number Portability Phase-II*, PN-4186 (to be published).[5]

Other References:

Illinois Number Portability Workshop, *Generic Switching and Signaling Requirements for Number Portability*, Issue 1.05, August 1, 1997.[5]

Midwest Number Portability Workshop, *Generic Requirements for SCP Application and GTT Function for Number Portability*, Issue 1.00, December 17, 1997.[6]

NPAC SMS *Interoperable Interface Specification*, NANC Version 1.5, September 09, 1997.[6]

NPAC SMS *Functional Requirements Specification*, NANC Version 1.5, September 09, 1997.[6]

Illinois Number Portability *Generic Operator Services Switching Requirements for Number Portability*, Issue 1.1, June 20, 1996.[6]

INC *Report on Number Portability*, 96-0607-013, July 1996.[6]

North American Numbering Council Local Number Portability Administration Working Group *Report on Wireless Wireline Integration*, May 8, 1998.[6]

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3 USER PERSPECTIVE

3.1 NP Capability Overview

Number Portability (NP) gives the end user the ability to move from one switch to another and keep their original Directory Number (DN). There are 3 types of Number Portability - Service Portability, Service Provider Portability and Location Portability.

1) Service Portability - allows an end user to retain their DN after changing services.

2) Service Provider Portability - allows an end user to retain their DN after changing service providers.

3) Location Portability - allows an end user to retain their DN after changing physical locations. (Subscribers have generally enjoyed the ability to move within a wire center while keeping the same DN, because they could be served by the same switch. NP does not change this capability. Location portability is generally viewed as addressing subscribers moving beyond their current rate center boundary.)

Currently, this document only supports requirements for service provider portability and location portability within a rate center. This NP capability will be based on ANSI IN or pre-IN (IN/1) signaling. ANSI IN signaling will follow T1.667 Intelligent Network protocol. This capability may use a new ANSI IN trigger, which can support all three types of NP. This capability does not preclude the use of pre-IN (IN/1) triggers to access the NPDB application. When pre-IN (IN/1) is used, the signaling follows the message set defined for Toll-Free service in Bellcore TR-NWT-000533, Supplement 1. The signaling for Toll-Free service is used to minimize the need to develop new message sets, etc., at a pre-IN (IN/1) switch to support NP. As a result, various parameters are needed in the messages to satisfy the protocol but are not used by actual NP processing

When a customer ports their service to a different service provider while retaining their DN, the two service providers (old and new) supply information to the NPAC. This data about the customer's ported service is sent by the NPAC to the LSMS. The LSMS provisions the NPDB application and the NP GTT function. The NPDB application uses this information to respond to NP queries it receives from the switches it serves.

When an NPA-NXX is defined as portable (the coordination of line assignments is outside the scope of this capability), calls to that NPA-NXX will encounter an NP trigger in a switch with the NP capability. The switch will send an NP query to the NPDB application.

The NPDB application will look up the dialed DN, and if the number has been ported, the NPDB application will return a response including a Location Routing Number (LRN) of the recipient switch. When the switch receives the LRN, the LRN will be used to route the call to its correct destination. The switch will use the received LRN to populate the ISDN User Part (ISUP) Initial Address Message's (IAM's) Called Party Number parameter. The actual dialed digits (plus implied NPA) are placed in the Generic Address Parameter (GAP) of the ISUP IAM.

Queries for non-ported DNs will cause the NPDB application to return the actual dialed DN and not an LRN. In this case, the switch will route the call based on analysis of the dialed DN.

Whether the DN is ported or not, the Forward Call Indicator (FCI) parameter in the ISUP IAM will be used to indicate whether an NP query was performed. The FCI parameter is used as a

mechanism to prevent more than one NP query from being launched on a call. If ISUP signaling is not available between switching systems, the LRN, GAP and FCI will not be signaled. This may result in a second NP query for the same call.

Switches that do not have the ability to query the NPDB application will route the call to the donor switch or a tandem switch that has NPDB application access capabilities and the donor or tandem switch will launch the query to determine routing.

The NPDB application need not know whether the switch generating the NP query is the originating switch, an intermediate (tandem) switch, or a terminating (donor) switch.

There are two NP query formats that can be supported by switches (ANSI IN or pre-IN (IN/1)). The different query formats are generated by two different NP triggers that can be implemented by switches. The NPDB application must be able to receive the types of NP queries generated by the switches it serves. The NPDB application will be required to return the properly formatted response for each NP query it receives, based on the format of the received query.

A number of services in use today rely upon SS7 signaling. These include Line Information Database (LIDB) (alternate billing services), CLASS, Calling Name (CNAM), and Inter-Switch Voice Messaging (ISVM). Prior to NP, the SS7 network used six-digit GTT procedures (analysis of NPA-NXX) to route messages for these services to the target system. Once a given NPA-NXX is supported in multiple target systems, a GTT function based on ten-digit analysis is needed to correctly identify the target system. For those services that do not need to operate between networks, six-digit GTT procedures may continue to be adequate. The support of these services between networks is dependent upon bilateral business agreements. Ten-digit GTT may be needed within networks if intra-service provider porting takes place.

The following statements pertain to this capability and the ANSI IN or pre-IN (IN/1) capabilities specified in this document for the NPDB application and the NP GTT function:

a) This capability specifies NP query and response message formats based on one of the following NP trigger types:
   ♦ The ANSI IN Specific Digit String (SDS) trigger
   ♦ The pre-IN (IN/1) trigger currently used for Toll-Free service.

b) NP triggers are expected to be assigned in the switch on a six-digit (NPA-NXX) basis. (A service provider may assign triggers on digit strings of other lengths if supported by the switch.)

c) SS7 ten-digit NP GTT processing is required to properly route queries for numbers in a portable NPA-NXX for the following services:
   ♦ CLASS Automatic Callback and Automatic Recall features
   ♦ CLASS Screen List Editing (SLE)

d) SS7 ten-digit NP GTT processing is required to properly route LIDB queries for numbers in a portable NPA-NXX.

e) SS7 ten-digit NP GTT processing is required to properly route ISVM queries for numbers in a portable NPA-NXX, where SS7 signaling is used to route ISVM queries.

f) SS7 ten-digit NP GTT processing is required to properly route CNAM queries for numbers in a portable NPA-NXX.

g) Location Routing Numbers (LRNs) will be provisioned to uniquely identify each switch that supports NP.

h) Inter-network support of the services identified in c) through f) depend on business agreements being in place.

3.2 End user Perspective (Human Interface)

NP is transparent to the end user. NP is a network capability which allows the DN of an end user to be moved from one switch to another within the rate center. There may be some feature limitations when the end user changes their service to a different service provider. Some features previously used by the customer may not be supported by the new service provider's network. Also, some features may no longer work because they require an intra-switch or intra-network relationship with other users that no longer exists once the customer changes to the new service provider.

The end user will be responsible for initiating the porting of their service. An end user must request any change in services or service providers while still retaining their DN. The end user will also have the option to retain their DN following a location move within the rate center.

The operation of the NPDB application residing in the NPDB application platform should be transparent to the end user. There is no direct interaction between the end user and the NPDB application residing on the NPDB application platform.

3.3 Service Provider Perspective

The following scenarios need to be facilitated:

♦ Provisioning the NP data in the NPDB application platform in support of the NPDB application.

♦ Provisioning NP GTT tables in the network.

♦ The service provider "A" customer ports their number to service provider "B."

♦ A customer in a Number Portability network discontinues their service.

♦ Provisioning of MTP and SCCP gateway screening data.

♦ Provisioning of MTP routing data.

♦ Ensure interconnection and business agreements are in place and updated for each service (LIDB, CLASS, CNAM, and ISVM), including those with out-of-region networks.

♦ If applicable, ensure interconnection and business agreements are in place and updated with hub signaling providers.

There is a set of data which must be populated in the NPDB application platform in support of the NPDB application. This data includes information about users that have ported their numbers to different service providers. The data indicates the LRN of the switch that serves each ported DN. This information is provided by the NPAC to the NPDB application via the LSMS.

There are two sets of data which must be provided in support of the NP GTT function, for each service (LIDB, CLASS, CNAM, and ISVM) which is supported between NP capable networks. The first set of data represents ten-digit GTTs for subscribers that have ported their DNs. For

ported DNs in other NP capable networks, this information is provided from the NPAC. The NPAC will provide information for non-final GTT routing towards gateways in the other service provider's network. Non-final SCCP CdPA data must contain an SSN equal to zero. A non-zero SSN may result in provisioning errors. The service provider must provide the ten-digit GTT information for ported DNs within their own network. The service provider must provide final GTT routing for ported DNs within their network. The second set of data represents default GTT information (based on 6 digits) is used to reach non-ported DNs within a portable NPA-NXX that have not ported. The default GTT information is provided by a service provider's internal processes.

Service providers, both ILECs and CLECs, need to ensure interconnection and business agreements are in place with all in-region carriers for the LIDB, CLASS, CNAM, and ISVM services. Gateway and query destination node point code information needs to be exchanged. Pre-provisioning needs to occur for the MTP and SCCP gateway screening data and the MTP routing data. If a hub provider is used, agreements need to address performing ten-digit GTT and modification of gateway screening in both the hub and destination networks.

3.3.1 Operations Personnel

Operations personnel provide the resources (administration, provisioning, maintenance, and billing) for customers who desire to change their current subscriber arrangement due to service, service provider, or location changes. This process should be as transparent as possible to the end user with minimal disruption of service. The operations personnel or third-party administration will be responsible for updating the databases efficiently as numbers get ported.

3.3.2 Provisioning of NP Data

The data representing LRNs of ported DNs will be provided electronically from the NPAC to LSMS. The LSMS must provide this data to the appropriate NPDB application.

Data representing gateway non-final GTT information for ported DNs will also be provided electronically from the NPAC to LSMS. The LSMS system must provide this data to the appropriate NP GTT function.

Data representing final GTT routing for ported DNs within the service provider's network must be provided to the NP GTT function by the service provider's own processes.

> NOTE - This final GTT routing information provided by the service provider must have precedence over the gateway GTT information for the same DN provided by the NPAC. The service provider must have the capability to ensure the NPAC provided data does not "overwrite" the internally provided data for a given DN.

Data representing default six-digit GTT routing for non-ported DNs within portable NPA-NXXs must be provided to the NP GTT function by the service provider's own processes.

3.4 Call Flows

The following call flows are provided for illustration and are not exhaustive. The NP trigger (and resulting query) may be encountered at various switches within the network(s). No network boundaries should be assumed or implied unless specifically stated. See the Technical

Requirements for Number Portability - Switching Systems document for a more complete list of the different locations within the network where the NP trigger may be encountered during call setup. From the perspective of the NPDB application, there is no difference if the NP trigger is encountered in the originating switch, terminating (donor) switch, or intermediate (tandem) switch.

The NP GTT function can be provided by any suitable system in the service provider's network, such as an STP or SCP. For demonstrative purposes, the NP GTT function for ported NPA-NXXs in the following examples is assumed to be performed by an SCP. The NP GTT function could also be performed elsewhere in the network, such as at a suitably equipped STP.
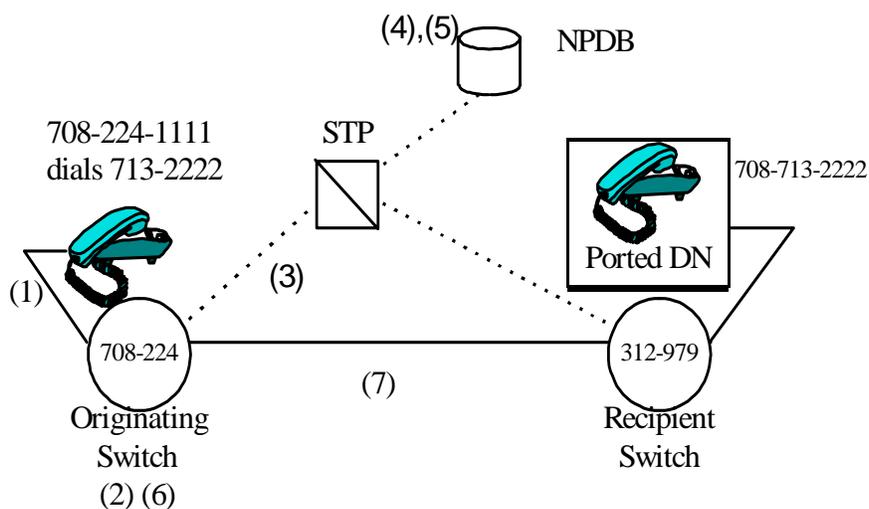
Figure 2: NP query processing by the NPDB application

Scenario A: Common example where a subscriber ports their number to a different switch and the subscriber can be connected via a direct connection. For other switch scenarios, see ATIS-1000002, call flow clause. The NPDB application's response does not differ based upon switch configuration

1. See Figure 2. Line A (708-224-1111) dials an intra-LATA call to Line B (708-713-2222)

2. The Originating switch performs digit analysis on the dialed digits to determine how to route the call. The switch determines that Line B is in a portable NPA-NXX (708-713) and does not reside on the switch.

3. The switch sends an ANSI IN (analyzedInformation) or pre-IN (IN/1) (ProvideInstructions:Start) query to deliver the dialed digits to the NPDB application platform.

4. The NPDB application searches its database for a match on the dialed digits. If found, the LRN associated with the dialed number is returned in the response, otherwise the dialed number is returned.

5. The NPDB sends an ANSI IN (analyzeRoute) or pre-IN (IN/1) (ConnectionControl:Connect) response to the originating switch.

6. The originating switch receives the NPDB response and analyzes the TCAP data. If an LRN was returned, the LRN is transmitted in the Called Party Number (CdPN) parameter and the dialed digits are transmitted in the GAP parameter of the ISUP IAM message. Otherwise, the dialed digits are transmitted in the CdPN parameter. The FCI Translated Called Number Indicator is set to indicate a query has been done (set to "translated number"). An ISUP route out of the switch is then determined.

7. The call is routed to the recipient switch based on the Called Party Number parameter.
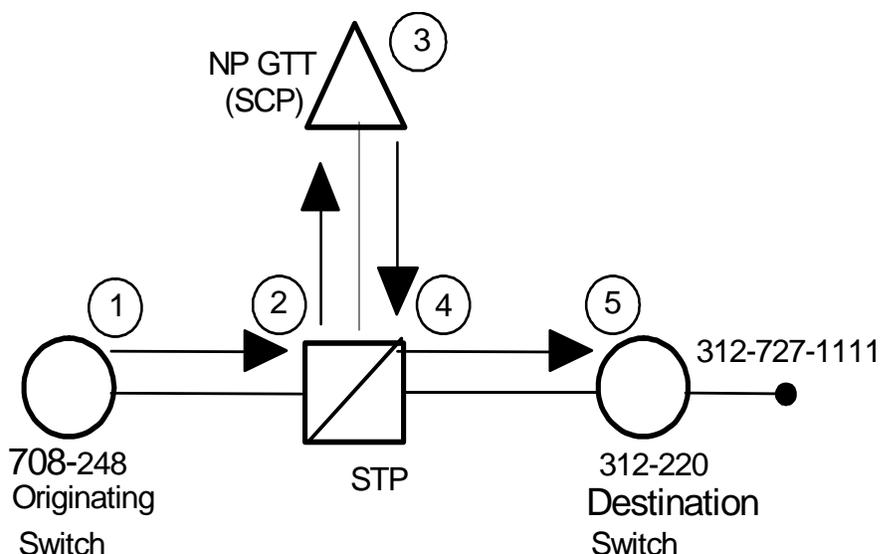
Figure 3: CLASS TCAP queries for portable NPA-NXX

Scenario B: This is an example when a CLASS feature in a switch (such as Auto Callback) generates a CLASS TCAP query (containing a ten-digit GTAI) to another switch. Because SCCP cannot translate the DN to a destination point code using only the first 6 digits (NPA-NXX) of the called party address for portable codes, the query must be routed to a ten-digit NP GTT function. The NP GTT function can be provided by any suitable system in the service provider's network, such as an STP or SCP. In this example, the ten-digit NP GTT function is provided by an SCP. Further, this example assumes the CLASS feature has been activated towards another user served by the same service provider (this example assumes a final GTT will be performed by the NP GTT function).

1. The originating switch (708-248) determines a need to launch a CLASS query for 312-727-1111. The switch formulates the query using the alias point code of the STP as the MTP destination point code, and codes the SCCP Global Title Address as the queried number (312-727-1111). The TT should be coded as appropriate for a CLASS query.

   MTP OPC = Originating switch; MTP DPC = alias STP; SCCP CdPA = GT (312-727-1111, TT = CLASS), SSN = 0

2. The STP receives the query and looks up the GTAI of 312-727-1111 in the six-digit GTT table identified by the TT. Since 312-727 has been designated as a portable NPA-NXX, the GTT table has been populated to indicate that a non-final translation should occur, with the

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message being forwarded to the NP GTT function (in this example provided by an SCP) for final translation.

MTP OPC = STP; MTP DPC = SCP; SCCP CdPA = GT (312-727-1111, TT = CLASS), SSN = 0

> NOTE - Routing from the STP performing the non-final GTT to the system performing the NP GTT function can be by either point code or alias point code. The choice has implications on network traffic management that are for the service provider to resolve.

3. The NP GTT function checks to see if there is a ten-digit translation for the number in the GTAI. If there is, the global title translation information is used to forward the query to the switch currently serving that DN. (If no ten-digit translation is found, that would mean the DN is still associated with the donor switch and a default six-digit translation for the NPA-NXX value would be performed before forwarding the query.)

MTP OPC = SCP; MTP DPC = Destination switch; SCCP CdPA = GT (unchanged), SSN = CLASS

4. The STP performs MTP routing for the message returned from the NP GTT function. The message is routed to the destination switch.

5. The destination switch receives the CLASS query and processes it as appropriate. The destination switch can route the response message directly to the originating switch, since the point code and SSN for the originating switch would have been carried unchanged in the Calling Party Address of the SCCP.
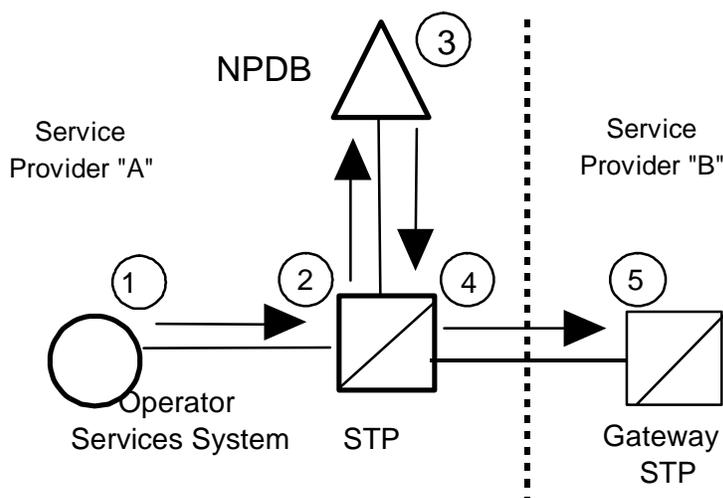
Figure 4: LIDB TCAP queries for Portable NPA-NXX to another network

Scenario C: This is an example when an operator services system generates a LIDB TCAP query (containing only a six- digit GTAI) for a ported DN served by a LIDB system in another network. Because the DN cannot be translated to a destination point code using only the 6 digits (NPA-NXX) within the GT for portable codes, the query must be routed to a ten-digit NP GTT function. The NP GTT function can be provided by any suitable system in the service provider's network, such as an STP or SCP. In this example, the ten-digit NP GTT function is provided by an SCP. Further, this example assumes a non-final GTT is used to route the LIDB TCAP query to the gateway STP in the target network.

1. The operator services system launches a LIDB query for 312-727-1111. The switch formulates the query using the alias point code of the STP as the destination, and codes the SCCP CdPA GT with the NPA NXX of the queried number (312-727). The TT should be coded as appropriate for a LIDB query.

   MTP OPC = Operator Services System; MTP DPC = alias STP; SCCP CdPA = GT (312-727, TT = LIDB); SSN = 0

2. The STP receives the query and looks up the GTAI of 312-727 in the six-digit GTT table identified by the TT. Since 312-727 has been designated as a portable NPA-NXX, the GTT table will have been populated to indicate that only a non-final translation should occur, with the message being forwarded to the NP GTT function(in this example provided by an SCP for further global title translation.

   MTP OPC = STP; MTP DPC = SCP; SCCP CdPA = GT (312-727, TT = LIDB); SSN = 0

   NOTE - Routing from the STP performing the non-final GTT to the system performing the NP GTT function can be by either point code or alias point code. The choice has implications on network traffic management that are for the service provider to resolve.

3. The NP GTT function recognizes that only six-digits are present in the GT. Based on the TT, the type of query (LIDB) is determined, and the NP GTT function decodes the necessary portion of the LIDB TCAP message to determine the ten-digit DN for the LIDB query. Once the DN has been retrieved from the TCAP portion, the NP GTT function checks to see if there is a ten-digit translation for the number. If there is a match on the full 10 digits of the DN, the translation information is used to route the message. (When no match is found for the ten-digit DN in the GTT translations, the default data would be examined on a six-digit basis to determine the translation information.) In this example, the ported number is served by another network, so the ten-digit translation indicates a non-final GTT to route to that network's gateway STP.

   MTP OPC = SCP; MTP DPC = gateway STP; SCCP CdPA = GT (312-727, TT = LIDB), SSN = 0

4. The STP would perform MTP routing for the message returned from the NP GTT function. The message would be routed to the gateway STP in the serving network.

5. The gateway STP receives the LIDB query and processes it as appropriate. The gateway STP may be able to perform a final GTT based on the six-digit GTAI value, or may need to perform an NP GTT function to route the message on 10 digits. (See the following Scenario D for an example of processing for a message requiring NP GTT function processing which is received by a gateway STP.
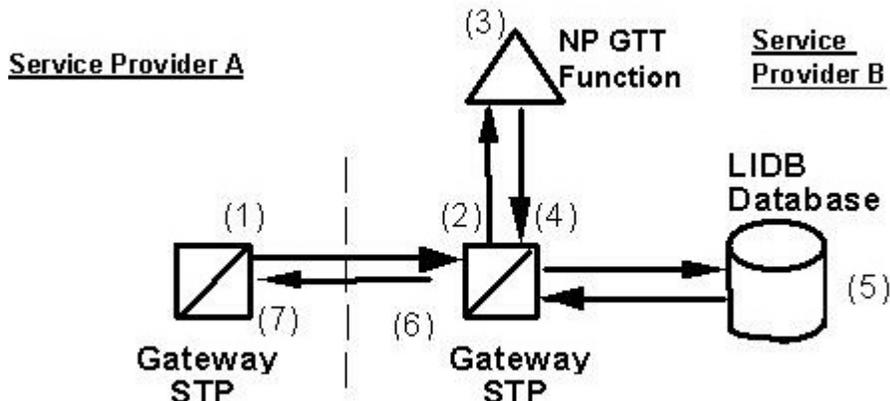
Figure 5: Receipt of LIDB TCAP message for portable NPA-NXX

Scenario D: This example shows when a LIDB query for a DN within a portable NPA-NXX is passed between networks. Because the DN cannot be translated to a destination point code using only the 6 digits (NPA-NXX) used to populate LIDB GTs, the query must be routed to a ten-digit NP GTT function.   This example shows the interactions between gateway processing at an STP and an NP GTT function performed in a system separate from the gateway STP. The NP GTT function can be provided by any suitable system in the service provider's network, such as an STP or SCP. In this example, the ten-digit NP GTT function is provided by an SCP, to demonstrate when the NP GTT function is implemented in a node other than the gateway STP. (The NP GTT function could also be performed elsewhere in the network, such as at a suitably equipped STP, or even by the gateway STP.)

1. The gateway STP in service provider A's network routes a LIDB query (for 312-727-1111) to service provider B's gateway STP. The source of the query is not important for this example. The process by which service provider A's network determines the routing is also not important for this example. For this example, service provider A may or may not have performed NP GTT function processing to determine the routing to service provider B.

2. The LIDB query is received by the gateway STP in service provider B's network. The gateway STP may perform the gateway screening process. Because 312-727 is a portable NPA-NXX, the GTT will result in a non-final translation routing to the NP GTT function (in this example an SCP).

   MTP OPC = Gateway STP; MTP DPC = SCP; SCCP CdPA = GT (312-727, TT = LIDB); SSN = 0

3. The LIDB query is received by the NP GTT function. Because only six-digits are present in the GTAI, the NP GTT function must examine the TCAP portion of the message to find the ten-digit DN value. Based on the TT, the type of query (LIDB) is determined, and the NP GTT function decodes the necessary portion of the LIDB TCAP message to determine the ten-digit DN for the LIDB query. Once the ten-digit DN is determined from the TCAP portion, the NP GTT function looks for the ten-digit DN value in its table of ported

numbers. If the number is ported, the NP GTT function will find information for a final (PC + SSN) or non-final translation (PC) in the table of ported numbers. In this example, the number is not ported, so an entry will not be found in the table of ported numbers. For non-ported numbers, the NP GTT function will determine the translation from default information based on NPA-NXX. In this example the default information indicates that a final translation (PC + SSN) to service provider B's LIDB system is appropriate for 312-727. The NP GTT function populates the outgoing SCCP Called Party Address with either the SSN or the PC and SSN for service provider B's LIDB system. The MTP routing label is populated with the PC of service provider B's LIDB system. The reformulated message is returned to the STP for routing (on PC and SSN).

MTP OPC = SCP; MTP DPC = SP B's LIDB; SCCP CdPA = GT (312-727, TT = LIDB), SSN = 0

> NOTE - The NP GTT function may result in a non-final translation to a gateway in another service provider's network in the example where the number has been ported, or in the example where service provider B receives services (LIDB, CNAM) from another network. Also, the service provider may configure the NP GTT function to perform a non-final translation to a destination within their own network, depending on where the service provider wants to perform various network management and load balancing functions.

4. The STP receives the message, which indicates routing on point code. The STP performs the routing and sends the message to the designated LIDB system.

5. The LIDB system receives the message containing the LIDB query, and passes the message to the LIDB application based on SSN. The LIDB application determines the information needed to respond to the query, and assembles the information for a response message. The LIDB system uses the SCCP CgPA information it received in the query for the address of the response message. This information (SCCP CgPA) should remain unchanged from the way it was populated by the system originating the query, and should identify the querying system. The LIDB system transmits the response message.

6. The STP receives the response, and performs point code routing that results in the message being transmitted to service provider A's gateway STP.

7. Service provider A's gateway STP receives the response message. It may perform gateway screening on the message prior to performing point code routing to send the response message to the system that originated the query.

4 NETWORK IMPACTS

This document assumes the service provider and vendor are generally familiar with the various recommendations and guidelines issued by industry organizations such as the Network Reliability Interoperability Council (NRIC) regarding network reliability and survivability. This document does not attempt to address the possible network architectures and configurations that might be used to support NP. It is the responsibility of the service provider to review their planned NP architecture to ensure that it meets appropriate levels of reliability and survivability.

4.1 Switching Systems

If switches are NP capable, they are expected to support NP triggers, along with the ability to generate an NP query and receive and process an NP response. In addition, switches that are NP capable are assumed to have appropriate routing tables.

The six and ten-digit GTT function for CLASS, ISVM, and CNAM queries are transparent to switching systems. No modifications to switching system software are required for interworking with the six or ten-digit GTT function for SS7 messages. Switching systems do not need to have switch NP software to generate CLASS, ISVM, or CNAM queries for ported DNs. There are no SS7 provisioning changes necessary to switches for CLASS, ISVM, or CNAM when NP is deployed.

4.2 Signal Transfer Point (STP)

One possible arrangement to support TCAP messaging (CLASS, LIDB, CNAM, ISVM) for portable NPA-NXXs is to provision the STP to support a non-final six-digit GTT to direct the SCCP messages to the NP GTT function or other locations for ten-digit GTT. If an SCP is used for the NP GTT function, the SCP must be capable of supporting non-final GTT functions (also sometimes known as "partial GTT"), as well as the ability of non-final GTTs to route messages to A-links.

The STP could instead be updated to handle ten-digit GTT.

There are no modifications for the SS7 protocols (messages, formats, procedures) supported by the STP at this time. There may be provisioning changes to the STP to appropriately route messages to the NPDB application and the NP GTT function. There may be configuration changes necessary to the SS7 network to support NP, depending on the service provider's SS7 architecture.

Existing MTP and SCCP routing procedures apply between the NP GTT function(s) and the STP(s). A new TT has been assigned to NP queries for identification purposes.

4.3 Local Service Management System (LSMS)

The NPDB application and NP GTT function will need a LSMS capability to receive NP data from the NPAC and properly structure that data for use by the particular vendor's product supporting the NPDB application and the NP GTT function. This LSMS function may be integral with the NPDB application and NP GTT function, or may be separate from them. The details of the LSMS function are considered "proprietary" to the specific vendor's product, and will not be specified in this document.

The LSMS must support provisioning of local data for the NPDB application and NP GTT function. Local data is the data necessary to the operation of the NPDB application and NP GTT function which will not be provided from the NPAC. This includes, but is not limited to, default GTT information and final GTT information.

4.4 Number Portability Administration Center (NPAC)

For a description of the NPAC and the functions supported by the NPAC, refer to the NPAC SMS Functional Requirements Specification (see references Clause 2.4.2).

4.5 Operations Systems Impacts

Operations systems impacts related to the NPDB application and NP GTT functions are outside the scope of this document. Each service provider must identify which systems will be impacted, and address the changes necessary for those systems.

4.6 Operator Services Systems

The operator services systems will be impacted by this capability and will use the NPDB application (for determining a user's service provider) and the NP GTT function (for routing LIDB queries appropriately). Operator services systems may also access the NPDB application to determine routing of calls, or they may route the call to an NP capable switch, which would perform call routing. The operator services systems requirements are available in the Technical Requirements for Number Portability - Operator Services Systems.

Non-NP capable operator services systems launch LIDB queries with six-digit values in the GT. To support six-digit GTT queries, they will need to be routed to a system that can access the full ten-digit billing number value within TCAP. If the network supports a six-digit NP GTT function in support of LIDB queries, then no changes to operator network elements are needed to support LIDB queries for portable NPA-NXXs. The alternative is to upgrade the operator services systems to populate the full ten-digit account number value in the SCCP CdPA GT for LIDB queries.

Operator services systems may query the NPDB application for information about ported numbers in order to obtain appropriate information for routing, charging, and collecting for the call. These queries must follow the requirements for NP queries from switches. The NP query is used by the operator services system to determine if a number has been ported, and to retrieve the LRN associated with a ported DN. The operator services system (or downstream system) may use the LRN to determine the service provider for ported users. This represents a new capability for operator services systems.

Some service providers may desire to measure NP queries to the NPDB application originated by operator services systems separately from queries received from switches. The need for this distinction is a matter to be addressed between service providers and their vendors, and is not addressed by this document.

4.7 Customer Premises Equipment (CPE) and User Equipment Needs and Impacts

No CPE needs or user equipment needs or impacts have been identified.

4.8 Wireless Service Providers

Refer to annexes C and D for applicability of the technical requirements described in this document to the wireless service providers.

4.9 Security Issues

There are no unique security issues identified. Because of the nature of NP, the information associated with NP, and the impact of NP on call processing, service providers are encouraged to provide adequate security to protect NP data and NP processes. The NPAC SMS Interoperability Interface Specification (see reference Clause 2.4.2) does provide some information on security interactions with the NPAC.

4.10 General Network Capacity Impacts

NP does have capacity impacts that need to be considered by a service provider. NP can impact the engineering of SS7 elements (STP, links, etc.) and PSTN trunking. NP can also have real time processor impacts on switches, and may require additional hardware or software for switches. Service providers need to consider the traffic impacts of the network architecture choices made for the NPDB application and NP GTT function, and should engineer their networks appropriately. Since specific impacts are highly dependent on network architectures, details cannot be provided in this document. Some impacts of NP may require co-ordination (forecasts, etc.) among service providers to enable each service provider to appropriately engineer their network.

5 NP CAPABILITY REQUIREMENTS

This clause defines the capability requirements for NP. 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 -00900> where REQ- is the tag type and 00900 is the number) which identifies the specific requirement. Bold text within the tag identifies the specific requirement. Non-bold text, if present within the tag, provides supplementary explanation of the requirement. Non-bold text is not an additional requirement.

This document uses the following terminology:

♦ **Requirement** - Capability 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 Requirements** - are needed by some but not all service providers and as such are left for the individual service providers to choose. A conditional requirement is flagged by the letters "**CR**".

The specific ANSI IN or pre-IN (IN/1) message sets and NP GTT capabilities that must be supported by a particular service provider's network are highly dependent on that service provider's architecture. For example, if a service provider's switches will only perform NP

queries using the pre-IN (IN/1) -like trigger, then there is no need for that service provider's NPDB application to process ANSI IN messages. Where a requirement applies only to the support of a specific NP trigger (ANSI IN SDS-based, or pre-IN (IN/1) -based) or function (GTT), the requirement will indicate by suffixing the function (e.g., **<REQ-000300> (GTT) <REQ-000300> (ANSI IN) or <REQ-000300> (IN/1).**

5.1 Data Structures

Some of the data for the NPDB application and NP GTT function will be provided by the NPAC. Additional data for service provider defined functions may be provided via various provisioning methods determined by the service provider.

5.1.1 Data for Ported DNs

The NPAC interface documents (see reference Clause 2.4.2) define a "downstream" interface, which will be used to provide data on ported DNs. Specifics on data elements to be received from the NPAC are detailed in the NPAC interface specification documents. The NPDB application and NP GTT function do not need to support the NPAC interface, but need to be supported by system(s) that do support the NPAC interface, in order to receive data elements from NPAC downloads. This support system is typically called a "LSMS". Processing between LSMS and either the NPDB or the NP GTT function is not addressed in this document, and is left to vendor and service provider to define.

It is assumed that the following capabilities will be provided by the LSMS

♦ The LSMS shall support the defined interface to the NPAC, and shall support all the functions of that interface, including receipt of data records for ported DNs.

♦ The LSMS shall provide appropriate data from the records it receives from the NPAC to the NPDB application. This data provided to the NPDB application shall include the DN and LRN for each ported DN.

♦ The LSMS shall provide appropriate data from the records it receives from the NPAC to the NP GTT function. This data provided to the NP GTT function shall allow the DN to be mapped to the GTT data (DPC and SSN for LIDB, CLASS, CNAM, and ISVM) for each ported DN.

5.1.1.1 Minimum Data for NPDB application

5.1.1.1.1 Minimum Data Needed for Ported DN in the NPDB application

<REQ-00100>

The NPDB application shall contain data (based on 10 digits) that include, at a minimum, the DN and LRN for each ported DN.

<End of REQ-00100>

The table contains the minimum data needed for the NPDB application for a ported DN. The directory number is 10 digits and would be used to index into the associated LRN.

Table 1: Minimum data needed for ported DN by the NPDB application

Item	Size	Type	Using Function	Comments
Directory Number	10	N	KEY FIELD	Unique identifier used as the key field into the ported DN
LRN	10	N	Provisioning NPDB application	Location Routing Number for use in NP query responses

NOTE - "Size" denotes number of numeric characters in field for display purposes. Information may actually be stored or transmitted in various formats (BCD, hex, etc.).

5.1.1.1.2 Other Data Needed for the NPDB application

If the NPDB application is going to handle IN/1 queries, it must have sufficient data items to be able to populate all of the mandatory parameters in the ConnectionControl:Connect message (IN/1 response). The ConnectionControl:Connect message is documented in TR-NWT-000533, Section 3.1.4. It contains the following parameters:

Table 2: TR-NWT-000533 Mandatory data for the NPDB application

Parameter Field	Nature	Contents
Digits (Carrier)	Mandatory	(3 or 4 digit CIC)[6]
Billing Indicators	Mandatory	(Call type + Feature ID)
Digits (Routing Number)	Mandatory	(LRN or Dialed Number)

The parameters shall be encoded according to TR-NWT-000533, Appendix B, Sections B.3 and B.4.2. Procedures for populating the Digits (Carrier) parameter shall be as described in TR-NWT-001050, Section 3.2. The values for these parameters should all be provisioned by the service provider.

5.1.1.2 Minimum Data for NP GTT Function

<REQ-00200> (GTT)

The NP GTT function shall contain GTT data (based on 10 digits) for the routing of signaling messages. This data will include DPC and SSN for supported message types (CLASS, CNAM, LIDB, ISVM).

<End of REQ-00200>

The table contains the minimum information needed by the NP GTT function for a ported number. The directory number is 10 digits and would be used to index into the associated NP GTT data.

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[6] As of September 01, 1998 all CICs are expected to be 4 digits.

Table 3: Minimum data needed for ported DNs in the NP GTT function

Item	Size	Type	Using Function	Comments
NPA-NXX-XXXX	10	N	KEY FIELD	Ported Directory Number
CLASS DPC	9	N	CLASS GTT	DPC for CLASS GTT
CLASS SSN	3	N	CLASS GTT	SSN for CLASS DPC
LIDB DPC	9	N	LIDB GTT	DPC for LIDB
LIDB SSN	3	N	LIDB GTT	SSN for LIDB
ISVM DPC	9	N	ISVM GTT	DPC for ISVM
ISVM SSN	3	N	ISVM GTT	SSN for ISVM
CNAM DPC	9	N	CNAM GTT	DPC for CNAM
CNAM SSN	3	N	CNAM GTT	SSN for CNAM

NOTE - "Size" denotes number of numeric characters in field for display purposes. Information may actually be stored or transmitted in various formats (BCD, hex, etc.). The information downloaded from NPAC to the tables for NP GTT data is sufficient only for non-final GTTs. Additional local data would be needed to replace the NPAC data if final GTTs are performed by the NP GTT function.

<REQ-00300> (GTT)

The NP GTT function shall be able to accept "null" entries for DPC and SSN if the specific service (LIDB, CLASS, CNAM, ISVM) is not supported by the service provider serving the ported DN.

<End of REQ-00300>

The NP GTT data downloaded to the NP GTT function via the LSMS is expected to represent the address of a gateway system within the SS7 network of the service provider serving the ported DN. If a non-final GTT to the network serving the ported DN is to be performed, this downloaded data will be used. Within the network of the service provider serving the ported DN, different GTT data needs to be substituted in place of the data downloaded by the NPAC.

♦ One possible choice is to substitute alternate non-final GTT data. (The NP GTT function would route messages to another system within the service provider's network, which would perform the final GTT. In this example, the service provider needs to carefully consider the SS7 architecture of their network to insure the alternate non-final GTT data that is substituted does not cause circular routing of messages.)

♦ Another choice is to have the NP GTT function itself perform the final GTT processing to destinations within the service provider's network. In this example the NP GTT function needs to support additional processing (for example, point code and subsystem management procedures for multiple systems, in the example of mated destinations) as well as additional data items (e.g., SSNs) which can be needed for final GTTs. (This data can include multiple DPC+SSN combinations for a given service type, as well as a method of indicating priority among the multiple DPC+SSN combinations.)

The specific additional data items needed for performing GTTs to destinations within a service provider's network depend on the architecture of that service provider's SS7 network, as well as

the service provider's choice of performing various kinds of non-final versus final GTTs within the NP GTT function. (It should be noted that the service provider may choose to perform non-final GTT processing at the NP GTT function for some services, while performing final GTT processing for messages for other services.) The determination of which kinds of GTT processing (non-final, final) and the specific data needed to support GTT processing to destinations within the service provider's network is a matter left to the service provider and their vendor. Service providers and vendors are directed to ANSI T1.112.4 for information regarding data needed to support various kinds of final and non-final GTT processing. The method of providing the alternate GTT data to the NP GTT function in place of the data provided from the NPAC is also left to the service provider and vendor to resolve. It should be noted that manual substitution processes may delay the provision of service to customers that "port in" to a service provider's network, as well as extend the period during which GTT looping can occur during the period when networks are updating GTT data to support a newly ported user.

> NOTE - The LSMS should retain the information as received in downloads from the NPAC, regardless of substitution of NP GTT data, in order to properly respond to audits initiated by the NPAC. See the NPAC Functional Requirements Specification (see reference Clause 2.4.2) for a determination of the data needs for LSMS support of the audit function.

5.1.2 Data for Default GTT Routing

In addition to the information for each ported DN, the NP GTT function needs to have default information for each portable NPA-NXX within the serving area. The source of this information is anticipated to be a local provisioning process internal to the service provider.

<REQ-00400> (GTT)

The NP GTT function shall contain default GTT data (based on 6 digits) for the routing of signaling messages. This data will include DPC and SSN for supported message types (CLASS, CNAM, LIDB, ISVM).

<End of REQ-00400>

The default information needed is as follows:

Table 4: Default data for the NP GTT function

Item	Size	Type	Using Function	Comments
NPA-NXX	6	N	key field	Portable NPA-NXX
Default CLASS DPC	9	N	CLASS GTT	Default DPC for CLASS GTT
Default CLASS SSN	3	N	CLASS GTT	Default SSN if CLASS DPC type is end office
Default LIDB DPC	9	N	LIDB GTT	Default DPC for LIDB
Default LIDB SSN	3	N	LIDB GTT	Associated with default LIDB DPC
Default ISVM DPC	9	N	ISVM GTT	Default DPC for ISVM
Default ISVM SSN	3	N	ISVM GTT	Associated with default ISVM DPC
Default CNAM DPC	9	N	CNAM GTT	Default DPC for CNAM
Default CNAM SSN	3	N	CNAM GTT	Associated with default CNAM DPC

NOTE - "Size" denotes number of alphanumeric characters in field for display purposes. Information may actually be stored or transmitted in various formats (BCD, hex, etc

5.1.3 Other Data Items

The NP GTT function differentiates among CLASS, LIDB, ISVM, and CNAM GTTs by TT. This data will be provided locally by the service provider. This data is only needed by the system that performs the NP GTT functions.

<REQ-00500> (GTT)

The NP GTT function shall be able to differentiate among SS7 messages for different services (CLASS, CNAM, LIDB, ISVM) based upon TT.

<End of REQ-00500>

The ability to have the NP GTT function change the TT or the TT and GTAI (for internetworking, prevention of looping, etc.) is described in Annex B.

5.2 NPDB application Processing Requirements

The NP trigger:

The NP trigger is defined as either a T1.667 trigger or as a pre-IN (IN/1) based trigger (that is assigned identically to the "Toll-Free" based IN trigger). The rules on when call processing can encounter the NP trigger follow the ANSI IN or pre-IN (IN/1) rules with some exceptions. Unlike other ANSI IN triggers, the NP trigger will initiate a query to the NPDB based on additional call processing checks after the trigger is initially encountered. In other words, the NP trigger is a conditional trigger and the operation will have functional components that are enhancements to the current ANSI IN or pre-IN (IN/1) trigger.

The pre-IN (IN/1)-based NP trigger is based upon the "Toll-Free" pre-IN (IN/1) trigger. Message coding, parameters, and protocol procedures follow the requirements for the pre-IN (IN/1) trigger, to satisfy the switch which is reusing the pre-IN (IN/1) protocol, even though NP processing in the switch differs from pre-IN (IN/1) processing. Only certain parameters in

the query and response messages are used for the NPDB application, but all parameters must be present and populated to satisfy pre-IN (IN/1) protocol processing. (It should be noted that MTP and SCCP procedures for the pre-IN (IN/1) NP messages will follow the requirements for the pre-IN (IN/1) service). The usage of MTP and SCCP differs somewhat between ANSI IN and pre-IN (IN/1) messages. One of the differences is that TR-NWT-000533 currently specifies the use of only six-digit values for the GTAI.

For pre-IN (IN/1) response messages SCCP population cannot conflict with TR-NWT-000533 (only fields and octets that are defined in TR-NWT-000533 should be populated) to maintain compatibility with switch processing.

5.2.1 Processing of NP Query Messages

The NPDB application can receive either of two different NP query messages. The different messages are the result of different triggers being used in the switch to support NP. A given NPDB application may need to support one, or both of the different NP query messages, depending on the NP trigger mechanisms that are used by the switches and other systems served by the NPDB application.

The allowed NP query messages are as follows:

1. analyzedInformation message (for the ANSI IN NP trigger)
2. ProvideInstructions:Start message (for the Pre-IN (IN/1) NP trigger)

See Clause 5.6.3.1 for the coding of these messages.

<REQ-00600>

The NPDB application shall support receipt of the ANSI IN analyzedInformation, or pre-IN (IN/1) ProvideInstructions:Start messages or both, dependant on the switches it serves for NP.

<End of REQ-00600>

Receipt of any other query messages is not expected by the NPDB application (as identified by SSN), and should be treated as an error. (See Clause 5.5.)

5.2.1.1 Parameters Received in ANSI IN Messages

The analyzedInformation message must contain certain parameters to enable the NPDB application. In addition, the ANSI IN protocol requires that certain parameters be included in these messages, even though the information in the parameters is not used by the NPDB application.

The UserID parameter is a mandatory parameter for the analyzedInformation message. The specific value of the parameter is not relevant for the NPDB application. If the parameter is missing, it should be treated as a fatal protocol error, and reported as a Missing Mandatory Parameter.

The BearerCapability parameter is also a mandatory parameter for the analyzedInformation message. The specific value of the parameter is not relevant for the NPDB application. If the

parameter is missing, it should be treated as a fatal protocol error, and reported as a Missing Mandatory Parameter.

<REQ-00700> (ANSI IN)

The UserID and BearerCapability parameters shall be treated as mandatory parameters.

<End of REQ-00700>

5.2.1.1.1 CalledPartyID Parameter Received in ANSI IN Message

The analyzedInformation message shall contain a CalledPartyID parameter that will identify the called DN for the call that generated the query. The parameter shall contain 10 digits. It shall be coded with a Nature of Number of "National (Significant) Number", "Subscriber", or "Testline", and a Numbering Plan of "ISDN Numbering Plan (Rec. E.164)".

<REQ-00800> (ANSI IN)

The CalledPartyID parameter is optional in the protocol but required for the NP application. If the parameter is not present, the NPDB application shall respond with a Missing Conditional Parameter indication in an ApplicationError message.

In addition, if

- ♦ **The CalledPartyID contains other than 10 digits, or**
- ♦ **Has any value for Nature of Number other than**
  - o **"National (Significant) Number", or**
  - o **"Subscriber", or**
  - o **"Testline"**

 or

- ♦ **Any value for the Numbering Plan other than "ISDN Numbering Plan"**

then

the NPDB application shall respond with an Erroneous Data Value indication in an ApplicationError message.

<End of REQ-00800>

5.2.1.1.2 TriggerCriteriaType Parameter Received in ANSI IN Message

<CR-00900> (ANSI IN)

The TriggerCriteriaType parameter shall be treated as a required parameter for the NP application. The value for the TriggerCriteriaType is "numberPortability (37)"

<End of CR-00900>

5.2.1.1.3 acgEncountered Parameter Received in ANSI IN Messages

The acgEncountered parameter may be included as part of network traffic management control. If present, it should be processed according to T1.667, Clause 7.4.6.1. Detailed procedures related to the use of this parameter can be found in GR-2938-CORE, Section 3.6.2.

<REQ-01000> (ANSI IN)

The acgEncountered parameter shall be supported by the NPDB application, as defined in Clause 7.3.1.3 and 7.4.6.1 of ANSI T1.667.

<End of REQ-01000>

5.2.1.1.4 Other Optional Parameters in Received ANSI IN Messages

Other parameters may be included in the NP query, and may be used for additional functions defined by the service provider. No other parameters are required in the received ANSI IN message for the proper operation of the NP application.

5.2.1.2 Parameters Received in pre-IN (IN/1) Messages

The pre-IN (IN/1) ProvideInstruction:Start message will contain either four or five parameters. The CIC Expansion parameter may or may not be present, depending on the system originating the query. The mandatory parameters in the pre-IN (IN/1) ProvideInstruction:Start message are Called Party Number, Calling Party Number, LATA, and Originating Station Type. Because the parameters are contained in a "parameter set", no specific parameter sequence should be assumed.

Two parameters in the ProvideInstruction:Start message are of interest to NP processing at the NPDB. The Service Key parameter shall include the ten-digit dialed number. There may be a CIC Expansion parameter present which is used to determine the format of the CIC in the response message (3 or 4 digits).

If any of the mandatory parameters are not received, then pre-IN (IN/1) error processing indicating "Unexpected Data Value" should be performed. ("Unexpected Data Value" should be used as opposed to the more recently standardized "Missing Mandatory Parameter" for compatibility with pre-IN) IN/1)processing.) If the dialed number does not contain 10 digits, the pre-IN (IN/1) error processing indicating "Unexpected Data Value" should be performed.

<REQ-01100> (IN/1)

The Service Key (which contains the Called Party Number), Calling Party Number, LATA, and Originating Station Type parameters shall be treated as mandatory parameters (see TR-NWT-000533, Appendix B, Table B-1).

<End of REQ-011000>

<REQ-01200> (IN/1)

The CIC Expansion parameter shall be supported by the NPDB application. (See TR-NWT-001050, Section 3.2)

<End of REQ-01200>

5.2.2 Responses for Ported DN

The NPDB application will determine whether there is a portability subscription entry in its database for the ten-digit DN received in the ANSI IN CalledPartyID parameter or pre-IN (IN/1) Called Party Number field. If there is a match for the ten-digit DN, the NPDB application shall determine the LRN associated with the called number from its database. The NPDB application should proceed with assembling a response message.

<REQ-01300>

If the called party DN received by the NPDB application in the NP query matches a DN for a ported DN, the application shall perform processing for a "Ported DN".

<End of REQ-01300>

<REQ-01400>

If the called party DN received by the NPDB application in the NP query does not match a DN for a ported DN, the application shall perform processing for a "Non-Ported DN".

<End of REQ-01400>

The NPDB application responses when a DN is found to be ported are:

1. analyzeRoute (when an analyzedInformation message was received).
2. ConnectionControl:Connect (when a ProvideInstructions:Start message was received).

<REQ-01500> (ANSI IN)

When an analyzedInformation message is received, the NPDB application shall respond with an analyzeRoute message.

<End of REQ-01500>

<REQ-01600> (IN/1)

When a ProvideInstructions:Start message is received, the NPDB application shall respond with a ConnectionControl:Connect message.

<End of REQ-01600>

See Clause 5.6.3.2 for the coding of these messages.

5.2.2.1 analyzeRoute Response for Ported DN

If the NP query was an analyzedInformation message, and the NPDB application determines that the DN identified in the query has been ported, it shall respond with an analyzeRoute message.

<REQ-01700> (ANSI IN)

The analyzeRoute response message for a ported DN shall contain the CalledPartyID parameter containing the LRN value determined from the NP database encoded using 10 digits, with Nature of Number set to "National (Significant) Number", and the Numbering Plan shall be identified as "ISDN Numbering Plan (Rec. E.164)".

<End of REQ-01700>

Additional parameters may be included in the message in support of additional functions determined by the service provider. However, unless the NPDB has a means of determining whether the querying switch or operator services system is capable of processing such parameters and values, the NPDB should only send parameters and values which, if ignored, do not interfere with NP processing and call completion.

<CR-01800> (ANSI IN)

The analyzeRoute response message for a ported DN may contain the AMAslpID parameter containing a value determined by the service provider in order to control AMA recording.

<End of CR-01800>

5.2.2.2 ConnectionControl:Connect Response for Ported DN

If the NP query was a ProvideInstructions:Start message, and the NPDB application determines that the DN identified in the query has been ported, it shall respond with a ConnectionControl:Connect message.

<REQ-01900> (IN/1)

The ConnectionControl:Connect response message for a ported DN shall include a "Digits (Routing Number)" parameter containing the ten-digit LRN value determined from the NP tables. The Nature of Number shall be coded as "national, no presentation restrictions". The Numbering Plan/Encoding Scheme shall indicate that the LRN is coded as BCD, according to the "telephony numbering plan" or "ISDN numbering plan". The NPDB application shall respond using the Numbering Plan scheme specified in the Digit parameter containing the Called Party Number in the query message, to ensure compatibility.

<End of REQ-01900>

<REQ-02000> (IN/1)

The ConnectionControl:Connect response message for a ported DN shall contain a "Digits (Carrier)" field, with the contents coded to a value that can be set by the service provider. If no CIC Expansion parameter was present in the received message, this field shall be coded to three digits. If a CIC Expansion parameter was present in the received message, this field shall be coded appropriately (see TR-NWT-001050, Section 3.2 and Appendix B).

<End of REQ-02000>

<REQ-02100> (IN/1)

The ConnectionControl:Connect response message for a ported DN shall include a "Billing Indicators" parameter to be populated with an AMA Call Type value and a Service Feature Identification value that can be set by the service provider.

<End of REQ-02100>

5.2.3 Responses for Non-Ported DN

If the NPDB application does not find a match for the received ten-digit DN, then the called number has not been ported. The NPDB application should proceed with assembling a response message.

The NPDB application responses when a DN is found to be not ported are:

1. analyzeRoute (when an analyzedInformation message was received).
2. ConnectionControl:Connect (when a ProvideInstructions:Start message was received).

See Clause 5.6.3.2 for the coding of these messages.

5.2.3.1 analyzeRoute Response for Non-Ported DN

If the NP query was an analyzedInformation message, and the NPDB application determines that the DN identified in the query has not been ported, it shall respond with an analyzeRoute message.

<REQ-02200> (ANSI IN)

The analyzeRoute response message for a non-ported DN shall contain the CalledPartyID parameter containing the same value for the called number that was received in the CalledPartyID parameter of the analyzedInformation message, with Nature of Number set to "National (Significant) Number", and the Numbering Plan shall be identified as "ISDN Numbering Plan (Rec. E.164)".

<End of REQ-02200>

Additional parameters may be included in the message in support of additional functions determined by the service provider. However, unless the NPDB has a means of determining whether the querying switch or operator services system is capable of processing such parameters and values, the NPDB should only send parameters and values which, if ignored, do not interfere with NP processing and call completion.

5.2.3.2 pre-IN (IN/1) ConnectionControl:Connect Response for Non-Ported DN

If the NP query was a ProvideInstructions:Start message, and the NPDB application determines that the DN identified in the query has not been ported, it shall respond with a ConnectionControl:Connect message.

<REQ-02300> (IN/1)

The ConnectionControl: Connect response message for a non-ported DN shall include a "Digits (Routing Number)" parameter containing the ten-digit value representing the dialed digits as received in the ProvideInstruction:Start message Service Key parameter. The Nature of Number shall be coded as "national, no presentation restrictions". The Numbering Plan/Encoding Scheme shall indicate that the Directory Number is coded as BCD, according to the "telephony numbering plan" or "ISDN numbering plan". The NPDB application shall respond using the same Numbering Plan scheme indicated in the query message, to ensure compatibility.

<End of REQ-02300>

<REQ-02400> (IN/1)

The ConnectionControl:Connect response message for a non-ported DN shall contain a "Digits (Carrier)" field, with the contents coded to a value that can be set by the service provider. If no CIC Expansion parameter was present in the received message, this field shall be coded to three digits. If a CIC Expansion parameter was present in the received message, this field shall be coded to four digits (see TR-NWT-001050, Section 3.2 and Appendix B).

<End of REQ-02400>

<REQ-02500> (IN/1)

The ConnectionControl:Connect response message for a non-ported DN shall include a "Billing Indicators" parameter to be populated with an AMA Call Type value and a Service Feature Identification value that can be set by the service provider.

<End of REQ-02500>

5.2.4 Other ANSI IN Responses and Messages

No ANSI IN responses other than those defined in the previous clauses are required for the proper operation of NP. The ANSI IN ACG message is allowed for NP.

5.2.4.1 ANSI IN ACG Message

The NPDB application may transmit the ANSI IN ACG message for purposes of traffic control. The conditions under which ACG shall be invoked and cleared are to be determined between the service provider and the vendor. For ANSI IN NP triggers, ACG shall operate as defined in T1.667. See Section 3.6 of GR-2938-CORE for details related to ANSI IN ACG procedures.

<REQ-02600> (ANSI IN)

The NPDB application shall support the ANSI IN ACG message for traffic control as defined in T1.667, Clause 7.4.3.1.

<End of REQ-02600>

5.2.5 Other Pre-IN (IN/1) Responses

No Pre-IN (IN/1) responses other than those defined in the previous clauses are required for the proper operation of NP. The Pre-IN (IN/1) ACG message is allowed for NP. The NPDB application will transmit the Pre-IN (IN/1) ACG message for purposes of traffic control. The conditions under which ACG shall be invoked and cleared are to be determined between the service provider and the vendor. For Pre-IN (IN/1) NP triggers, ACG shall operate as defined in TR-NWT-000533 for SCP overloads (Section 3.5.7.2 of TR-NWT-000533) and SMS initiated controls (Section 3.5.7.4 of TR-000533). Pre-IN (IN/1) ACG controls for calls to vacant code and non-purchased NPA (Section 3.5.7.1 of TR-NWT-000533) do not apply for the NPDB application. The applicability of mass calling controls (Section 3.5.7.3 of TR-NWT-000533) is for future study.

<REQ-02700> (IN/1)

The NPDB application shall support the Pre-IN (IN/1) ACG message for traffic control as defined for SCP overload (Section 3.5.7.2 of TR-NWT-000533) and SMS initiated controls (Section 3.5.7.4 of TR-NWT-000533).

<End of REQ-02700>

5.3 NP Global Title Translation Function

To support SS7 intersystem messaging for CLASS, LIDB, ISVM, and CNAM, this NP GTT function must be available somewhere within the service provider's network. The same system that supports the NPDB application may, at the service provider's option, also support this NP GTT function. The service provider may elect to have a different system (other than the system that supports the NPDB application) to perform this function. In determining how to support the NP GTT function within their network, the service provider should consider reliability and redundancy issues. If the service provider elects to perform this function elsewhere in their network, then the system that supports the NPDB application needs not support the functions and data items identified in this clause. The service provider will need to ensure that translations are appropriately configured in their SS7 network (STPs, switches) to route messages for portable NPA-NXXs to the system performing the NP GTT function. The service provider need only support the NP GTT function for the classes of SS7 TCAP intersystem signaling (CLASS, LIDB, ISVM, CNAM) supported by that service provider's network. For services that are supported only on an intra-network basis, performing GTTs on a six-digit basis may be sufficient. The service provider will need to determine which services in their network require message routing using the NP GTT function.

The NP GTT function needs to be performed on SS7 messages originated within the service provider's network that are to be routed on a GTT basis where the NPA-NXX within the GT represents a portable NPA-NXX. There appear to be at least three ways for systems within the service provider's network to route messages requiring the NP GTT function to the system performing that function:

1) The systems originating the messages may MTP address the messages directly to the system performing the NP GTT function. (In this example, the system performing the NP GTT function would also need to perform the NP GTT function on a six-digit basis for non-portable NPA-NXXs as well.)

2) The systems originating the messages may MTP address the messages to a system that performs only a six-digit GTT (e.g., an STP which currently performs six-digit GTTs). The system performing the six-digit GTT would selectively route (non-final GTT) messages with an SCCP Called Party Address representing a portable NPA-NXX to the system performing the NP GTT function. (Routing to the system performing the NP GTT function could be either by point code or alias point code, depending on the preferences of the service provider, based on network management impacts.)

3) The systems originating the messages can MTP address the messages to a system that performs a six-digit GTT. The system performing the six-digit GTT would selectively route (final GTT) messages with an SCCP Called Party Address

representing a portable NPA-NXX to the system performing the NP GTT function. The NP GTT function would be addressed by point code and subsystem number. In this example, the NP GTT function would appear as an application.

NOTE - This approach appears to be feasible, but has SS7 network management implications, as well as implications on routing and correlating response messages that are not addressed in this document.

The NP GTT function must be able to perform non-final GTTs, and may also perform final GTTs, depending on the network configuration planned by the service provider. A service provider is expected to perform non-final GTTs for messages destined for other networks (or final GTTs by business arrangements between networks). If a service provider decides to also perform non-final translations at the NP GTT function for messages relating to its own customers, then the provider must carefully plan the routing scheme within its SS7 network to avoid establishing circular routing of messages.

The NP GTT function also needs to be performed on SS7 messages received from other networks that are to be routed on a GTT basis where the NPA-NXX within the GT represents a portable NPA-NXX.

The system that performs the NP GTT function must have one point code and may have one or more alias point codes. The alias point code is a SS7 address that can be shared with other systems performing the NP GTT function. (See Section 4.2.3.1 of GR-82-CORE.)

<REQ-02800> (GTT)

The system performing the NP GTT function shall support the ability to be assigned both a point code and an alias point code.

<End of REQ-02800>

The system performing the NP GTT function must support SCCP routing procedures as defined in T1.112.4. When the system supporting the NP GTT function receives an SS7 message and ,

- ♦ The SCCP Called Party Address indicates to route on global title, and
- ♦ The SCCP address TT is recognized for CLASS, LIDB, ISVM, or CNAM

then the NP GTT function is invoked.

Based on the TT in the GT, the NP GTT function will look for a matching ten-digit GTAI value in the CLASS, LIDB, ISVM, or CNAM NP data. If no match is found, "default" data based on NPA-NXX will be used to complete the global title translation. The use of "default" data based on NPA-NXX eliminates the need to keep ten-digit GTT data for numbers that are not ported.

NOTE - The system that performs the ten-digit NP GTT function and the system that performs the NP default GTT could be different systems.

<REQ-02900> (GTT)

The system performing the NP GTT function shall support SCCP Routing and Management procedures as defined in T1.112.4, including those for final global title translations, if final GTTs are supported. See the following Note.

<End of REQ-02900>

<REQ-03000> (GTT)

If the ten-digit GTAI matches the DN of a ported number, the NP GTT function shall perform the GTT indicated by the TT, using the data associated with the ported DN.

<End of REQ-03000>

<REQ-03100> (GTT)

If the ten-digit GTAI does not match the DN of a ported number, the NP GTT function shall perform the GTT indicated by the TT, using the data associated with the default NPA-NXX.

<End of REQ-03100>

> NOTE - Support of final GTT by NP GTT function is not mandatory. If final GTTs are performed by NP GTT function, then SCCP management procedures necessary for supporting final GTTs must be supported. Performing final GTTs in the NP GTT function if the NP GTT function resides on an "end node" (platform connected to the network via A-links, such as an SCP) may raise network management issues for the service provider's network, to be addressed by the service provider. If final GTTs are not performed by the NP GTT function, then the service provider needs to configure routing so that messages passing through the NP GTT function destined for the service provider's own network receive final GTT processing in some network system. In this example, service provider needs to exercise care to avoid establishing circular routing.

<REQ-03200> (GTT)

If the system performing the NP GTT function is not also performing STP functions, it shall initiate error procedures (see T1.111.4) when it receives messages not MTP addressed to its point code or alias point code, or if it receives messages which indicate SCCP routing is to be performed by point code.

<End of REQ-03200>

If the system performing the NP GTT function does not support other GTT functions, and if the TT does not match a TT supported by that NP GTT function, then SCCP error procedures should be invoked (see T1.112.4.)

<REQ-03300> (GTT)

If the TT in the received message is not supported by the system performing the NP GTT function, SCCP error procedures shall be invoked (See T1.112.4.)

<End of REQ-03300>

Only the SCCP content for TCAP query messages is pertinent to NP GTT if the GTAI contains 10 digits. If the GTAI is less than 10 digits, the NP GTT function must decode the TCAP portion of the message, as described in Clause 5.3.2. The NP GTT function may modify the SCCP CdPA SSN and Routing Indicator, and optionally, the TT or the TT and GTAI. The NP GTT function should make no changes to the data within the fields of the SCCP Calling Party Address, or the TCAP portion of the message.

<REQ-03400> (GTT)

The NP GTT function may modify the contents of the SCCP Called Party Address SSN and Routing basis, and, optionally, the TT or the TT and GTAI (see annex B) for messages that successfully complete GTT processing. All fields within the SCCP Calling Party Address, and the entire TCAP portion of messages that successfully complete GTT processing shall be retransmitted without modification by the NP GTT function.

<End of REQ-03400>

Some networks may not support all the signaling services impacted by number portability (LIDB, CLASS, CNAM, ISVM). If a service is not supported by a service provider, the NPAC will download "null" data for the DPC and SSN fields associated with the non-supported service for the ported DN. This means there should be a ten-digit entry for the ported DN in the GTT tables, but the DPC and SSN entries associated with the ten-digit entry will be "null". If the GTT function finds a ten-digit match in the GTT tables, but the GTT data associated with the ten-digit entry is "null", the GTT cannot be completed.

<REQ-03500 (GTT)

If a ten-digit match is found for the GTAI in the GTT table, but the GTT data associated for the indicated TT is "null", it shall be treated as a non-existent translation, and the message return procedure shall be initiated with a Return Cause of "no translation for this specific address". (See T1.112.4.)

<End of REQ-03500>

If the NP GTT function is unable to perform a GTT because the ten-digit DN does not match any entries in the ten-digit data of ported DNs or six-digit data for default NPA-NXXs, then the GTT cannot be completed.

<REQ-03600> (GTT)

If neither a ten-digit match is found in the NP data, nor a six-digit match is found in the default data, it shall be treated as a non-existent translation, and the message return procedure shall be initiated with a Return Cause of "no translation for this specific address". (See T1.112.4.)

<End of REQ-03600>

5.3.1 NP GTT Function Processing for Ten Digit GTAI

Ten digit GTAI processing may be needed to route SS7 TCAP messages that support various services (examples include CLASS, ISVM, LIDB, or CNAM). CLASS, ISVM, LIDB, and CNAM TCAP messages are currently distinguishable from each other based on TT.

For these types of messages, a ten-digit GTAI will represent a DN. The NP GTT function will identify which GTT tables to use (CLASS, ISVM, CNAM) based on the received TT. The NP GTT function should check the global title tables for the indicated TT for an entry that matches the ten-digit value of the GTAI. If a match is found, the NP GTT function should use the GTT data associated with the found ported DN to formulate the SCCP information in the outgoing message.

5.3.1.1 Performing Final GTT For a Ported DN

If the GTT data associated with the ported line indicates a final translation[7], the NP GTT function will repopulate the existing SCCP CdPA with the received GTAI (ten-digit DN) and SSN from the global title tables, and will include an indication that further SCCP routing is to be

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[7] This is indicated by the routing indicator changed to DPC and SSN routing. Also, at this point, a non-zero entry is required in the SSN. This distinction is not indicated in the rest of this document.

based on the DPC and SSN derived from the global title translation. It will retransmit the message with the repopulated SCCP CdPA, an MTP DPC set to the DPC derived from the global title tables, and the MTP OPC of the NP GTT node itself.

5.3.1.2 Performing Non-Final GTT For a Ported DN

If the GTT data associated with the ported line indicates a translation that is not final , the NP GTT function will populate the SCCP CdPA either with the received TT or the TT and GTAI values or, optionally, with new post-NP GTT TT or the TT and GTAI values if the NP GTT record indicates TT replacement or the TT and GTAI replacement. (See annex B for details related to TT and the TT and GTAI replacement.) (Since a non-final GTT is being performed, the SSN should be populated as zero[8].) The NP GTT function will indicate further SCCP routing is to be based on GTT. It will retransmit the message with the SCCP Called Party Address, populated as described above, an MTP DPC derived from the NP GTT data, and the MTP OPC of the NP GTT node itself.

5.3.1.3 Performing Final GTT For a Non-Ported DN

If no ten-digit match is found for the GTAI in the translation tables, the NP GTT function should use the data in the default NPA-NXX table to route the message. If the default record for the NPA-NXX of the ten-digit GTAI indicates a final translation to the final network element, the NP GTT function will repopulate the SCCP Called Party Address which contains the received GTAI (10 digits) and SSN from the default record, and that further SCCP routing is to be based on DPC and SSN derived from the translation. It will retransmit the message with the repopulated SCCP Called Party Address, an MTP DPC set to the DPC derived from the global title tables, and the MTP OPC of the NP GTT node itself.

5.3.1.4 Performing Non-Final GTT For a Non-Ported DN

If no ten-digit match is found for the GTT in the translation tables, and the default NPA-NXX entry indicates a non-final translation, the NP GTT function will copy the SCCP Called Party Address which contains the received GTAI value. (Since a non-final GTT is being performed, the SSN should be populated as zero.) The NP GTT function will indicate further SCCP routing is to be based on GTT. It will retransmit the message with the replicated SCCP Called Party Address, and an MTP DPC set to the DPC derived from the global title tables, and the MTP OPC of the NP GTT function itself.

5.3.2 NP GTT for Less than Ten-Digit GTAI

Less than ten-digit GTAI processing may be needed to route SS7 TCAP messages that support various services (examples include LIDB, CLASS, ISVM, or CNAM. LIDB, CLASS, ISVM, and CNAM TCAP messages are currently distinguishable from each other based on TT. In general, current implementations use six-digit GTs in LIDB query messages. Other message types may

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[8] The SCCP protocol specifies that, for a non-final GTT, the SSN should be populated as received. However, in some implementations this will result in an error.

use less than 10 digit GTAIs depending on capabilities and configurations of the service provider's network and systems.

Some systems place less than 10 digits (NPA-NXX) in the GTAI field of the SCCP CdPA parameter. In this example, the NP GTT function cannot determine the subscriber DN to match from examination of SCCP data only. If the NP GTT function determines that the GTAI is less than 10 digits, then the NP GTT function must decode the TCAP portion of the message to determine the subscriber DN. The value of the incoming TT will determine which TCAP parameter's information that should be used as input to the ten-digit translation performed by the NP GTT function.

Once the DN has been retrieved from the TCAP portion of the message, processing continues as for the ten-digit GTAI. If the received message included a GTA containing less than ten-digits, the message as it is retransmitted from the NP GTT function shall also have a GTAI containing less than 10 digits.

<REQ-03700> (GTT)

When a TT indicates that ten-digit GTT processing should be performed and less than 10 digits are present in the GTAI, then the NP GTT function shall decode the TCAP portion of the message to determine a ten-digit DN, based on the value of the incoming TT, to use in place of the GTAI for GTT processing.

<End of REQ-03700>

A non-final translation for a ported number is given as an example. Upon receiving a less than 10 digit GTAI, the NP GTT function will use the TT to identify the type of TCAP message (CLASS, LIDB, ISVM, or CNAM). The NP GTT function will decode the TCAP portion of the message to identify a ten-digit DN to use for the GTT. (See Clause 5.6.5 for information about appropriate TCAP message formats.) The ten-digit value determined from the TCAP portion will be used in place of the less than ten-digit GTAI in further GTT processing. If the GTT data associated with the ten-digit value indicates a translation that is not final, the NP GTT function will populate the SCCP Called Party Address with either the same TT and GTAI value that was received (less than 10 digits), or, optionally, different post-NP GTT TT or the TT and GTAI values based on the ported number subscriber NP GTT data, if the NP GTT function supports TT replacement or the TT and GTAI replacement (see annex B). (Since a non-final GTT is being performed, the SSN should be populated as zero.) The NP GTT function will indicate further SCCP routing is to be based on GTT. It will retransmit the message with the SCCP Called Party Address populated as described above, an MTP DPC derived from the ported DN NP GTT data, and the MTP OPC of the NP GTT function itself.

If the NP GTT function is unable to determine a ten-digit DN value from the TCAP portion of the message, it shall treat the situation as an SCCP error, even though TCAP decoding was attempted or performed. (See Clause 5.5.) Also, if a match cannot be found for the DN retrieved from the TCAP portion in either the ten-digit or six-digit NP data, it shall be treated as a non-existent translation, and the message return procedure shall be initiated. (See T1.112.4.)

<REQ-03800> (GTT)

If the message contains only a less than ten-digit GTAI, and the NP GTT function is unable to determine a ten-digit DN value from the TCAP portion of the message, it shall treat the situation as an SCCP error, and initiate the message return procedure, if requested.

<End of REQ-03800>

> NOTE - The parameter containing the DN of the called party within the TCAP portion of the message may be part of a parameter "set". The sequencing of parameters within a "set" may vary, and cannot be guaranteed.

5.4 Operator Services Support Functions

The functions performed by Operator Systems which are impacted by NP include:

- ♦ LIDB TCAP queries (calling card, billing validation, etc.)
- ♦ Routing Determination
- ♦ Busy Line Verification (BLV)
- ♦ Charge determination (Future)

The NP GTT function defined in Clause 5.3 will provide for the proper routing of LIDB TCAP queries initiated by an operator services system.

If the operator services system performs routing determination for calls to portable NPA-NXXs, it will need to query the NPDB application to determine the proper routing information (i.e., the LRN for a ported number, etc.). It will do so using any of the allowed NP query messages (see Clause 5.6.3.1). The NPDB application shall respond identically to NP query messages initiated from operator services systems as it does for NP query messages initiated from a switch (see Clause 5.2).

> NOTE - operator services systems may not support the full range of ANSI IN capabilities. In particular, an operator services system may not respond to a query response requesting action at the operator services system.

In order to perform Busy Line Verification (BLV), the operator services system will need to know which network serves a particular directory number. For ported numbers, the operator services system will be able to use the LRN to identify the serving network. To determine whether a DN has been ported, and to determine the LRN for ported DNs, the operator services system will need to perform an NP query when it attempts BLV for a DN within a portable NPA-NXX. It will do so using any of the allowed NP query messages (see Clause 5.6.3.1). The NPDB application shall respond identically to NP query messages initiated from operator services systems as it does for NP query messages initiated from an switch (see Clause 5.2). The operator services system will use the information returned in the response to determine if it can perform a BLV for the requested DN. If the operator services system determines from the response that it cannot perform BLV for the requested DN, it may use the information in the response to determine which network serves the DN, and hand-off the call to an operator services system serving that network.

For further details on the operation of operator services systems for NP, see the Technical Requirements for Number Portability - Operator Services Switching Systems.

5.5 Errors and Exceptions

<REQ-03900>

General SS7 protocol errors of formats and coding (MTP, SCCP, TCAP) of ANSI IN or pre-IN (IN/1) messages processed by the NP application shall be dealt with as defined in T1.111, T1.112, and T1.114.

<End of REQ-03900>

<REQ-04000>

General SS7 protocol errors of formats and coding (MTP, SCCP) for messages routed to the NP GTT function for processing, or messages rerouted by the NP GTT function shall be dealt with as defined in T1.111 and T1.112.

<End of REQ-04000>

<REQ-04100> (ANSI IN)

General ANSI IN protocol errors (formats, parameters, missing mandatory parameters, etc.) and failures (a hardware or software resource is unable to provide functionality that is necessary for the completion of an operation) shall be dealt with as defined in T1.667, Clauses 7.4.2 and 7.4.7.2.

<End of REQ-04100>

<REQ-04200> (IN/1)

General pre-IN (IN/1) protocol errors (bad formats, missing mandatory parameters, etc.) and failures (a hardware or software resource is unable to provide functionality that is necessary for the completion of an operation) shall be dealt with as defined in TR-NWT-000533, Section 3.1.7.

<End of REQ-04200>

<REQ-04300> (ANSI IN)

If the NPDB application supporting queries from ANSI IN NP triggers receives any TCAP messages other than those which it expects to receive , the NPDB application shall consider it an Erroneous Data Value, and respond with an Application Error (TCAP Return Error) message. The error message shall identify the operation code of the received message as the erroneous data item.

<End of REQ-04300>

<REQ-04400> (IN/1)

If the NPDB application receives any pre-IN (IN/1) query messages with an unrecognized Operation Code, the response shall be a TCAP Reject message with a Problem Code that indicates a Problem Type of "Invoke" with a Specifier of "Unrecognized Operation Code"

<End of REQ-04400>

<REQ-04500> (ANSI IN)

If the NPDB application receives an ANSI IN NP query that is missing parameters defined as optional but required for the NP processing, it shall respond with a Missing Conditional Parameter indication in an Application Error message.

<End of REQ-04500>

<REQ-04600> (IN/1)

If the contents of a parameter in an pre-IN (IN/1) query are incorrect (wrong length, wrong value, unrecognized value, etc.), the NPDB application shall respond with a Return Error message, with an error code of "unexpected data value", and a Problem Data parameter which reports the offending element and value.

<End of REQ-04600>

<REQ-04700>

If the NPDB application receives an NP query for an NPA-NXX not known to it, the NPDB application shall respond as for a non-ported number.

Because no error message is returned to the switch, the call will be routed with the FCI bit set to number translated rather than default routed. Thus, if the number had indeed been ported, the call will fail.

<End of REQ-04700>

<REQ-04800> (GTT)

Errors for the NP GTT function shall be treated as defined in T1.112. If no GTT entry can be found to match the GTAI in the received message, then the NP GTT function will initiate the message return procedure with the Return Cause of "no translation for this specific address" as defined in T1.112.4.

<End of REQ-04800>

<REQ-04900> (GTT)

When

- ♦ **The NP GTT function needs to examine TCAP data in order to determine the ten-digit DN (i.e., messages containing less than 10 digits in the GTAI, and matching a portable NPA-NXX), and**
- ♦ **There are any errors in the TCAP portion (including unrecognized DN) that interfere with determining the ten-digit DN and prevent the completion of the NP GTT function,**

then the NP GTT function

- ♦ **Shall respond as if the translation of the global title does not exist, and**
- ♦ **Shall initiate the SCCP message return procedure with the Return Cause of "no translation for this specific address".**

<End of REQ-04900>

(The SCCP error procedure of <REQ-04900> is used to prevent problems for the system originating the message which might otherwise receive TCAP error messages from a Point Code it expects to only perform MTP and SCCP processing. It also eliminates the need for the NP GTT function to implement full TCAP procedures for messages for which it is only performing six-digit GTT.)

<REQ-05000>

The NPDB application platform shall be capable of handling any of the SS7 MTP, SCCP, or TCAP error messages defined in T1.111, T1.112, and T1.114 that may be sent from the switch (or operator services system).

NOTE - IS-41 networks use T1.114-1988, not T1.114-1992 or later.

<End of REQ-05000>

<REQ-05100> (ANSI IN)

The NPDB application shall be prepared to receive any of the ANSI IN error messages from the switch (or operator services system) documented in as defined in T1.667, Clauses 7.4.2 and 7.4.7.2.

<End of REQ-05100>

<REQ-05200> (IN/1)

The NPDB application shall be prepared to receive any of the pre-IN (IN/1) error messages which might be sent from the switch (or operator services system) as documented in TR-NWT-000533, Section 3.1.7, and Appendix B.

<End of REQ-05200>

5.6 Signaling and Protocol Requirements for Interfaces

5.6.1 NPAC to LSMS

Details on the signaling and protocol for the "downstream" interface between NPAC and LSMS are defined by the NPAC interface specification (see reference Clause 2.4.2.)

5.6.2 LSMS to NPDB and NPGTT Systems

The interface between the LSMS and the NPDB and NP GTT platform is to be determined by the system vendor. Both of these interfaces are beyond the scope of this document.

5.6.3 Switch to NPDB application

The following switch to NPDB application signaling messages are used to support NP. Comments are included in the message formats to indicate which optional parameters are required for the NPDB application. Comments also indicate which response messages are used by the NPDB application.

1.1.1.1 5.6.3.1 NP Query Messages

For the analyzedInformation message, the optional parameters that are not noted as necessary for NP processing may be received in the NP query message, but may be ignored for the purposes of the NPDB application.

The analyzedInformation message is defined in T1.667, Clause 7.3.1.3:

```
analyzedInformation      OPERATION
PARAMETER                SEQUENCE {
                         UserID,
                         BearerCapability,
```

CalledPartyID	OPTIONAL	-- Required for NP
LATA	OPTIONAL	
TriggerCriteriaType	OPTIONAL	-- Conditional for NP
ChargeNumber	OPTIONAL	
CallingPartyID	OPTIONAL	
CallingPartyBGID	OPTIONAL	
ChargePartyStationType	OPTIONAL	
PrimaryCarrier	OPTIONAL	
AccessCode	OPTIONAL	
CollectedAddressInfo	OPTIONAL	
CollectedDigits	OPTIONAL	
VerticalServiceCode	OPTIONAL	
Tcm	OPTIONAL	
OriginalCalledPartyID	OPTIONAL	
RedirectingPartyID	OPTIONAL	
RedirectionInformation	OPTIONAL	
acgEncountered	OPTIONAL	-- Conditional for NP
Amp	OPTIONAL	
	}	

```
    ERRORS {            applicationError
                        }
    -- LINKED {
                -- analyzeRoute,         -- Used for NP
                -- continue,             -- Not allowed for NP
                -- sendToResource,       -- Not allowed for NP
                -- releaseCall           -- Not allowed for NP
                -- }
```

The ProvideInstructions:Start message is documented in TR-NWT-000533, Section 3.1.3. The CIC Expansion parameter is documented in TR-NWT-001050, Section 3.2. The ProvideInstructions: Start message has the following parameters:

Parameter Field	Nature	Contents
Service Key (Digits (Dialed digits))	Mandatory	(called party number)
Digits (Calling Party Number)	Mandatory	(calling party number)
Digits (Originating LATA)	Mandatory	(LATA ID)
Originating Station Type	Mandatory	(ANI II digits)
CIC Expansion	Optional	(CIC response 3 or 4 digits)

5.6.3.2 NP Response Messages
The analyzeRoute message is defined in T1.667, Clause 7.3.1.3:

analyzeRoute	OPERATION			
PARAMETER	SEQUENCE {			
	ChargeNumber		OPTIONAL	
	CallingPartyID		OPTIONAL	
	ChargePartyStationType		OPTIONAL	
	CalledPartyID		OPTIONAL	-- Required for NP
	OutpulseNumber		OPTIONAL	
	Tcm		OPTIONAL	
	PrimaryTrunkGroup		OPTIONAL	
	AlternateTrunkGroup		OPTIONAL	
	SecondAlternateTrunkGroup		OPTIONAL	
	PrimaryCarrier		OPTIONAL	
	AlternateCarrier		OPTIONAL	
	SecondAlternateCarrier		OPTIONAL	
	PassiveLegTreatment		OPTIONAL	
	RedirectingPartyID		OPTIONAL	
	PrimaryBillingIndicator		OPTIONAL	
	AlternateBillingIndicator		OPTIONAL	
	SecondAlternateBillingIndicator		OPTIONAL	
	OverflowBillingIndicator		OPTIONAL	
	AMAAlternateBillingNumber		OPTIONAL	
	AMABusinessCustomerID		OPTIONAL	
	SEQUENCE AMALineNumber	OF	OPTIONAL	
	AMAslpID		OPTIONAL	-- Optional for NP
	SEQUENCE AMADigitsDialedWC	OF	OPTIONAL	
	Amp		OPTIONAL	
			}	
ERRORS {	applicationError			
	}			

The ConnectionControl message (IN response) is documented in TR-NWT-000533, Section 3.1.4. It contains the following parameters:

Parameter Field	Nature	Contents
Digits (Carrier)	Mandatory	(3 or 4 digit CIC)
Billing Indicators	Mandatory	(Call type + Feature ID)
Digits (Routing Number)	Mandatory	(LRN or Dialed Number)

The parameters should be populated with values according to TR-NWT-000533, Appendix B, Section B.4.2, except for Digits (Carrier). Population of the Digits (Carrier) parameter should be according to TR-NWT-001050, Appendices A and B.

5.6.3.3 NP Message Parameters

Parameters for the analyzedInformation and analyzeRoute messages are coded according to T1.667, Clauses 7.4.3.4 and 7.4.3.5 respectively . Parameters for the ProvideInstructions:Start and ConnectionControl:Connect messages are coded according to TR-NWT-000533, Sections 3.1.3, 3.1.4 and Appendix B.

5.6.4 Operator Services Systems to NPDB application System

Operator Services Systems will communicate to the NPDB application using the messages defined in the previous clause addressing switch to NPDB application platform messages.

> NOTE - Operator services systems may not support the full range of ANSI IN capabilities. In particular, an operator services system may not respond to a query response requesting action at the operator services system.

5.6.5 TCAP Message Formats for NP GTT Function

The NP GTT function will need limited ability to decode TCAP portion of messages when the GTAI of the received message contains less than 10 digits.

The following information is provided as guidance in locating the ten-digit DN within the TCAP portion of a message.

Table 5: References for TCAP decode for ten-digit DN

Feature	SCCP CdPA Length	TCAP Op Code	Minimum TCAP Parameters	Reference
Auto Callback	6-10	Misc. - Queue Call	Svc. Key (destin.)	TR-NWT-000215
Auto Recall	6-10	Misc. - Queue Call	Svc. Key (destin.)	TR-NWT-000227
Screen List Edit	6-10	Parm - Provide Value	Svc. Key (destin.)	TR-NWT-000220
Calling Name	6-10	Parm - Provide Value	Svc. Key (calling)	TR-NWT-001188
LIDB	6	Parm - Provide Value	Svc. Key (see Clause 5.6.5.1 for details)	GR-1149-CORE
ISVM Activation	6-10	Rpt Event - Msg Avail	Svc. Key (destin.)	GR-866-CORE
ISVM Deactivation	6-10	Rpt Event - Msg Rtvd	Svc. Key (destin.)	GR-866-CORE

5.6.5.1 LIDB TCAP Message Formats

SS7 TCAP messages to the LIDB may include multiple components. In order to determine the DN to use for ten-digit NP GTT processing, only the first component within any TCAP message

needs to be examined. (By implication, multiple components will all be related to the same DN, so only one component needs to be examined.)

All LIDB TCAP components to be processed will have an operation code of "Parameter - Provide Value". If any other operation code is present instead of "Parameter - Provide Value", then it should be treated as a NP GTT failure, and the SCCP message return procedure should be initiated.

Six different services use LIDB queries, and all currently place only six-digit values in the GTAI. Seven different messages may need to be processed to determine the DN to use as a ten-digit value for NP GTT processing. (Calling card service may use either of two different message structures.) The queries for these six services use different sets of parameters within the component portion. The type of message, and which parameters will be present in a given component portion will be determined by an identifier in the parameter set that indicates one of the following query types:

- ♦ Intercept (support of this message is optional)
- ♦ Originating Line Number Screening
- ♦ Calling Card Query - Type 1
- ♦ Calling Card Query - Type 2 (support of this message is optional)
- ♦ Billed Number Screening
- ♦ Terminating Line Number Screening (support of this message is optional)
- ♦ IC Denial Check (support of this message is optional)

LIDB messages for which support is "optional" are not known to be currently implemented or in use by any system. Also, IC Denial would never be transmitted by itself, so processing of this component by itself would not be necessary. (Processing the component accompanying IC Denial would be sufficient to route the message.)

If any other type of query is identified, then it should be treated as a NP GTT failure, and the SCCP message return procedure should be initiated.

The first component in each of the following LIDB query types will include a Service Key parameter. Some Service Key parameters include multiple digits fields. The digits field which is to be used to determine the ten-digit DN for NP GTT processing for each type of LIDB query message is as follows:

Table 6: Digits field for LIDB queries used to determine ten-digit DN for NP GTT processing.

Message	Type of Digits (See Note)	Notes
Intercept	Dialed(Called)	No other digits fields will be present in the service key field
OLNS	Either ANI (Calling) or Calling Directory Number will be present (but not both)	Additional digits fields with Dialed (called) or Billing Number digits may be present
CC Type 1	Billing Number	Additional digits fields with ANI (Calling) and Dialed (Called) will be present
CC Type 2	Billing Number	Additional digits fields with PIN, ANI (Calling) and Dialed (Called) will be present
BNS	Billing Number	Additional digits fields with Dialed (Called) and ANI (Calling) will be present
TLNS	Dialed (Called)	Additional digits fields with Billing Number or ANI (Calling) may be present
IC Denial	Either ANI (Calling) or Billing Number will be present (but not both)	An additional digits field with Carrier Identification will be present in the service key

NOTE - The first digits field within the service key field may contain the DN to use for NP GTT function processing. However, because the Service Key parameter in these TCAP messages is itself a "set", the order of the elements within the Service Key parameter cannot be guaranteed. Vendors should therefore be cautioned that Basic Encoding Rules for decoding of the TCAP message and attention to the embedded "Type of Digits" fields is the only reliable way to locate the necessary ten-digit information.

If the type of digits field indicated in the table for a given message type cannot be located, then it should be treated as a GTT failure, and the SCCP message return procedure should be initiated.

If any number of digits besides ten is found within the indicated digits field within the Service Key parameter, it should be treated as a GTT failure, and the SCCP message return procedure should be initiated.

5.6.5.2 GTT Routing of CLASS Response Messages

Some systems use global title addressing for responses to AC/AR queries. For these response messages, NP GTT processing is indicated if the GTAI contains a portable NPA-NXX value. If the GTAI in a CLASS response message contains only 6 digits, then the NP GTT function may optionally route the message using six-digit default GTT tables, instead of attempting to further decode the TCAP portion of the message, failing to find a ten-digit value, and invoking message return procedures (if indicated). The TCAP portion of an AC/AR response message does not contain a ten-digit DN, so processing the TCAP portion of the AC/AR response messages need not be performed. AC/AR response messages may be identified by TCAP Package Types of "Response" or "Conversation with Permission". The NP GTT function must decode the TCAP Package Type within the message before determining whether the option to route the message

using the six-digit default NP GTT data can be applied. If the TCAP Package Type indicates that the CLASS message is a query, the NP GTT function should continue decoding the TCAP portion of the message to look for a ten-digit number on which to apply NP GTT processing. If the TCAP Package Type in the CLASS message contains the value "Response" or "Conversation with Permission," the NP GTT function may default route the message if the service provider and vendor determine that this option should be invoked. It should be noted that applying this routing option to CLASS response messages related to ported DN may result in some messages being misrouted.

<CR-05300> (GTT)

If a service provider and vendor support GTT routing of responses to CLASS AC/AR queries, and a CLASS message with a six-digit GTAI is received by the NP GTT function, the NP GTT function may optionally route the message by processing the GT using default NP GTT data instead of performing message return procedures (as would otherwise be indicated due to a lack of ten-digit information within the TCAP portion of AC/AR response messages).

<End of CR-05300>

<CR-05400> (GTT)

If a service provider and vendor agree to support default routing of GTT routed responses to CLASS AC/AR queries, the NP GTT function shall process the TCAP Package Type associated with incoming CLASS messages (i.e., incoming messages with the CLASS TT) that contain six-digit GTAIs prior to applying subsequent NP GTT processing to determine whether to apply default routing, or to continue decoding the TCAP portion of the message to determine a ten-digit value on which to apply NP GTT processing.

<End of CR-05400>

5.7 Hardware Interface Requirements

No unique hardware elements are needed.

5.8 Operations, Administration, Maintenance and Provisioning Requirements

5.8.1 Measurements

Specific measurement needs will be determined by the service provider. The following list of measurements is provided for guidance. Some service providers may be satisfied with gross counts (not broken out by LRN, point code, etc.). Some service providers may prefer an intermediate level of aggregation, with counts totaled by carrier, instead of by individual point code, LRN, etc. Some service providers may desire to track queries by type of system that originates the query (e.g., switch or operator services system).

<CR-05500>

The NPDB application shall track the following application measurements on an hourly and daily basis:

- ♦ **NP queries per originating system by point code (switch or Operator System)**
- ♦ **NP queries for ported numbers per LRN**

♦ **NP queries for non-ported number per NPA-NXX**

♦ **NP query failures (index parameters to be determined)**

<End of CR-05500>

<CR-05600>

The NP GTT function shall track the following measurements on an hourly and daily basis:

♦ **Ten-digit GTTs by TT per originating system (point code)**

♦ **Ten-digit GTTs for ported numbers by DPC**

♦ **Ten-digit GTT failures (index parameters to be determined)**

♦ **Six-digit GTTs by TT per originating system (point code)**

♦ **Six-digit GTTs for non-ported numbers by DPC**

♦ **Six-digit GTT failures (index parameters to be determined)**

<End of CR-05600>

Ten-digit GTT failure count only records GTT failures when less than 10 digits are present in the GTAI and the NP GTT function fails to locate a suitable ten-digit value through TCAP decoding. Six-digit GTT failure count records all other causes of GTT failures, which can be inclusive of ten-digit GTT failure counts. (Vendor should inform their customers whether their six-digit GTT failure counts are inclusive or exclusive of ten-digit GTT failure counts.)

Counts for GTT failures should be kept by service provider (Point Code of SCCP Calling Party Address)

Additional application measurement requirements may be defined by the service provider.

Measurements identified in this clause are application measurements, and do not supersede any platform or link measurements indicated in any other requirements.

5.8.2 Network Management
<REQ-05700> (ANSI IN)

The NPDB application shall be capable of supporting the ANSI IN ACG procedures as defined in Clause 7.4.3.1 of T1.667.

<End of REQ-05700>

Further details related to ANSI IN ACG procedures can be found in GR-2938-CORE, Section 3.6. This includes transmitting ACG messages to served systems (switches and operator services systems) under appropriate circumstances, and responding to acgEncountered parameters in received messages.

<REQ-05800> (IN/1)

The NPDB application shall be capable of supporting pre-IN (IN/1) ACG procedures (TR-NWT-000533, Section 3.5.7). The NPDB application shall transmit the pre-IN (IN/1) ACG message to served systems (switches and operator services systems) when necessary to control load.

<End of REQ-05800>

NOTE - The ANSI IN ACG procedures differ from the pre-IN (IN/1) ACG procedures.

<REQ-05900>

The NPDB application platform supporting the NPDB application shall be able to support appropriate MTP and SCCP management controls defined in T1.111 and T1.112.

<End of REQ-05900>

<REQ-06000> (GTT)

The NP GTT function shall be able to support appropriate MTP and SCCP management controls defined in T1.111 and T1.112, including the SCCP management controls of T1.112.4 necessary for performing final GTTs, if the NP GTT function supports final GTTs.

<End of REQ-06000>

5.8.3 Maintenance Requirements

No additional maintenance requirements specific to the NPDB application or NP GTT function have been identified.

5.8.4 Billing

Some service providers may want the NPDB application and NP GTT function to keep counts for billing purposes. The counts identified in <CR-06100> through <CR-06150> may be needed for billing purposes.

<CR-06100>

The NPDB application shall provide a count of NP queries per originating system by point code (switch or Operator System).

<End of CR-06100>

<CR-06110>

The NPDB application shall provide a count of NP queries for ported numbers per LRN.

<End of CR-06110>

< CR-06120>

The NPDB application shall provide a count of NP queries for non-ported number per NPA-NXX.

<End of CR-06120>

< CR-06130>

For purposes of identifying a query performed by a donor network on behalf of an N-1 network, the NPDB application shall provide a count of NP queries per combination of originating system by point code and incoming trunk group number.

<End of CR-06130>

< CR-06140>

The NP GTT function shall provide a count of ten-digit GTTs by TT per originating system (point code).

<End of CR-06140>

< CR-06150>

The NP GTT function shall provide a count of six-digit GTTs by TT per originating system (point code).

<End of CR-06150>

If either the NPDB application or NP GTT function keep counts for billing purposes, the counts should be output in record format suitable for the service provider's billing systems. Specific formats and transmission are to be determined by the service provider. Bellcore AMA Formats (BAF) are one possible structure for these records.

Most service providers consider the collection of counts for billing purposes to be a function which requires high reliability and minimal loss of information. Service providers may have specific requirements for the reliability and loss of information collected for billing purposes. This may include storing counts used for billing purposes on magnetic media (disks, tapes, etc.) at the site.

There are no mandatory requirements for the NPDB application to include any AMA parameters in ANSI IN NP responses. A service provider may include AMA parameters in ANSI IN NP responses for purposes not defined in this document. Specifically, a service provider may decide to optionally include the AMAslpID parameter in the ANSI IN analyzeRoute message. In this example, the NPDB application might need to be able to discriminate among querying systems to determine when an AMAslpID parameter should be included in the ANSI IN analyzeRoute response message. The method of providing this discrimination is beyond the scope of these requirements, and will need to be addressed by each service provider.

5.8.5 Administrative I/O Messages and Reports

The need for specific administrative messages and reports are to be defined by the vendors and service providers as needed.

5.8.6 Audits

The LSMS must be able to respond to audit requests generated by the NPAC. These audit requests are used to verify data in LSMS, and are initiated for troubleshooting and other purposes. The NPAC and LSMS audit functions are detailed in the NPAC feature requirements and Interface specification documents (see references Clause 2.4.2.) Audit requests are not made from the NPAC to the NPDB application or NP GTT function.

The data in the NPDB application and NP GTT function are derived, in part, from the data provided from the NPAC to the LSMS. The LSMS may be co-resident with the NPDB application or NP GTT function, or the LSMS may reside on a separate system. The LSMS may communicate directly with the NPDB application or NP GTT function, or may communicate through one or more intermediate systems. It is important that the integrity of data be maintained as it flows from the LSMS interface to the NPDB application and NP GTT function, regardless of the particular architecture employed. In general, two categories of functions

should be used (as appropriate based on architecture) to maintain the integrity of the data within the NPDB application and the NP GTT function. The first are inter-system (or inter-application) capabilities that can be used to verify a set of data against the "upstream" data from which it is derived. The second are intra-system (or intra-application) capabilities that identify irregularities between a current and a previous version of a set of data.

The NPDB application and NP GTT function should also support appropriate data integrity functions, independent of the functions required of the LSMS in support of the NPAC processes. The integrity functions should be capable of being scheduled to run in the background, or on a periodic basis. There should also be integrity functions which can be invoked manually to verify a limited number of records within the NPDB application or NP GTT function in near-real time. The integrity functions should identify, and to the extent possible, automatically correct any discrepancies they identify within the data of the NPDB application and NP GTT function. The specific details of the integrity functions, including how such functions are managed and invoked, will be determined between the carrier and the supplier, based on the desired quality of service, and the architecture employed. Integrity functions may be implemented in various ways. They could be an integral part of the NPDB application and NP GTT function, or they may be performed by a separate application upon the data sets used by the NPDB application and NP GTT function, for example.

<REQ-06200>

The NPDB application and NP GTT function shall support intra-system and inter-system integrity functions, as appropriate based upon architecture, to maintain the accuracy of the data within the systems, including the accuracy of data derived from the records provided by the NPAC.

<End of REQ-06200>

<REQ-06300>

There shall be appropriate data integrity functions to support the NPDB application and NP GTT function that can be scheduled to run in the background or on a periodic (scheduled) basis.

<End of REQ-06300>

<REQ-06400>

There shall be appropriate data integrity functions to support the NPDB application and NP GTT function capable of being invoked manually to verify a limited number of records in near real time.

<End of REQ-06400>

<REQ-06500>

The data integrity functions supporting the NPDB application and NP GTT function shall be capable not only of identifying discrepancies within and between sets of data, but shall also be capable of correcting discrepancies.

<End of REQ-06500>

5.9 Initialization and Recovery Requirements

NPDB application and NP GTT function should not violate availability and accuracy requirements during or because of initialization or recovery activities. (This may be accomplished in part through deployment of multiple NPDB applications and NP GTT functions within the network.)

5.10 Capacity, Performance and Reliability Requirements

The NPDB application and NP GTT function should be highly reliable. The NPDB application should be available to a query originating node (e.g., switch or operator services system) for a given NPA-NXX at a service availability level of 99.999%.

<REQ-06600>

A single NPDB application platform shall have a total (all causes) downtime objective of no more than 115 minutes per year. This includes 60 minutes of scheduled downtime per year.

<End of REQ-06600>

<REQ-06700> (GTT)

The NP GTT function shall meet the SCCP relay point unavailability requirements of Clause 3.1 of T1.112.5.

<End of REQ-06700>

The 99.999% service availability objective is typical for functions based in the SS7 network and the services supported by the SS7 signaling network. Service providers might be able to employ different network architectures to meet this requirement. One such network architecture would be to employ a mated pair of SCPs fully interconnected to a mated pair of STPs. Other architectures might be able to also satisfy the NP query processing reliability objectives. Beyond the capabilities of their own networks, service providers might reach agreements for the use of resources in other service providers' networks to meet this reliability objective.

<REQ-06800>

The network unavailability of NP query processing for all reasons shall not exceed 3 minutes per year.

<End of REQ-06800>

Service providers are reminded that due to the critical nature of the NPDB application, provisions should also be made for survivability (e.g., deployment of mated pairs or other methods of system duplication). Service providers may have additional requirements for availability of the NPDB application and LNP GTT function.

The target performance for the NPDB application query is 95th percentile delay of 500ms under designed maximum load. This means that the NPDB application should be able to respond to a query for 95% of the messages within 500ms under designed maximum load. Delay should be measured from the time the last bit of the incoming message is received until the first bit of the outgoing message is transmitted by the NPDB application system. "Designed maximum load" will be determined by the service provider in discussions with the vendor, but should be capable of supporting busy hour traffic levels.

Various systems depend on the rapid transmission of messages through the SS7 network. Operator services systems, for examples, currently time out if a response to a LIDB query is not received within two seconds. With NP, messages may encounter significantly more GTT processes as they move through the network. To minimize the impacts on systems which use SS7 signaling, it would be desirable that the NP GTT function meet delay specifications of T1.112.5. The standard identifies maximum mean and 95% delays for normal traffic loads, as well as traffic loads 15% and 30% greater than normal. For normal traffic loads, the standard specifies a maximum mean delay of 155 ms, and a maximum 95% delay of 310 ms for each GTT performed. Delay should be measured from the time the last bit of the incoming message is received until the first bit of the outgoing message is transmitted by the system supporting the NP GTT function.

It must be noted that the standards for "transit time" were developed for different architectures and functionality than defined for NP. These standards may no longer be appropriate given the size of GTT tables that can be associated with NP, as well as the ten-digit processing and TCAP decoding which can also be associated with the NP GTT function.

More stringent requirements for delay may be defined by the service provider.

<REQ-06900>

NP query processing delay shall be no greater than 500 ms measured from the time the last bit of the incoming message is received until the first bit of the outgoing message is transmitted by the NPDB application system. 500 ms is the max delay and 95% mean delay shall be no greater than 350 ms.

<End of REQ-06900>

<REQ-07000> (GTT)

It is an objective that the NP GTT function meets the T1.112.5 standard for "Transit time of a UDT message in a relay point" as defined in Clause 3.1 of that standard.

<End of REQ-07000>

It would be desirable for the NP GTT function to meet the requirements of GR-82-CORE, Section 9.3 "Accuracy" for undetected errors and loss of messages.

<REQ-07100> (GTT)

It is an objective that the NP GTT function meets the requirements of GR-82-CORE, Section 9.3 "Accuracy" for "undetected errors" and "loss of messages".

<End of REQ-07100>

The NPAC specifications indicate the NPAC may download records for ported DNs at a maximum average rate of twenty five records per second. (2.5 CMIP transactions per second, each transaction containing a maximum of 10 records. A record can also contain a range. Refer to the NPAC interface documents for details.) The goal for activating portability for DNs is within fifteen minutes after the record for the ported DN is downloaded by the NPAC. These constraints place requirements on the processing of downloaded records on the LSMS, NPDB application, and NP GTT function which must be addressed by the vendor and the service provider.

The LSMS must support the download rate specified for the downstream interface within the NPAC requirements. It is a goal that updates should be active in the network within 15 minutes of being downloaded by the NPAC.

The NP GTT function might be deployed as "replicated" systems by a service provider. This may be motivated by any of several reasons, including capacity or reliability concerns. Traditionally, systems deployed on a replicated basis have been deployed as "mated pairs". The capability to deploy systems in triples, quadruples, etc., is imminent. (This is sometimes referred to as an "N+" or "N+1" configuration.) SCCP procedures support various "loadsharing" capabilities to distribute messages across replicated systems. Since the system performing the NP GTT function may perform other processes as well, it is possible for the NP GTT function by itself to be non-operational, while some or all of the remaining functions performed by the system are operational. SS7 procedures are designed to ensure that messages are not routed to a system when the required messaging function on that system is not working. This principle should also be followed for the NP GTT function. If a service provider deploys the NP GTT function on a replicated basis, the service provider should be sure to employ procedures and architectures that assure that messages requiring NP GTT processing are not routed to systems that are not currently able to perform the NP GTT function (failed, out of service, etc.).

There are at least three methods to assure messages are not routed to non-functional NP GTT functions.

♦ If routing to the NP GTT function is by alias point code or non-final GTT, then the replicated NP GTT functions should implement the SCCP procedures (normally implemented by STPs) for the transfer of SCCP functions (forced or controlled rerouting) during conditions when the NP GTT function is unavailable.

♦ If the routing to the NP GTT function is by final GTT, then SSN management procedures can be used to ensure that messages will not be delivered to systems when the NP GTT function is unavailable.

♦ If the systems performing the NP GTT function are designed or configured such that the entire system (viewed from the SS7 network) is unavailable when the NP GTT function cannot be performed, then the point code management procedures will route all message traffic, including messages requiring the NP GTT function, to replicated systems.

These procedures are purely internal to each service provider. As a result, each service provider r can select any scheme which accomplishes the objective that messages requiring NP GTT function processing should only be delivered to systems actively performing the NP GTT function. The service provider needs to ensure that the selected scheme is compatible with the architecture and operation of other systems in the service provider's SS7 network. For example, if the service provider implements the NP GTT function on SCP-like systems, and plans to use forced or controlled rerouting to address NP GTT function unavailability, they should insure the supporting STPs will accept MTP network management messages from the SCPs over what appears to the STP to be A-links.

<REQ-07200> (GTT)

If a service provider employs replicated NP GTT functions, then the service provider shall use a combination of architecture and network management capabilities to assure that

messages requiring NP GTT function processing are only delivered to systems actively performing the NP GTT function.

<End of REQ-07200>

Annex A
(Informative)

ANNEX A   LOOPING OR MISROUTING OF SIGNALING MESSAGES WITH NUMBER PORTABILITY

A1. Introduction

This annex introduces the problem of looping or misrouting of signaling messages that will occur when the data in the GTT nodes are not in sync. This annex documents some of the potential pros and cons of the alternatives. It is important to note that some alternatives may detect when looping occurs, but may not protect against it. A long term solution is needed

A2. Background

Prior to NP there is minimal risk of SCCP routed TCAP messages looping between SS7 signaling networks. Routing to an appropriate LIDB service provider is currently on three- or six-digit GTT, where the NPA-NXX is always associated with a single LIDB service provider. The LIDB GTT data was provided monthly by the LARG, with advance notice given by any major churn (e.g., NPA splits). CLASS services are provided intranetwork and on a limited internetwork basis and in general require a maximum six-digit translation. Translations on greater than 6 digits have been employed on a limited basis to support split NXXs.

A3. Problem Statement

NP capable networks must have a ten-digit GTT node to support LIDB and CLASS services. The ten-digit GTT data will be provided by the NPAC, resulting in the provisioning of the ten-digit GTT data in near real-time. The six-digit data will still be provided via the LERG and LARG, as it is currently.

Assumptions:

GTT data will not be in sync because not all networks or GTT nodes within a network can be updated (provisioned) at the same time.

Hub (intermediate) signaling networks will be used for routing signaling messages. A hub signaling network transports signaling message to a destination network on behalf of an originating network. There may be more than one hub signaling network in the signaling message flow.

A query and response may be routed asymmetrically (e.g., network A may query to network B via network C, while the response may be routed directly from network B to network A).

Looping or misrouting of signaling messages will occur when data in the GTT nodes is not in sync. This problem needs to be addressed in order to prevent congestion and failure in the SS7 signaling networks.

Figures A1 and A2 show examples of looping between two networks and when an intermediate signaling network are involved, respectively. Finite looping occurs until all networks are updated with the new GTT data provided by the NPAC.

Figure A. 1: Examples of Looping Between Two Networks

An Intermediate Signaling Network

Normal DB Query/Response   *(Subscriber Ports from A to B)*
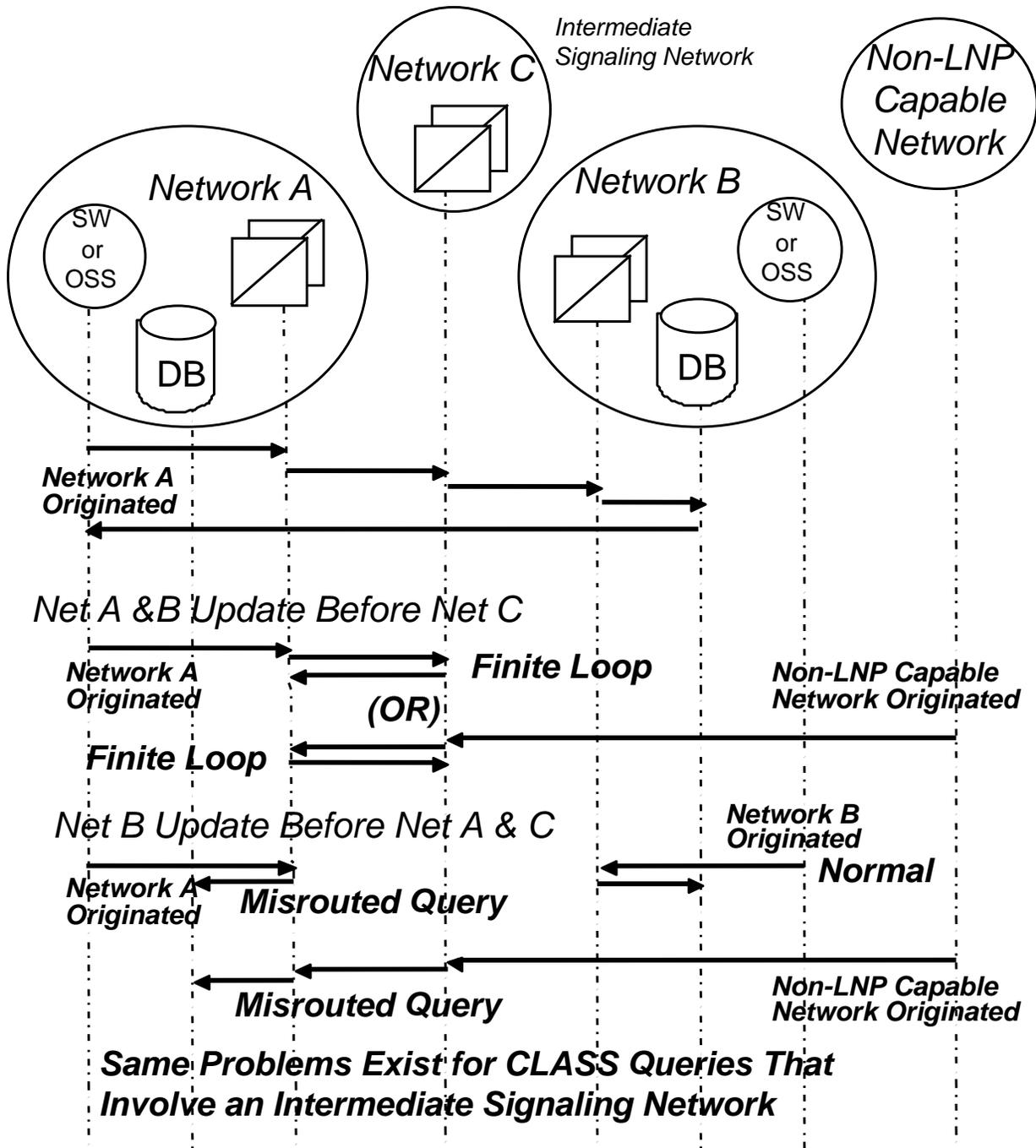
Figure A. 2: Examples of Looping and Misrouting with an Intermediate Signaling Network

A4. Possible Alternatives

The following alternatives provide various degrees of protection from looping of SCCP routed signaling messages:

1. The ten-digit GTT node always performs final GTT.
2. TT mapping on internetwork linksets.
3. Update GTT provisioning in ported to network prior to updating the provisioning in other networks.
4. Gateway screening of SS7 messages.
5. Transaction ID comparison list.
6. MTP loop detection and removal procedures.
7. MTP hop counter.
8. SCCP hop counter.
9. Hop counter in a TCAP parameter.
10. Internetwork OMAP.
11. Hop counter in the SSN field of the GTAI.
12. TT Mapping at the ten-digit GTT node.
13. TT mapping and GTAI replacement at the ten-digit GTT node.
14. Multiple alias point codes.
15. Separate pre and post ten-digit STPs.

Some of these alternatives, if implemented, could have severe negative impacts on routing of non-NP messages in the SS7 network.

A4.1. The ten-digit GTT node always performs final GTT

<u>Description</u>

All NP capable networks would have to provide the DPC and SSN of the destination signaling end point, instead of a DPC and SSN of a gateway node. The ten-digit GTT node would always perform final GTT. The output of the final GTT would be the DPC and SSN provisioned for that TT, resulting in the signaling message to be routed to a destination node.

Previously, for other applications, there has been opposition to non-destination networks performing final GTT because it would limit architecture flexibility in a destination network (e.g., keeping number moves from one data base to another data base within a network transparent to other networks).

<u>Pros</u>

♦ Provisioning based solution. No network element development is required.
♦ Does not impact non-NP capable networks.
♦ No additional provisioning.
♦ Protects against looping, even when signaling transport networks are involved.

<u>Cons</u>

♦ Industry based solution. All NP capable networks would have to provide the PC + SSN of the destination signaling end point.

♦ Broadcast of SCCP Signaling Network Management messages to unconcerned signaling points

  o SCCP gateway screening will not be performed.

  o Contrary to current industry practices.

A4.2. TT mapping on internetwork linksets

Description

TT Mapping is a capability that allows an STP to perform Global Title Translation (GTT) for routing SCCP messages using translations that correspond to a TT (the "mapped TT") that differs from the TT specified in the message (the "message TT"). Although GTT is performed using the mapped TT, the message TT is not altered by the TT Mapping function. TT Mapping is applied selectively, based on the linkset on which the message is received.

The principal use of TT Mapping is to resolve conflicts in the assignment of intranetwork TTs when messages pass between networks. This TT Mapping capability could also be used to limit the looping of SCCP messages between networks.

A network can use TT Mapping unilaterally to protect itself against message looping. It can provision two TTs for each application, one for originating messages and one for terminating messages. TT = X for originating messages contains both (a) internal translation data for destinations within the network, and (b) industry translation data for destinations outside the network. TT = Y for terminating messages contains only (a) internal translation data for destinations within the network.

The network uses TT Mapping on internetwork linksets to map TT = X to TT = Y. If the network originates a message, it will not encounter TT Mapping prior to GTT, and will use TT = X. This message may be routed within the network or to another network. However, if the network receives a message from another network, the message will encounter TT Mapping prior to GTT in the receiving network, and will use TT = Y. This message can be routed only within the network. Thus, a message received from another network cannot be routed to another network, preventing message looping.

Pros

♦ Provisioning based solution. Assuming the GTT node has the TT Mapping capability, no network element development is required.

♦ A network can use this implementation of TT Mapping unilaterally to protect itself against message looping.

Cons

♦ Will not protect against looping if a network is acting as an intermediate signaling network performing GTT.

♦ Additional TT required (limited resource)

♦ Additional administration and provisioning of:

  o TT mapping on per linkset basis, and

  o Intranetwork TT mapping table.

A4.3. Update GTT provisioning in ported to network prior to updating the provisioning in other networks

Description

GTT data in the ported to network is updated at some time prior to updating the GTT data in other networks.

Pros

♦ OAM&P based solution, no network element development is required.

Cons

♦ Will not protect against looping when a transport network is used to perform GTT, without following an operational protocol. This operational protocol would synchronize when the data in GTT nodes are updated.

NOTE - This operational protocol does not currently exist.

o Requires industry buy-in of operational protocol.

o Network level acknowledgments would be required in order to determine when the next downloads can begin.

A4.4. Gateway Screening of SS7 messages

Description

This alternative compares the Network Identifier (NID) of the point code from the output of the GTT to the NID from the MTP OPC and discards if there is a match. Other variations of gateway screening include screening out messages where the NID from the MTP OPC is the same as the NID of the receiving network. Or gateway screening might be used to screen out messages where the point code of the SCCP CgPA is the same as the receiving network. Service providers must review their network configurations and gateway screening capabilities to select a useful set of screening parameters.

NOTE - It may not always be appropriate to block your own point code(s). It is also not clear how (or whether) gateway screening could be used by SS7 "hub" service providers, in order to prevent looping.

Pros

♦ A network can use this implementation unilaterally to protect itself against message looping.

Cons

♦ May requires modifications to gateway screening procedures.

♦ Additional provisioning of gateway screening tables.

A4.5. Transaction comparison list

Description

The TCAP Transaction ID (TID) is unique to every TCAP message, being generated from an originating switch identifier. At the ten-digit GTT node, the TID could be extracted from the TCAP message and compared to a "Transaction Comparison List." A loop is detected when there is a match with the extracted TID and a number in the list. The message is then discarded, may be trapped, and an alarm is generated. If the extracted TID does not match a number on

the list, it is then added to the Transaction Comparison List. The Transaction Comparison List is of fixed length, based on first-in-first-out. The length of the list would be engineered based on traffic load. This alternative may allow a message to loop, but not indefinitely, in the example of replicated systems performing the comparison. At a maximum, the message could pass through each replicated system once. The message won't be killed until it passes through a system the second time.

Pros

♦ Only impacts 10 Digit GTT nodes.

♦ A network can use this implementation unilaterally to protect itself against message looping.

Cons

♦ Requires additional development in ten-digit GTT node.

♦ Every TCAP message, at the ten-digit GTT, would have the TID extracted and compared, unless the capability was only invoked under congestion conditions. Performance issues with having to process TCAP information.

♦ GTT node should not be extracting information from TCAP, though it is recognized that the GTAI may be extracted from TCAP in some instances.

♦ Substantial processing would be needed for "bookkeeping" and managing inter-layer dependencies.

♦ TID is only unique per message source. To be complete, the match would have to be made on the SCCP Calling Party Address plus TID.

♦ Might fail reply messages unless only the Originating Transaction ID is checked.

♦ Would fail a second reply message during a TCAP conversation.

A4.6. MTP loop detection and removal procedures

Description (From T1.111.7, Section 2.4)

This procedure is designed to automatically detect the circular routing problem, prohibit the route, and notify a management system to conduct additional unspecified diagnostic tests and to correct the routing data.

1. One of two events, but not both, must be used to trigger the execution of the circular route test: onset of congestion and rerouting of signaling traffic.

   a. The congestion trigger is based on a link transmission queue increasing in congestion status. When the first link in a link set becomes congested, a STP continues to monitor only this link in the link set for further increases in congestion status. After the link increases in congestion status, including the initial onset of congestion, the STP tabulates the DPCs of certain number N (50-200) of messages being transmitted on the link of concern. The STP then sends circular route test messages to switches of the M (3-10) most frequently occurring DPCs. A subsequent test is executed upon the next increase in congestion status after the test messages are transmitted for the previous test. When the congestion status of the concerned link abates to 0 or if the concerned link fails, the STP returns to monitoring the entire link set for an increase in congestion status of any link in the link set.

The test is executed for congestion on any link set, including the C-link set. Alternatively, an option is not to execute the test on the C-link set.

b.   The circular route test can alternatively be triggered when a STP reroutes traffic to a destination (i.e., upon changeover/changeback, forced or controlled rerouting, or a change in routing data) to a different priority route. If the STP reroutes to a different priority combined link set, the test is executed on both link sets. Test messages are sent to each destination affected by the rerouting. For this triggering method, the test is not executed when rerouting to or from the C-link set.

The method used to detect loops when a STP uses cluster routing is network dependent. This trigger mechanism will detect most but not all MTP circular routes.

For each triggering of the test, the Signaling Link Selection (SLS) code of the test message must be changed. The test messages for each destination tested for each test triggering must use the same SLS code. The test message is the signaling-route-set-congestion- test message with the priority assigned to 3. When a signaling point receives a circular route test addressed to itself, it should discard the message.

2.   If the STP receives a test message originated by itself, it marks the route set unavailable to the destination and sends transfer-prohibited messages in response or broadcast mode to adjacent SPs. A management is notified of the destination that is involved in the circular route. The unavailable state of the route set is maintained until operations personnel or management system correct the routing problem and reset the unavailable state to available. signaling-route--set-test messages are not sent by the STP on the routes of concern for the destination involved inn the loop.

If the triggering mechanism is not used for the C-link set, the STP must also screen for test messages originated by its mate STP. Additional procedures for a STP upon receiving a test message originated by its mate are network dependent.

Pros

♦   Standard procedure, T1.111.7, Section 2.4.

♦   A network can use this implementation unilaterally to protect itself against message looping caused by MTP routed signaling messages.

♦   A network can use this implementation unilaterally to detect the source of message looping caused by SCCP routed signaling messages.

Cons

♦   Does not protect against message looping caused by SCCP routed signaling messages.

A4.7. MTP hop counter

Description

A counter is set by the originating signaling node. Each subsequent signaling node would decrement the counter. When the counter was decremented to zero, the message is discarded, may be trapped, and an alarm generated.

Problem: MTP has a fixed format with not enough spare bits in the MTP header for a hop counter.

A proposed solution placed the hop counter at the end of the signaling message between the TCAP application and MTP Level 2 Cyclic Redundancy Check.

Pros

♦ (None noted)

Cons

♦ Rejected by T1S1 due to backward compatibility problems. Non-capable MTP Hop Counter nodes will disregard the hop counter.

♦ The hop counter will be disregarded when the signaling message is passed from MTP to SCCP for GTT.

A4.8. SCCP hop counter

Description

SCCP Hop Counter is similar to the MTP Hop Counter except that the counter is in the SCCP layer instead of the MTP layer. A counter is set by the originating signaling node. Each subsequent signaling node would decrement the counter. When the counter was decremented to zero, the message is discarded, may be trapped, and an alarm generated. The SCCP Hop Counter is only supported in XUDT or LUDT SCCP message formats for connectionless oriented SCCP signaling.

Problem: UDT SCCP message format is currently used for all services in North America (e.g., LIDB, IN, AIN). The UDT SCCP message format is fixed and can not accommodate optional parameters (e.g., SCCP Hop Counter).

Pros

♦ Standard procedure.

♦ All future standard services and network capabilities developed by T1 are expected to encourage the use of the XUDT or LUDT SCCP format.

Cons

♦ UDT SCCP message format is currently used for all services in North America (e.g., LIDB, IN, AIN). The UDT SCCP message format is fixed and can not accommodate optional parameters (e.g., SCCP Hop Counter*)*.

A4.9. Hop counter in a TCAP parameter

Description

A counter is set in an optional TCAP parameter by the first ten-digit GTT node encounter by the signaling message. Each subsequent GTT signaling node would extract the counter from TCAP, decrement the counter, and place the decremented value back into the Hop Counter TCAP parameter. When the counter was decremented to zero, the message is discarded, may be trapped, and an alarm generated.

Pros

♦ Could be implemented only in the 10 Digit GTT node.

♦ Would detect and protect against looping of SCCP routed signaling messages that require 10 Digit GTT.

Cons

♦ Protocol violation.

♦ Some GTT nodes will have to insert the Hop Counter parameter in the TCAP

♦ Potential incompatibilities with existing services that may treat this new parameter as unrecognized.

A4.10. Internetwork OMAP

Description

Internetwork OMAP provides procedures that allow for the verification of MTP and SCCP routing data across network boundaries. A MRVT or SRVT signaling message could be launched in one network and used to verify if a signaling message can be routed to the appropriate signaling end point in the destination network.

Internetwork OMAP was identified as a capability that would offer additional benefit for the long term.

Pros

♦ Tool that can be used to validate signaling routing data across network boundaries.

♦ Will detect looping routes, in addition to other route failures caused by misprovisioning.

♦ Standardized procedures.

Cons

♦ Not currently implemented and deployed.

♦ Manually initiated SS7 route verification test

♦ Additional load on the signaling network(s)

♦ Can not eliminate the looping message.

A4.11. Hop counter in the SSN field of the GTAI

Description

Use the SSN field in the GTAI as the hop counter, decrementing the counter at each ten-digit GTT node until the counter is zero. The signaling message is then discarded and trapped, and an alarm generated.

Pros

♦ Will detect and protect against looping signaling messages.

Cons

♦ Incompatible with existing signaling protocol parameter formats and procedures

♦ Rejected by T1S1.3.

A4.12. TT mapping at the ten-digit GTT node

Description

The first ten-digit GTT node encountered by the signaling message would:

1. Perform a ten-digit GTT on the GTAI.
2. Perform TT Mapping, replacing the original TT with the Mapped Value.
3. Route to the next relay node, if intermediate GTT was performed.

The next relay node (GTT node) would perform a six- digit final GTT, then forwarding the message to the appropriate signaling end point.

Pros:

♦ Discards looping messages

♦ If customers' records at the destination network are organized in three- or six-digit groups, only three- or six-digit GTT is required for incoming traffic, when the TT has been previously replaced. Thus ten-digit GTT is performed once on a transaction.

♦ Requires no knowledge of the other network's configuration.

Cons:

♦ Requires internetwork multilateral operational agreements and coordination.

♦ Requires assignment or standardization of double the TTs for each application.

♦ Requires additional provisioning of, and memory capacity for, GTT data.

♦ Development required at certain ten-digit GTT nodes.

A4.13. TT mapping and GTAI replacement at the ten-Digit GTT node

Description

The first ten-digit GTT node encountered by the signaling message would:

1. Perform a ten-digit GTT on the GTAI.
2. Perform TT mapping, replacing the original TT with the mapped value.
3. Replace the existing GTAI, with an LRN, mapped from the original GTAI.
4. Route to the next relay node, if intermediate GTT was performed.

The next relay node (GTT node) would perform a six-digit final GTT, then forwarding the message to the appropriate signaling end point.

Pros:

♦ Discards looping messages.

♦ Perform ten-digit GTT once per transaction.

♦ Requires no knowledge of the other network's configuration.

Cons:

♦ Requires internetwork multilateral operational agreements and coordination.

♦ Requires assignment or standardization of double the TTs for each application.

♦ Requires additional provisioning of, and memory capacity for, GTT data.

♦ Development required at certain ten-digit GTT nodes.

♦ Restricts database or platform provisioning, due to the coupling of global title routing to the LRN.

A4.14. Multiple alias point codes

Description

To implement this solution, two alias point codes are defined for the NP functions at an STP pair. One can be referred to as the pre-query alias point code and is intended to provide ten-digit GTT for queries which have not yet undergone ten-digit GTT. The other can be referred to as the post query alias point code and is intended to provide final routing for queries which have already undergone ten-digit GTT and have been routed to the destination network on that basis. Queries from the implementing network requiring ten-digit GTT, as well as queries from other networks which purchase this capability from the implementing network, are addressed to the pre query alias point code. Queries from networks which implement their own ten-digit GTT function, or which purchase it from a third party service provider, are addressed to the post query alias point code. For other networks performing ten-digit GTT, the post query alias point code should be provisioned in two places. First the post query alias point code should be provisioned as the default DPC for queries concerning non-ported numbers in NPA-NXXs within the implementers' network. Second, in records for numbers porting into the implementing network, the post query alias point code should be provisioned (via the appropriate NPAC) as the DPC to which queries for the four NP-impacted services should be routed.

Looping is prevented by means of gateway screening which is implemented at the STP. This screening is defined to discard any incoming queries addressed to the post query alias point code which, after ten-digit GTT, are to be routed to any external network. The rationale for this discard is that queries addressed to the post query alias point code have already been subject to ten-digit GTT which has determined that they should be delivered to the implementing network. If the implementing network thinks they should belong elsewhere, it is indicative of a loop. That queries addressed to the pre query alias point code are not screened enable the implementing network to offer ten-digit GTT capability to external networks without compromising its looping prevention algorithm.

Pros:

♦ Can be implemented unilaterally

♦ Requires no changes to protocol specifications or requirements.

Cons:

♦ Implementation of "alias point codes" for the ten-digit GTT function.

♦ May result in SS7 routing provisioning in interconnecting networks (currently supported with operational procedures).

A4.15. Separate pre & post ten-digit GTT STPs

Description

This option makes use of two pairs of STPs, one to handle queries which have not undergone ten-digit GTT, and the other to handle queries which have. (These are analogous to the pre query alias point code and the post query alias point code of the previous option, except that here, they are implemented using separate pairs of STPs.) The first pair would determine the destination network for the query (for the implementers' nodes and networks purchasing ten-digit GTT capability.) The second pair would route only to nodes in the implementers' network. The second (post query) STP pair could operate in several ways. As in the previous

option, it could perform ten-digit GTT and discard (via gateway screening) any query which, after ten-digit GTT, was destined for an external network. Alternatively, it could use a six-digit table of LRNs and require all accessing networks to replace the Global Title with the LRN of the recipient switch. Depending on the routing methodology used by the post query STP pair, this option may be implemented either unilaterally by a network (by deploying ten-digit GTT and gateway screening), or with the cooperation on the interconnected networks (using six-digit LRN Global Title Tables and requiring Global Title replacement by all querying nodes.)

Pros:

♦ Can be implemented unilaterally.

♦ Requires no changes to protocol specifications or requirements.

Cons:

♦ Complicates network architecture, routing and provisioning.

♦ Optimal implementation would require deployment of Global Title replacement.

A5. Recommendation

The normal operation of GTT downloads from the NPAC will make finite GTT looping an expected condition in a network and between networks. NP GTT data will not be in sync because not all networks, or NP GTT nodes within a network, can be updated (provisioned) at the same time. When data in the NP GTT node is inaccurate due to unsynchronized updates among various networks or among NP GTT nodes within a network, GTT processing can result in looping of signaling messages. Various near term loop detection and protection schemes have been deployed to prevent or minimize looping from occurring. The near term alternatives described in this Annex that are being used include:

♦ TT Mapping on Internetwork Linksets;

♦ TT mapping at the NP GTT node;.

♦ Gateway screening of SS7 messages;

♦ TT mapping and GTAI replacement at the NP GTT;

♦ Multiple alias point codes;

♦ Separate pre- and post-ten-digit GTT nodes.

In addition, proprietary schemes are being used. All of the near term methods are configuration and implementation schemes that are susceptible to provisioning errors resulting in looping of SS7 messages. They do not require protocol modifications, with the exception of the new TT assignments. Use of a SCCP Hop Counter has been identified as a solution. Compatibility issues need to be addressed.

ANNEX B TT OR THE TT AND GTAI REPLACEMENT: OPTIONAL CAPABILITIES FOR PREVENTING LOOPING OF SIGNALING MESSAGES WITH NUMBER PORTABILITY

B1. Introduction

Annex A discusses a number of alternatives for detecting or preventing the looping of TCAP messages that will occur when the data in NP GTT nodes is not synchronized. Among the alternatives addressed in Annex A is the use of TT or TT the GTAI replacement to prevent the looping of signaling messages with NP. This annex describes conditional requirements to support the use of post-NP GTT TT values by NP GTT implementations that support TT replacement or the TT and GTAI replacement (for ported numbers) as part of the NP GTT function. TT replacement or the TT and GTAI replacement represent optional capabilities that network providers may choose to use within their networks. In addition, the TT replacement capability, with or without GTAI replacement may also be applied between networks, where appropriate agreements exist with the recipient service providers of those networks with regard to the application of this optional capability and the specific TT or TT and GTAI values to be used.

The conditional requirements described in this annex supplement the NP GTT requirements described in Clause 5 of this document. Implementations of the NP GTT function that support the optional TT or the TT and GTAI replacement capability must also meet the NP GTT requirements described in Clause 5 of this document.

B2. Background

As discussed in Clause 3.1, the nature of the global title address information in the query messages associated with CLASS, LIDB, ISVM and CNAM will cause the routing of these service-related messages to be impacted by NP. Implementation of NP will require that the NP GTT function be applied to these messages to ensure proper routing. When data supporting the NP GTT function is inaccurate, due to unsynchronized updates among various networks or among SCCP relay nodes within a network, message looping can result. The optional TT replacement capability allows a unique post-NP GTT TT to be associated with LIDB, CLASS, ISVM and CNAM messages as they undergo NP GTT processing to distinguish those messages that have already undergone NP GTT processing from those that have not. This prevents the looping of TCAP messages that can result from unsynchronized NP GTT data among different network nodes and facilitates efficient routing of TCAP messages by allowing the NP GTT function to be encountered only once.

A related optional capability is the ability to change the GTAI, in outgoing messages related to ported numbers, to a routing number provided by the NP GTT function. This capability is useful in network implementations where it is necessary or desirable that a final GTT be performed on a six-digit basis. If, as part of the NP GTT function, an LRN is substituted for the GTAI in the outgoing message, a subsequent SCCP Relay Node can perform a final GTT on a six-digit basis. This is because the NPA-NXX of the LRN is sufficient to unambiguously identify the destination node for the message.

B2.1. Data to Support TT Replacement and GTAI Replacement

Internetwork post-NP GTT TT values for CLASS, CNAM, LIDB, and ISVM are specified in T1.112.3, Annex A and described in T1.112.3, Annex B. It is recommended that these values be used by Service Providers who support TT replacement on an internetwork basis. If TT replacement is performed by the NP GTT Function, the data associated with ported DNs (as described in Clause 5.1.1.2) and the default data for the NP GTT function (as described in Clause 5.1.2) will also need to include the post-NP GTT TT to be used in outgoing messages, for those cases where the recipient service provider has requested TT replacement. The post-NP GTT TT data item consists of three numeric characters.

<CR-07300> (GTT)

If the NP GTT function supports TT replacement, it shall contain post-NP GTT TT data for each individual 10-digit global title entry and TT for which the recipient network has requested TT replacement.

<End of CR-07300>

<CR-07400> (GTT)

If the NP GTT function supports TT replacement, it shall contain post-NP GTT TT data for each default (six-digit) entry and TT for which the recipient network has requested TT replacement.

<End of CR-07400>

If GTAI replacement is to be performed by the NP GTT function, the NP GTT data associated with the ported DNs will need to either explicitly include the post-NP GTT GTAI value (i.e., a ten-digit numeric field of the form NPA-NXX-XXXX), or an indicator that points to the appropriate existing data field within the subscriber record (e.g., the LRN). The exact format of the post-NP GTT GT data will be determined by the service providers that choose to implement this capability and their vendors.

<CR-07500> (GTT)

If the NP GTT function supports TT replacement and GTAI replacement, it shall contain post-NP GTT GTAI data for each individual 10-digit GT entry and TT for which the recipient network has requested TT and GTAI replacement.

<End of CR-07500>

Data representing the post-NP GTT TTs and GTAI values must be provided to the NP GTT function by the service provider's own operations processes because it is not provided by the NPAC. Recipient service provider networks can indicate they wish to receive TT replacement, or both TT replacement and GTAI replacement, for each individual ten-digit number or for groups or classes of numbers. Recipient service provider networks can also indicate they wish to receive TT replacement for certain default six-digit values. The relay node service provider must not provision only TT replacement data if the recipient service provider supplied both TT replacement and GTAI replacement data.

The SCCP relay node service provider (sending) must support at a minimum the ten-digit GTT capability. The recipient service provider shall not require the SCCP relay node service

provider to support the TT replacement capability or the TT replacement and GTAI replacement capability. The method by which service providers express their desire for TT replacement or both TT replacement and GTAI replacement to other networks, and the manner in which the specific TT and GTAI replacement data is exchanged between networks, is not addressed by this document, and is left to bi-lateral or other agreements.

B2.2 Procedures to Support TT or TT and GTAI Replacement

If a network supports TT replacement or the TT and GTAI replacement as part of the NP GTT function, and:

♦ a ten-digit match is found for the incoming GTAI in the NP GTT table,

♦ the NP GTT data indicates a translation that is not final, and

♦ the NP GTT entry indicates TT replacement and GTAI replacement,

the NP GTT function will populate the TT and the GTAI in the outgoing message with the post-NP GTT values specified in the ported DN record. If the ported DN record indicates TT replacement, this value will be populated in the outgoing message. If the ported DN data record specifies that the outgoing message should contain the received TT value, this value will be populated in the TT field of the outgoing message. Likewise, if the ported DN record indicates that GTAI digits should be replaced, the new digits will be populated in GTAI field of the outgoing message. If the ported DN record indicates that the GTAI digits should not be replaced, then the original GTAI digits should be populated in the outgoing message.

One reason that a network provider may choose to do both TT replacement and GTAI replacement is to facilitate a final translation being performed on a six-digit basis in the recipient network. For example, if the post-NP GTT GTAI is the LRN associated with the ported DN, in some cases the SCCP Relay Node in the recipient network can determine the point code and subsystem number of the target service node based on a translation of the first 6 digits of the GTAI (i.e., the NPA-NXX of the LRN). A new TT is needed because the first 6 digits of a replacement GTAI can also be the NPA-NXX of a subscriber number. If the GTAI and TT are not changed in the outgoing message, the receiving SCCP relay node will not be able to distinguish this message from one that has not yet undergone NP GTT processing. As a result, the SCCP relay node will route the message to the NP GTT node in the recipient service provider's network where an additional ten-digit translation will be performed.

The TT replacement or the TT and GTAI replacement capability is to be used between networks by bi-lateral agreement. This capability imposes no obligation on carriers to accept signaling which has undergone TT replacement or TT and GTAI replacement unless they are a party to such a bi-lateral agreement. Further, this capability imposes no obligation on carriers to perform TT replacement or TT and GTAI replacement for other networks.

<CR-07600> (GTT)

If

♦ **the NP GTT function supports TT replacement or the TT and GTAI replacement, and**

♦ **a ten-digit match is found for the incoming GTAI in the NP GTT table, and**

♦ **the NP GTT data indicates a translation that is not final, and**

♦ **TT replacement or the TT and GTAI replacement is indicated for the specific record,**
then the NP GTT function shall populate

♦ **the TT field (if TT replacement is indicated) or**
♦ **the TT and GTAI fields (if TT and GTAI replacement is indicated)**

of the outgoing message based on the post-NP GTT TT and GTAI data in the ported DN record.

If

♦ **the length of the GTAI in the received message is less than 10 digits, and**
♦ **GTAI replacement is to be performed,**

then

the NP GTT function shall use the same number of digits from the beginning of the replacement GTAI data for the outgoing message. The values of the TT and GTAI populated by the NP GTT Function in the outgoing message may be different from the TT and GTAI values received by the NP GTT function.

<End of CR-07600>

If the NP GTT function does not find a ten-digit match for the GTAI in the ported DN NP GTT data, it will look for six-digit default data associated with the NPA-NXX of the GTAI. If the NP GTT function supports TT replacement and default data is found which indicates a non-final translation, the NP GTT function will populate the TT in the outgoing message with the post-NP GTT value specified in the default data. If the default data indicates TT replacement, this value will be populated in the outgoing message. If the default data specifies that the outgoing message should contain the received TT value, this value will be populated in the TT field of the outgoing message. Note that GTAI replacement does not apply to messages related to non-ported DNs. Service providers need to understand that they cannot determine whether the GTAI contains a replacement or original GTAI based on the presence of a post-NP GTT TT value.

<CR-07700> (GTT)

If

♦ **the NP GTT function supports TT replacement, and**
♦ **a ten-digit match is not found for the incoming GTAI in the ported DN NP GTT table, and**
♦ **six-digit default data is available, and**
♦ **the default NP GTT data indicates a translation that is not final, and**
♦ **TT replacement is indicated for the specific six-digit default case,**

then

the NP GTT function shall populate the outgoing TT with the post-NP GTT TT value identified in the default data. The value of the TT populated by the NP GTT function in the outgoing message may be different from the TT value in the message received by the NP GTT function.

<End of CR-07700>

ANNEX C   PCS 1900 APPLICABILITY FOR NUMBER PORTABILITY DATABASE AND GLOBAL TITLE TRANSLATIONS REQUIREMENTS

C1. Introduction

This Annex is **WTSC**'s assessment of the applicability of the requirements and assumptions in this document for wireless number portability in a PCS-1900 environment in the accompanying table, "Not applicable" means that there is no wireless number portability requirement or assumption that maps to the indicated wireline number portability requirement or assumption.

This mapping does not fully address the interaction between wireless and wireline networks and the associated interconnection billing impacts.

C2. PCS Specific Terminology

♦ The term "trigger" imply one of the following:
   o IN
   o AIN
   o WIN
   o Modified Toll-Free logic (See ANSI T1.708)
   o Hardcoded
♦ In PCS 1900 networks, the term "trigger" does not imply the deployment of IN, AIN, WIN.
♦ In PCS 1900 networks, the term pre-IN (IN/1) refers to modified Toll-Free logic (800 logic).

C3. PCS 1900 Applicability Matrix

PCS 1900 Applicability for NPDB and GTT Requirements	
Technical Requirements for Number Portability - Database and Global Title Translation[9]	**PCS 1900 Applicability**
2.2 Assumptions	
1) NP is limited to circuit mode calls.	Applicable with the following modification: The second sentence is not true for wireless, except the Short Message Service feature will be used in ported environment.
2) Location and service provider portability within a rate center.	Applicable.
3) NP deployment not flash-cut.	Applicable.

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[9] See the main body for the full text regarding the assumptions and requirements given in this column.

PCS 1900 Applicability for NPDB and GTT Requirements	
Technical Requirements for Number Portability - Database and Global Title Translation[9]	**PCS 1900 Applicability**
4) Ported DNs are returned to donor switch when vacant.	Applicable with the following modification: The number returns to the donor Service Provider when vacant.
Multiple service providers on the same switch are beyond the current scope.	Deleted in final document
5) NP supporting switches must support NPA splits.	Applicable.
6) At least one NPA-NXX per switch.	Applicable.
7) One NPA-NXX LRN is required per LATA.	Applicable.
8) LRNs may be DNs, and or ported DNs.	Applicable.
9) Donor switches must be NP capable.	Applicable.
10) NPDB may be unique to the network architecture served.	Applicable.
11) NPDB platforms may run other applications.	Applicable.
12) NPDB platform implementation is open.	Applicable.
13) NPDB platform hardware and software are open.	Applicable.
14) Service provider networks may share or have more than one NPDB platform.	Applicable.
15) NP GTT exists within a service provider's network.	Applicable.
16) Interactions between NPDBs and NP GTTs on the same platform are beyond scope.	Applicable.
17) NP SS7 SCCP TT can be unique.	Applicable
18) Service Codes (411, 911, 800) are not NP applicable.	Applicable.
19) SS7 translations for SSPs and STPs are NP capable.	Applicable.
NP GTT billing impacts are beyond the current scope	Deleted in final document.
20) NP does not impact SS7 gateway screening.	Applicable.
21) NP platform mated-pair operation, ACG, and traffic balancing are beyond scope.	Applicable.
22) Interactions between ACG ANSI-IN, pre-IN and LIDB controls are beyond scope.	Applicable.
ACG ANSI-IN, pre-IN and LIDB controls are based on six-digits.	., merged with 22.
23) OMAP message routing is beyond scope.	Applicable.
5.1 Data Structures	
<REQ-00100> A minimum NPDB subscriber entry contains a DN and a LRN.	Applicable.
<REQ-00200> Minimum NP GTT data items definitions.	Applicable. Add entry in the table for Short Message Service.
<REQ-00300> DPC and SSN may be null on NP GTT.	Applicable.
<REQ-00400> NP GTT default six-digit translation.	Applicable.

PCS 1900 Applicability for NPDB and GTT Requirements	
Technical Requirements for Number Portability - Database and Global Title Translation[9]	**PCS 1900 Applicability**
<REQ-00500> NP GTT can differentiate between SS7 messages.	Applicable.
5.2 NPDB application Processing Requirements	
<REQ-00600> NPDB receiving two different query messages.	Applicable See ANSI T1.708 for detail.
<REQ-00700> UserID & BearerCapability parameters mandatory.	Not applicable
<REQ-00800> CalledPartyID parameter necessary.	Not applicable
<CR-00900> TriggerCriteriaType parameter necessary.	Not applicable
<REQ-01000> acgEncountered NPDB parameter supported.	Not applicable
<REQ-01100> CdPN, CgPN, LATA, Originating Station Type parameters mandatory.	Applicable See ANSI T1.708 for detail.
<REQ-01200> CIC Expansion NPDB parameter supported.	Applicable. See ANSI T1.708 for detail.
<REQ-01300> CdPN matches ported DN.	Applicable.
<REQ-01400> CdPN not ported DN match.	Applicable.
<REQ-01500> NPDB analyzeRoute response message.	Not applicable.
<REQ-01600> NPDB ConnectionControl Connect response message.	Applicable. See T1.708 for detail.
<REQ-01700> CdPID parameter in NPDB analyzeRoute ported response message.	Not applicable.
<CR-01800> AMAslpID parameter in NPDB analyzeRoute ported response message.	Not applicable.
<REQ-01900> Digits (Routing Number) parameter in NPDB ConnectionControl Connect ported response message.	Applicable. See T1.708 for detail.
<REQ-02000> Digits (Carrier) field in NPDB ConnectionControl Connect ported response message.	Applicable. See T1.708 for detail.
<REQ-02100> Billing Indicators parameter in NPDB ConnectionControl Connect ported response message.	Not applicable. See T1.708 for details.

PCS 1900 Applicability for NPDB and GTT Requirements	
Technical Requirements for Number Portability - Database and Global Title Translation[9]	**PCS 1900 Applicability**
<REQ-02200> CdPID parameter in NPDB analyzeRoute non-ported response message.	Not applicable.
<REQ-02300> Digits (Routing Number) parameter in NPDB ConnectionControl Connect non-ported response message.	Applicable. See T1.708 for details.
<REQ-02400> Digits (Carrier) field in NPDB ConnectionControl Connect non-ported response message.	Applicable. See T1.708 for details.
<REQ-02500> Billing Indicators parameter in NPDB ConnectionControl Connect non-ported response message.	Not applicable. See T1.708 for details.
<REQ-02600> NPDB ACG message.	Not applicable.
<REQ-02700> SCP overload and SMS initiated NPDB ACG message.	Not applicable.
5.3 NP Global Title Translation Function	Global Title Translation will be required for Short Message Service.
<REQ-02800> Point code and Capability code in NP GTT.	Applicable.
<REQ-02900> SCCP Routing and Management procedures in NP GTT.	Applicable.
<REQ-03000> ten-digit GTT matches NP ported number.	Applicable.
<REQ-03100> ten-digit GTT does not match NP ported number.	Applicable.
<REQ-03200> NPGTT supporting error procedures when not also a STP.	Applicable.
<REQ-03300> SCCP error when received TT not supported by NP GTT.	Applicable.
<REQ-03400> NP GTT may only modify CdPN on successful GTTs.	Applicable.
<REQ-03500> ten-digit GTAI match in GTT table.	Applicable.
<REQ-03600> No match on ten-digit and six-digit GTT table.	Applicable.

PCS 1900 Applicability for NPDB and GTT Requirements	
Technical Requirements for Number Portability - Database and Global Title Translation[9]	**PCS 1900 Applicability**
<REQ-03700> ten-digit GTT processing required with less than ten-digit GTAI.	Applicable.
<REQ-03800> ten-digit GTT processing required with less than ten-digits available.	Applicable.
5.5 Errors and Exceptions	
<REQ-03900> General SS7 protocol errors.	Applicable. See ANSI T1.708 for detail.
<REQ-04000> SS7 protocol errors as per ANSI T1.111/112.	Applicable.
<REQ-04100> ANSI IN protocol errors as per TR-NWT-001285 Sec.4.	Not applicable.
<REQ-04200> General pre-IN protocol errors as per TR-NWT-00533.	Applicable. See T1.708 for detail.
<REQ-04300> NPDB queries.	Not applicable.
<REQ-04400> ANSI IN protocol errors as per TR-NWT-001285 Sec.4.	Applicable.
<REQ-04500> General pre-IN protocol errors as per TR-NWT-00533.	Not applicable.
<REQ-04600> Parameter value errors in pre-IN queries respond RETURN ERROR.	Applicable.
<REQ-04700> Unrecognized NPA-NXX errors in NPDB queries respond as per "non-ported number".	Applicable.
<REQ-04800> NP GTT function errors as per ANSI-T1-112; no match as per ANSI T1.112.4.	Applicable.
5.8 Operations, Administration, Maintenance and Provisioning Requirements	
<REQ-04900> NP GTT less than ten-digits encounter TCAP errors Return Cause "no translation for this specific address".	Not applicable.
<REQ-05000> NPDB platform supports SS7 MTP, SCCP or TCAP error messages.	Applicable.
<REQ-05100> NPDB platform supports ANSI SSP (e.g., Operator) IN error messages.	Not applicable.

PCS 1900 Applicability for NPDB and GTT Requirements	
Technical Requirements for Number Portability - Database and Global Title Translation[9]	**PCS 1900 Applicability**
<REQ-05200> NPDB platform supports pre-IN (e.g., IN/1) error messages.	Not applicable.
5.6 Signaling and Protocol Requirements	
<CR-05300> CLASS response messages when no ten-digit TCAP parameter routed via GTAI.	Not applicable.
<CR-05400> Default routing of delayed CLASS AC/AR query response messages.	Not applicable.
<CR-05500> NPDB measurements made on an hourly or daily basis.	Applicable.
<CR-05600> NP GTT measurements made on an hourly or daily basis.	Applicable.
<REQ-05700> NPDB supports ANSI IN ACG procedures.	Not applicable.
<REQ-05800> NPDB supports pre-IN (IN/1) ACG procedures.	Not applicable.
<REQ-05900> NPDB supports MTP and SCCP controls.	Applicable.
<REQ-06000> NP GTT supports MTP and SCCP controls.	Applicable.
<CR-06100> The NPDB application shall provide a count of NP queries per originating system by point code (switch or Operator System).	The original requirement 06100 was modified to become 4 requirements: 06100, 06110, 06120, and 06130. As these are essentially the same requirements, just reformatted and it was applicable before, all 4 requirements are marked Applicable.
<CR-06110> The NPDB application shall provide a count of NP queries for ported numbers per LRN.	Applicable.
< CR-06120> The NPDB application shall provide a count of NP queries for non-ported number per NPA-NXX.	Applicable.
< CR-06130> For purposes of identifying a query performed by a donor network on behalf of an N-1 network, the NPDB application shall provide a count of NP queries per combination of originating system by point code and incoming trunk group number.	Applicable.
< CR-06140> The NP GTT function shall provide a count of ten-digit GTTs by TT per originating system (point code).	This is a new requirement and needs to be evaluated.

PCS 1900 Applicability for NPDB and GTT Requirements	
Technical Requirements for Number Portability - Database and Global Title Translation[9]	**PCS 1900 Applicability**
< CR-06150> The NP GTT function shall provide a count of six-digit GTTs by TT per originating system (point code).	This is a new requirement and needs to be evaluated.
<REQ-06200> NPDB and GTT data integrity function supports inter-system and intra-system verification of records.	Applicable.
<REQ-06300> NPDB and GTT data integrity function supports periodic background verification of records.	Applicable.
<REQ-06400> NPDB and GTT data integrity function supports manual verification of records.	Applicable.
<REQ-06500> NPDB data integrity function supports discrepancy detection and correction.	Applicable.
5.10 Capacity, Performance and Reliability Requirements	
<REQ-06600> NPDB platform unplanned downtime; 12-hours per year or less.	Applicable.
<REQ-06700> NP GTT meets SCCP Relay Point Unavailability requirements.	Applicable.
<REQ-06800> Network NP query unavailability; 3-minutes per year or less.	Applicable.
<REQ-06900> NP query processing delay; 500ms or less.	Applicable.
<REQ-07000> NP GTT supports ANSI T1.112.5, Section 3.1 "UDT message transit time".	Applicable.
<REQ-07100> NP GTT supports GR-82-CORE, Section 9.3.	Applicable.
<REQ-07200> Replicated NP GTT functions.	Applicable.
<CR-07300> If the NP GTT function supports TT replacement, it shall contain post NP GTT TT data for each individual DN entry	This is a new requirement and needs to be evaluated.
<CR-07400> If the NP GTT function supports TT replacement, it shall contain post NP GTT TT data for each default (six-digit) entry	This is a new requirement and needs to be evaluated.

PCS 1900 Applicability for NPDB and GTT Requirements	
Technical Requirements for Number Portability - Database and Global Title Translation[9]	**PCS 1900 Applicability**
<CR-07500> If the NP GTT function supports TT replacement and GTAI replacement, it shall contain post NP GTT GTAI data (ten-digit values) for each individual DN entry	This is a new requirement and needs to be evaluated.
<CR-07600> If the NP GTT function supports TT replacement or TT and GTAI replacement, a ten-digit match is found for the incoming GTAI	This is a new requirement and needs to be evaluated.
<CR-07700> If the NP GTT function supports TT replacement, a ten-digit match is not found for the incoming GTAI	This is a new requirement and needs to be evaluated.

ANNEX D TR45.2 WIRELESS APPLICABILITY INPUT FOR T1S1.6 NUMBER PORTABILITY DATABASE AND GLOBAL TITLE TRANSLATIONS REQUIREMENTS

D1. Introduction

This Annex is TR45.2's preliminary assessment of the applicability of the requirements and assumptions in this document for wireless number portability in a TIA/EIA-41-D environment. In the accompanying table, "Not applicable" means that there is no wireless number portability requirement or assumption that maps to the indicated wireline number portability requirement or assumption.

This mapping does not fully address the interaction between wireless and wireline networks and the associated interconnection billing impacts.

D2. TR45.2 Wireless Applicability Matrix

TR45.2 Wireless Applicability Matrix		
Technical Requirements for Number Portability - Database and Global Title Translation[10]		**TR-45.2 (AMPS Based 800 & 1800)**
	2.2 Assumptions	
1)	NP is limited to circuit mode calls.	Applicable with modification The second sentence is not true for wireless, except the Short Message Service feature will be used in ported environment.
2)	Location and service provider portability within a rate center.	Applicable.
3)	NP deployment not flash-cut.	Applicable.
4)	Ported DNs are returned to donor switch when vacant.	Applicable with modification: The number returns to the donor Service Provider when vacant.
	Multiple service providers on the same switch are beyond the current scope.	Deleted in final document
5)	NP supporting switches must support NPA splits.	Applicable.
6)	At least one NPA-NXX per switch.	Applicable with modification: Wireless switches having only part of an NPA-NXX require a unique NPA-NXX for LRNs
7)	One NPA-NXX LRN is required per LATA.	Applicable with modification: LATA boundaries may not apply to wireless.
8)	LRNs may be DNs, and or ported DNs.	Applicable.
9)	Donor switches must be NP capable.	Applicable.
10)	NPDB may be unique to the network architecture served.	Applicable.

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[10] See the main body for the full text regarding the assumptions and requirements given in this column.

TR45.2 Wireless Applicability Matrix	
Technical Requirements for Number Portability - Database and Global Title Translation[10]	**TR-45.2 (AMPS Based 800 & 1800)**
11) NPDB platforms may run other applications.	Applicable.
12) NPDB platform implementation is open.	Applicable.
13) NPDB platform hardware and software are open.	Applicable.
14) Service provider networks may share or have more than one NPDB platform.	Applicable.
15) NP GTT exists within a service provider's network.	Applicable.
16) Interactions between NPDBs and NP GTTs on the same platform are beyond scope.	Applicable.
17) NP SS7 SCCP TT can be unique.	Applicable with modification: TT 11 can be used by ANSI-41.
18) Service Codes (411, 911, 800) are not NP applicable	Applicable
19) SS7 translations for SSPs and STPs are NP capable.	Applicable
NP GTT billing impacts are beyond the current scope.	Deleted in final document
20) NP does not impact SS7 gateway screening.	Applicable.
21) NP platform mated-pair operation, ACG, and traffic balancing are beyond scope.	Applicable.
22) Interactions between ACG ANSI-IN, pre-IN and LIDB controls are beyond scope.	Applicable.
ACG ANSI-IN, pre-IN and LIDB controls are based on six-digits.	Merged with 22
23) OMAP message routing is beyond scope.	Applicable.
5.1 Data Structures	
00100 A minimum NPDB subscriber entry contains a DN and a LRN.	Applicable.
00200 Minimum NP GTT data items definitions.	Applicable. Add Short Message Service (SMS) to table 3.
00300 DPC and SSN may be null on NP GTT.	Applicable.
00400 NP GTT default six-digit translation.	Applicable.
00500 NP GTT can differentiate between SS7 messages.	Applicable.
5.2 NPDB application Processing Requirements	
00600 NPDB receiving two different query messages.	Not applicable, see IS-756 (WNP PH1)
00700 UserID & BearerCapability parameters mandatory.	Not applicable, see IS-756 (WNP PH1)
00800 CalledPartyID parameter necessary.	Not applicable, see IS-756 (WNP PH1)
00900 TriggerCriteriaType parameter necessary.	Not applicable, see IS-756 (WNP PH1)

TR45.2 Wireless Applicability Matrix	
Technical Requirements for Number Portability - Database and Global Title Translation[10]	**TR-45.2 (AMPS Based 800 & 1800)**
01000	acgEncountered NPDB parameter supported.	Not applicable, see IS-756 (WNP PH1)
01100	CdPN, CgPN, LATA, Originating Station Type parameters mandatory.	Not applicable, see IS-756 (WNP PH1)
01200	CIC Expansion NPDB parameter supported.	Not applicable, see IS-756 (WNP PH1)
01300	CdPN matches ported DN.	Not applicable, see IS-756 (WNP PH1)
01400	CdPN not ported DN match.	Not applicable, see IS-756 (WNP PH1)
01500	NPDB analyzeRoute response message.	Not applicable, see IS-756 (WNP PH1)
01600	NPDB ConnectionControl Connect response message.	Not applicable, see IS-756 (WNP PH1)
01700	CdPID parameter in NPDB analyzeRoute ported response message.	Not applicable, see IS-756 (WNP PH1)
01800	AMAslpID parameter in NPDB analyzeRoute ported response message.	Not applicable, see IS-756 (WNP PH1)
01900	Digits (Routing Number) parameter in NPDB ConnectionControl Connect ported response message.	Not applicable, see IS-756 (WNP PH1)
02000	Digits (Carrier) field in NPDB ConnectionControl Connect ported response message.	Not applicable, see IS-756 (WNP PH1)
02100	Billing Indicators parameter in NPDB ConnectionControl Connect ported response message.	Not applicable, see IS-756 (WNP PH1)
02200	CdPID parameter in NPDB analyzeRoute non-ported response message.	Not applicable, see IS-756 (WNP PH1)
02300	Digits (Routing Number) parameter in NPDB ConnectionControl Connect non-ported response message.	Not applicable, see IS-756 (WNP PH1)
02400	Digits (Carrier) field in NPDB ConnectionControl Connect non-ported response message.	Not applicable, see IS-756 (WNP PH1)
02500	Billing Indicators parameter in NPDB ConnectionControl Connect non-ported response message.	Not applicable, see IS-756 (WNP PH1)
02600	NPDB ACG messages.	Not applicable, see IS-756 (WNP PH1)
02700	SCP overload and SMS initiated NPDB ACG messages.	Not applicable, see IS-756 (WNP PH1)
	5.3 NP Global Title Translation Function	
02800	Point code and Capability code in NP GTT.	Applicable.
02900	SCCP Routing and Management procedures in NP GTT.	Applicable.
03000	ten-digit GTT matches NP ported number.	Applicable.
03100	ten-digit GTT does not match NP ported number.	Applicable.

TR45.2 Wireless Applicability Matrix	
Technical Requirements for Number Portability - Database and Global Title Translation[10]	**TR-45.2 (AMPS Based 800 & 1800)**
03200	NPGTT supporting error procedures when not also a STP.	Applicable.
03300	SCCP error when received TT not supported by NP GTT.	Applicable.
03400	NP GTT may only modify CdPN on successful GTTs.	Applicable.
03500	ten-digit GTAI match in GTT table.	Applicable.
03600	No match on ten-digit and six-digit GTT table.	Applicable.
03700	ten-digit GTT processing required with less than ten-digit GTAI.	Applicable.
03800	ten-digit GTT processing required with less than ten-digits available.	Applicable.
	5.5 Errors and Exceptions	
03900	General SS7 protocol errors.	Not applicable, see IS-756 (WNP PH1)
04000	SS7 protocol errors as per T1.111/112.	Applicable
04100	ANSI IN protocol errors as per T1.667.	Not applicable, see IS-756 (WNP PH1)
04200	General pre-In (IN/1) protocol errors as per TR-NWT-000533.	Not applicable, see IS-756 (WNP PH1)
04300	NPDB queries	Not applicable, see IS-756 (WNP PH1)
04400	ANSI IN protocol errors as per TR-NWT-001285 Sec.4.	Not applicable, see IS-756 (WNP PH1)
04500	General pre-IN protocol errors as per TR-NWT-00533.	Not applicable, see IS-756 (WNP PH1)
04600	Parameter value errors in pre-IN queries respond RETURN ERROR.	Not applicable, see IS-756 (WNP PH1)
04700	Unrecognized NPA-NXX errors in NPDB queries respond as per "non-ported number".	Not applicable, see IS-756 (WNP PH1)
04800	NP GTT function errors as per ANSI-T1-112; no match as per ANSI T1.112.4.	Applicable.
04900	NP GTT less than 10 digits encounter TCAP errors Return Cause "no translation for this specific address".	Applicable.
05000	NPDB platform supports SS7 MTP, SCCP or TCAP error messages.	Applicable with modification: IS41 networks use T1.114-1988 and not T1.114-1996
05100	NPDB platform supports ANSI SSP (e.g., Operator) IN error messages.	Not applicable, see IS-756 (WNP PH1)
05200	NPDB platform supports pre-IN (e.g., IN/1) error messages.	Not applicable, see IS-756 (WNP PH1)
	5.6 Signaling and Protocol Requirements for Interfaces	
05300	CLASS response messages when no ten-digit TCAP parameter routed via GTAI.	Not applicable

TR45.2 Wireless Applicability Matrix	
Technical Requirements for Number Portability - Database and Global Title Translation[10]	**TR-45.2 (AMPS Based 800 & 1800)**
05400	Default routing of CLASS AC/AR query response messages.	Not applicable
	5.8 Operations, Administration, Maintenance and Provisioning Requirements	
05500	NPDB measurements made on an hourly or daily basis.	Applicable
05600	NP GTT measurements made on an hourly or daily basis.	Applicable.
05700	NPDB supports ANSI IN ACG procedures.	Not applicable.
05800	NPDB supports pre-IN (IN/1) ACG procedures.	Not applicable.
05900	NPDB supports MTP and SCCP controls.	Applicable.
06000	NP GTT supports MTP and SCCP controls.	Applicable.
06100	The NPDB application shall provide a count of NP queries per originating system by point code (switch or Operator System).	The original requirement 06100 was modified to become 4 requirements: 06100, 06110, 06120, and 06130. As these are essentially the same requirements, just reformatted and it was applicable before, all 4 requirements are marked Applicable.
06110	The NPDB application shall provide a count of NP queries for ported numbers per LRN.	Applicable.
06120	The NPDB application shall provide a count of NP queries for non-ported number per NPA-NXX.	Applicable.
06130	For purposes of identifying a query performed by a donor network on behalf of an N-1 network, the NPDB application shall provide a count of NP queries per combination of originating system by point code and incoming trunk group number.	Applicable.
06140	The NP GTT function shall provide a count of ten-digit GTTs by TT per originating system (point code).	This is a new requirement and needs to be evaluated.
06150	The NP GTT function shall provide a count of six-digit GTTs by TT per originating system (point code).	This is a new requirement and needs to be evaluated.
06200	NPDB and GTT data integrity function supports inter-system and intra-system verification of records.	Applicable.
06300	NPDB and GTT data integrity function supports periodic background verification of records.	Applicable.
06400	NPDB and GTT data integrity function supports manual verification of records.	Applicable.
06500	NPDB data integrity function supports discrepancy detection and correction.	Applicable.

TR45.2 Wireless Applicability Matrix	
Technical Requirements for Number Portability - Database and Global Title Translation[10]	**TR-45.2 (AMPS Based 800 & 1800)**
	5.10 Capacity, Performance and Reliability Requirements	
06600	NPDB platform unplanned downtime: 12 hours per year or less.	Applicable
06700	NP GTT meets SCCP Relay Point Unavailability	Applicable
06800	Network NP query unavailability: 3-minutes per year or less	Applicable
06900	NP query processing delay: 500ms or less	Applicable
07000	NP GTT supports ANSI T1.112.5, Section 3.1 "UDT message transit time"	Applicable
07100	NP GTT supports GR-82-CORE, Section 9.3.	Applicable.
07200	Replicated NP GTT functions.	Applicable.
07300	If the NP GTT function supports TT replacement, it shall contain post NP GTT TT data for each individual DN entry	This is a new requirement and needs to be evaluated.
07400	If the NP GTT function supports TT replacement, it shall contain post NP GTT TT data for each default (six-digit) entry	This is a new requirement and needs to be evaluated.
07500	If the NP GTT function supports TT replacement and GTAI replacement, it shall contain post NP GTT GTAI data (ten-digit values) for each individual DN entry	This is a new requirement and needs to be evaluated.
07600	If the NP GTT function supports TT replacement or TT and GTAI replacement, a ten-digit match is found for the incoming GTAI	This is a new requirement and needs to be evaluated.
07700	If the NP GTT function supports TT replacement, a ten-digit match is not found for the incoming GTAI	This is a new requirement and needs to be evaluated.

Annex E

(Informative)

E. ANNEX E REQUIREMENTS CROSS REFERENCE

E1. Introduction

Below is a cross reference for the requirements tags in the Midwest SCP and GTT Generic Requirements (Issue 1.00) and the requirements provided in this technical requirements document. This information is provided for information only as an aid to the industry.

E2. Cross Reference Table

Warning: In some cases, the requirements in this specification may have been modified from the original form and content from that which is defined in the ICC GR. N/A indicates that there is no cross- reference and therefore does not apply.

Cross Reference Table from Midwest SCP Document to T1S1.6 Document	
Midwest SCP and GTT Generic Requirements (Issue 1.00 - Requirement number	**Number Portability - Database and Generic Translation Type - Requirement Number**
N/A, new requirement	<REQ-00100>
N/A, new requirement	<REQ-00200>
<REQ-100V1>	N/A, deleted, is now text
<REQ-110V1>	N/A, deleted, is now text
<REQ-120V1>	N/A, deleted, is now text
<REQ-130V1> (GTT)	<REQ-00300>
<REQ-140V1> (GTT)	<REQ-00400>
<REQ-150V1> (GTT)	<REQ-00500>
<REQ-160V1>	<REQ-00600>
<REQ-170V1> (PODP)	<REQ-00700>
<REQ-180V1> (PODP)	<REQ-00800>
N/A, new requirement	<REQ-00900>
<REQ-190V1> (PODP)	<REQ-01000>
<REQ-200V1> (IN)	<REQ-01100>
<REQ-210V1> (IN)	<REQ-01200>
<REQ-220V1>	<REQ-01300>
<REQ-230V1>	<REQ-01400>
<REQ-240V1> (PODP)	<REQ-01500>

Cross Reference Table from Midwest SCP Document to T1S1.6 Document	
Midwest SCP and GTT Generic Requirements (Issue 1.00 - Requirement number	**Number Portability - Database and Generic Translation Type - Requirement Number**
<REQ-250V1> (IN)	<REQ-01600>
<REQ-260V1> (PODP)	<REQ-01700>
<REQ-270V1> (PODP)	<REQ-01800>
<REQ-280V1> (IN)	<REQ-01900>
<REQ-290V1> (IN)	<REQ-02000>
<REQ-300V1> (IN)	<REQ-02100>
<REQ-310V1> (PODP)	<REQ-02200>
<REQ-320V1> (IN)	<REQ-02300>
<REQ-330V1> (IN)	<REQ-02400>
<REQ-340V1> (IN)	<REQ-02500>
<OPT-350V1> (PODP)	N/A, deleted
REQ-360V1> (PODP)	<REQ-02600>
<OPT-370V1> (IN)	N/A, deleted
<REQ-380V1> (IN)	<REQ-02700>
<REQ-390V1> (GTT)	<REQ-02800>
<REQ-400V1> (GTT)	<REQ-02900>
<REQ-410V1> (GTT)	<REQ-03000>
<REQ-420V1> (GTT)	<REQ-03100>
<REQ-430V1> (GTT)	<REQ-03200>
<REQ-440V1> (GTT)	<REQ-03300>
<REQ-450V1> (GTT)	<REQ-03400>
<REQ-460V1 (GTT)	<REQ-03500>
<REQ-470V1> (GTT)	<REQ-03600>
<REQ-480V1> (GTT)	<REQ-03700>
<REQ-490V1> (GTT)	<REQ-03800>
<REQ-500V1>	<REQ-03900>
<REQ-510V1>	<REQ-04000>
<REQ-520V1> (PODP)	<REQ-04100>
<REQ-530V1> (IN)	<REQ-04200>

Cross Reference Table from Midwest SCP Document to T1S1.6 Document	
Midwest SCP and GTT Generic Requirements (Issue 1.00 - Requirement number	**Number Portability - Database and Generic Translation Type - Requirement Number**
<REQ-540V1> (PODP)	<REQ-04300>
<REQ-550V1> (IN)	<REQ-04400>
<REQ-560V1> (PODP)	<REQ-04500>
<REQ-570V1> (IN)	<REQ-04600>
<REQ-580V1>>	<REQ-04700>
<REQ-590V1> (GTT)	<REQ-04800>
<REQ-600V1> (GTT)	<REQ-04900>
N/A, new requirement	<CR-05400>
<REQ-610V1>	<REQ-05000>
<REQ-620V1> (PODP)	<REQ-05100>
<REQ-630V1> (IN)	<REQ-05200>
<OPT-640V1> (GTT)	<CR-05300>
<OPT-650V1>	<CR-05500>
<OPT-660V1>	<CR-05600>
<REQ-670V1>	N/A, deleted
<REQ-680V1>	N/A, deleted
<REQ-690V1> (PODP)	<REQ-05700>
<REQ-700V1> (IN)	<REQ-05800>
<REQ-710V1> (PODP/IN)	<REQ-05900>
<REQ-720V1> (GTT)	<REQ-06000>
<REQ-730V1>	N/A, deleted
<OPT-740V1>	<CR-06100>
<OPT-740V1>	<CR-06110>
<OPT-740V1>	<CR-06120>
<OPT-740V1>	<CR-06130>
N/A, new requirement	<CR-06140>
N/A, new requirement	<CR-06150>
<REQ-750V1>	N/A, deleted
N/A, new requirement	<REQ-06200>

Cross Reference Table from Midwest SCP Document to T1S1.6 Document	
Midwest SCP and GTT Generic Requirements (Issue 1.00 - Requirement number	**Number Portability - Database and Generic Translation Type - Requirement Number**
N/A, new requirement	<REQ-06300>
N/A, new requirement	<REQ-06400>
N/A, new requirement	<REQ-06500>
<REQ-760V1>	<REQ-06600>
<REQ-770V1> (GTT)	<REQ-06700>
N/A, new requirement	<REQ-06800>
<REQ-780V1>	<REQ-06900>
<REQ-790V1> (GTT)	<REQ-07000>
<REQ-800V1> (GTT)	<REQ-07100>
<REQ-810V1>	N/A, deleted, now is text
N/A, new requirement	<REQ-07200>
N/A, new requirement	<CR-07300>
N/A, new requirement	<CR-07400>
N/A, new requirement	<CR-07500>
N/A, new requirement	<CR-07600>
N/A, new requirement	<CR-07700>