ATIS-0700711.1999(S2019)

Number Portability for PCS 1900 Short Message Service and other Services

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ATIS-0700711.1999(R2014), *Number Portability for PCS 1900 Short Message Service and other Services*

Is an American National Standard developed by the **Systems and Networks (SN)** Subcommittee under the **ATIS Wireless Technologies and Systems Committee (WTSC)**.

American National Standard
for Telecommunications –

Number Portability for PCS 1900 Short Message Service and other Services

Secretariat

Alliance for Telecommunications Industry Solutions

Approved May 27, 1999

American National Standards Institute, Inc.

American National Standard

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Contents

Foreword (This foreword is not part of American National Standard T1.711-1999.)

This document describes network modifications needed to facilitate the operation of PCS 1900 services in the Number Portability environment.

This standard is intended for use in conjunction with the following American National Standards for Telecommunications:

- ANSI T1.708-1998, *Telecommunications - PCS 1900 Service Provider Number Portability*

- ANSI T1.112-1996, *Telecommunications - Signalling System Number 7 (SS7) - Signalling Connection Control Part (SCCP)*

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

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Working Group T1P1.5 developed this standard. Over the course of its development, the following individuals participated in the Working Group's discussions and made significant contributions to the standard:

American National Standard
for Telecommunications –

Number Portability for PCS 1900 Short Message Service and other Services

1 Scope

This standard defines the PCS 1900 requirements needed to support Short Message Service and other Services in a Number Portability environment. In this document, the phrase "Number Portability environment" refers to an environment where Service Provider Number Portability is active in the PCS 1900 networks. The phrase "Number Portability" and "Service Provider Number Portability" is used interchangeably throughout this document.

This standard ensures that Short Message Service Point-to-Point (SMS-PP) works for all subscribers in a PCS 1900 Number Portability environment regardless of whether the subscriber has ported or not.

The impact of Number Portability on Customized Applications for Mobile network Enhanced Logic (CAMEL), General Packet Radio Service (GPRS), number pooling, optimal routing, and roaming is outside the scope of this document. In addition, interworking with equivalent services in non-PCS 1900 networks is also outside the scope of this document.

2 Normative References

The following standards contain provisions, which, through reference in this text, constitute provisions of this American National Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this American National Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

ANSI J-STD-023-1996, *Telecommunications – PCN to PCN Intersystem Operations Based on PCS 1900**

ANSI T1.111-1996, *Telecommunications - Signalling System Number 7 (SS7) - Message Transfer Part (MTP)**

ANSI T1.112-1996, *Telecommunications – Signalling System Number 7 (SS7) Signalling Connection Control Part (SCCP)**

   NOTE - Translation Types 10 and 14 will be published in the next revision of ANSI T1.112

ANSI T1.641-1995, *Telecommunications – Calling Name Identification Presentation**

ANSI T1.708-1998, *Telecommunications – PCS 1900 Service Provider Number Portability**

ATIS Technical Requirements for Number Portability – Database and Global Title Translation, 1998[1)]

GSM 03.96 (1998), *Digital Cellular Telecommunications System (phase 2+), Name Identification Supplementary Service – Stage 2*

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* For electronic copies of some standards, visit ANSI's Electronic Standards Store (ESS) at www.ansi.org. For printed versions of all these standards, contact Global Engineering Documents, 15 Inverness Way East, Englewood, CO 80112-5704, (800) 854-7179.
[1)] Available from the Alliance for Telecommunications Industry Solutions, 1200 G Street, NW, Suite 500, Washington, DC 20005.

3 Definitions

3.1 Alias Point Code: A SS7 address that is shared by more than one system supporting the same GTT function (or other SS7 function). It allows other systems to address the function instead of maintaining the status of multiple point codes.

3.2 Directory Number: Any North American Numbering Plan (NANP) 10-digit dialable number assigned to address a wireline or a wireless subscriber.

DNs are inclusive of PCS 1900 Mobile Station International ISDN Numbers (MSISDNs).

3.3 Donor: The switch or network from which the subscriber has ported. If the subscriber has ported more than once, the first switch or network to release the subscriber is referred to as the original donor switch or donor network. The original donor switch is the switch to which a call will be routed in the absence of number portability information, as it is the default owner of the directory number.

3.4 Global Title (GT): A "logical" or "virtual" address used for routing SS7 messages using Signaling Connection Control Part (SCCP) capabilities. To complete message routing, a GT must be translated to a SS7 point code and Sub-System Number.

3.5 Global Title Address (GTA): The address digits contained in the GT. Examples include NPA-NXX-XXXX or a MSISDN.

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

3.7 Mobile Station International ISDN Number: An E.164 dialable number. In PCS 1900 networks in North America, this may be represented as the complete E.164 formatted dialable number (1-NPA-NXX-XXXX) or just the 10-digit NANP portion (NPA-NXX-XXXX). The selection of which is dependent on the service (e.g., CNAP, Short Message Service).

3.8 Portable Number: Any number within a block of NANP numbers identified to be involved in number portability by an appropriate (local, state, or federal) authority. Members of the block can be identified by their NPA-NXX.

3.9 Ported Number: A portable directory number that has been moved from one switch to another where the switch may or may not belong to the same service provider.

3.10 Recipient: The switch or network to which a subscriber's directory number has been ported.

3.11 Service Provider: Any entity that is authorized, as appropriate, by local government, state, or federal authorities to provide communications service to the public.

3.12 Service Provider Number Portability: Allows an end user to retain the same directory number after changing from one service provider to another.

4 Abbreviations

ANSI	American National Standards Institute
CC	Country Code (E.164)
CAMEL	Customized Applications for Mobile network Enhanced Logic
CdPN	Called Party Number
CNAP	Calling Name Presentation
CNDB	Calling Name Database
DCS	Digital Cellular telecommunication System
DN	Directory Number
DPC	Destination Point Code
FCI	Forward Call Indicators
GAP	Generic Address Parameter
GMSC	Gateway Mobile Switching Center

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GPRS	General Packet Radio Service
GSM	Global System for Mobile communications
GSTP	Gateway STP
GTA	Global Title Address
GTT	Global Title Translation
HLR	Home Location Register
IAM	Initial Address Message
ISTP	International STP
ISUP	Integrated Services Digital Network (ISDN) User Part
IWMSC	Interworking Mobile Subscriber Center
LRN	Location Routing Number
LSMS	Local Service Management System
MAP	Mobile Application Part
MF	Multi-Frequency
MS	Mobile Station
MSC	Mobile Switching Center
MSISDN	Mobile Station International ISDN Number
MSRN	Mobile Subscriber Roaming Number
MTP	Message Transfer Point
NANP	North American Numbering Plan
NP	Number Portability
NPDB	Number Portability Database
NP GTT	Number Portability Global Title Translation
NPA	Numbering Plan Area
NPAC-SMS	Number Portability Administration Center – Service Management System
OPC	Origination Point Code
PCS	Personal Communication Services
PLMN	Public Land Mobile Network
PSTN	Public Switch Telephone Network
SC	Service Center
SCCP	Signaling Connection Control Part
SIM	Subscriber Identity Module
SM	Short Message
SM MO	Short Message Mobile Originated Point-to-Point
SM MT	Short Message Mobile Terminated Point-to-Point
SMS	Short Message Service
SMS-PP	Short Message Service Point-to-Point
SP	Signaling Point
SRI	Send Routing Information
SS7	Signalling System Number 7
SSN	Sub-System Number
STP	Signaling Transfer Point
TCAP	Transaction Capabilities Application Part
UDT	SCCP Unitdata message
UDTS	SCCP Unitdata Service message
VLR	Visitor Location Register

5 General Description

5.1 Services impacted by Service Provider Number Portability

This subclause provides a brief description of the services that are impacted by Service Provider Number Portability.

5.1.1 Short Message Service Point-to-Point (SMS-PP)

This service allows a mobile subscriber to send and receive text messages on their Mobile Station (MS). SMS-PP comprises of two basic parts:

a) Short Message Mobile Originated Point-to-Point (SM MO): Allows the MSC that performs the SMS interworking function to transfer a Short Message (SM) submitted by the MS to the Service Center. The MS sends the SM to the MSC together with the E.164 address of the Service Center (SC).

In North America, SM MO can operate in one of the following ways:

- The SM is sent to the SC serving the home Public Land Mobile Network (PLMN) of the calling party. This is not impacted by Number Portability since it is assumed that the E.164 address of the SC is never ported.

- The SM is sent to the SC serving the home PLMN of the called party. This is not impacted by Number Portability since it is assumed that the E.164 address of the SC is never ported.

The SM MO is not directly impacted by Number Portability[2).

b) Short Message Mobile Terminated Point-to-Point (SM MT): Allows the MSC that performs the SMS gateway function to transfer a short message submitted from the SC to the MS. The SC can be in the home PLMN of either the calling or called party. The SC sends the short message to the SMS-GMSC. The SMS-GMSC interrogates the HLR to retrieve routing information necessary to forward the short message to the relevant MSC, transiting other networks if necessary. The MSC, upon receipt, sends the short message to the MS.

In North America, SM MT can operate in one of the following ways:

- The SC serving the home PLMN of the calling party initiates the SM MT. This is impacted by Number Portability if the called party is ported. In this case, the SMS-GMSC must interrogate the HLR in the recipient network using the NP GTT function in order to deliver the message to the MS.

- The SC serving the home PLMN of the called party initiates the SM MT. This is not impacted by Number Portability.

5.1.2 Call Forwarding Busy (CFB)

This service allows a mobile subscriber to forward all incoming calls to another DN when the called party is busy.

Call Forwarding Busy is impacted by Number Portability. If the "forwarded to" number is portable, an NP query needs to be made in order to correctly route the call.

[2) For SM MO, the SC may need to verify that the originating or terminating MSISDN for the received SM is a legitimate MSISDN to its own PLMN. To verify non-ported MSISDNs, it may be sufficient for the SC to store only the NPA-NXXs assigned to its own PLMN. To verify ported MSISDNs, the SC may need to store the complete NPA-NXX-XXXX numbers of these MSISDNs.

5.1.3 Call Forwarding on mobile subscriber Not Reachable (CFNRc)

This service allows a mobile subscriber to forward all incoming calls to another DN when the called party is not reachable by the network because the MS is off, is out of coverage, or is not registered in the network.

Call Forwarding Not Reachable is impacted by Number Portability. If the "forwarded to" number is portable, an NP query needs to be made in order to correctly route the call.

5.1.4 Call Forwarding No Reply (CFNRy)

This service allows a mobile subscriber to forward all incoming calls to another DN when the called party does not answer the call within a certain time period. The call is forwarded after the time period has expired.

Call Forwarding No Reply is impacted by Number Portability. If the "forwarded to" number is portable, an NP query needs to be made in order to correctly route the call.

5.1.5 Call Forwarding Unconditional (CFU)

This service allows a mobile subscriber to forward all incoming calls to another Directory Number (DN).

Call Forwarding Unconditional is impacted by Number Portability. If the "forwarded to" number is portable, an NP query needs to be made in order to correctly route the call.

5.1.6 Calling Name Presentation (CNAP)

This service enables the called party to receive the calling name information.

CNAP is impacted by Number Portability. If the calling party number is portable, the NP-GTT function needs to be used in order to route the name query to the correct name database.

5.1.7 Multi-Party Service (Conference)

This service enables a mobile subscriber to setup multi-party calls (i.e., a simultaneous communication among more than two parties).

This service is impacted by Number Portability. If the called party number(s) is portable, an NP query needs to be made in order to correctly route the call.

5.2 Services not impacted by Service Provider Number Portability

This subclause provides a brief description of the services that are not impacted by Service Provider Number Portability.

5.2.1 Advice of Charge Information (AoCI)

This service provides information to estimate the cost of the service used.

5.2.2 Advice of Charge Charging (AoCC)

This service provides accounting information for billing.

5.2.3 Barring of all Incoming Calls (BAIC)

This service restricts all incoming calls to a mobile subscriber.

5.2.4 Barring of all Outgoing Calls (BAOC)

This service prevents the mobile subscriber from originating any outgoing calls.

5.2.5 Barring of all Incoming Calls when roaming Outside the Home PLMN Country (BIC-Roam)

This service restricts all incoming calls to a mobile subscriber when that mobile subscriber is roaming outside the home network.

5.2.6 Barring of all Outgoing International Calls (BOIC)

This service restricts the mobile subscriber from originating any outgoing international calls.

5.2.7 Barring of all Outgoing International Calls excepts those directed to the Home PLMN Country (BOIC-exHC)

This service restricts the mobile subscriber from originating any outgoing international calls except those to their home country network.

5.2.8 Calling Line Identification Presentation (CLIP)

This service enables the called party to receive the calling number information.

5.2.9 Calling Line Identification Restriction (CLIR)

This service enables the calling party to restrict the presentation of the calling number information to the called party.

5.2.10 Connected Line identification Presentation (CoLP)

This service enables a calling party to receive the connected party's number information.

5.2.11 Connected Line identification Restriction (CoLR)

This service enables the connected party to restrict the presentation of the connected number information to the calling party.

5.2.12 Call Hold

This service allows a mobile subscriber to interrupt (place on hold) communication on an active call and then, if desired, re-establish communication.

5.2.13 Call Waiting (CW)

The service enables a mobile subscriber to be notified of an incoming call while the call is in a busy state (i.e., during a conversation). The subscriber can either answer or ignore the incoming call.

5.3 Service Provider Number Portability Impacts on Translation Types

Prior to Service Provider Number Portability, Translation Type 10 was used for SCCP routing of all PCS 1900 MAP messages that use the E.164 global title address. In the NP environment, to reduce incoming traffic to the NP GTT function, a new Translation Type 14 has been introduced to be used in conjunction with Translation Type 10.

The recommended usage of these two Translation Types in an NP environment is as follows (this recommendation applies to both national and international numbers):

- All MAP messages that are SCCP routed to a Network Entity should use Translation Type 10.
- All MAP messages that are SCCP routed to a MSISDN should use Translation Type 14.

In both cases, the GTA in the SCCP Called Party Address contains an E.164 address.

6 Functional Entities and Call Flows
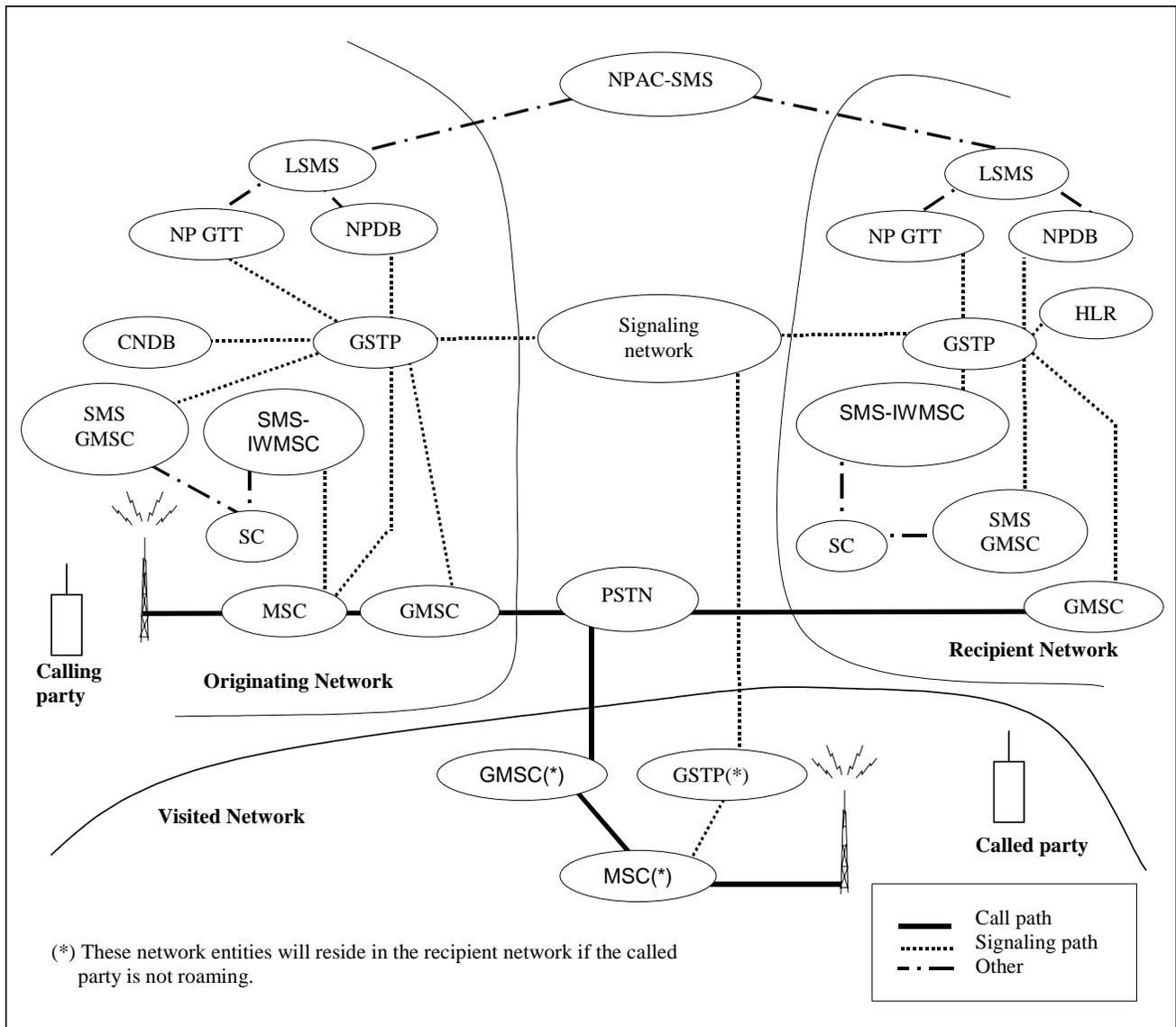
6.1 Functional Entities

Figure 1 - PCS 1900 Functional Architecture

The functional entities shown in Figure 1 are described below.

6.1.1 Calling Name Database (CNDB)

The CNDB contains the name information for each DN. The serving MSC queries this database using the calling party's DN to obtain the name information.

6.1.2 Gateway Signaling Transfer Point (GSTP)

The GSTP is an STP that performs interconnection with other networks.

A GSTP of the originating network may perform the non-final GTT that results in the routing of the SMS message to the NP GTT function. If the NP GTT function is resident on the GSTP, this non-final GTT is unnecessary.

A GSTP of the destination network may perform the SCCP routing of the SMS interrogation message to the HLR. A NP GTT function may also be needed for routing the SMS interrogation message to the HLR within the destination network depending on the architecture of the network.

Similarly, the GSTP in the visited or recipient network performs a non-final GTT for Calling Name Presentation (CNAP).

6.1.3 Home Location Register (HLR)

The HLR is a database that maintains information for the management of mobile subscribers. It contains the subscription information and may contain the location of each registered mobile station.

6.1.4 Local Service Management System (LSMS)

The LSMS is responsible for distributing the NP data updates from the NPAC-SMS to the service provider's NP GTT function.

6.1.5 Mobile Switching Center (MSC)

The MSC performs all the switching functions for mobile stations. This includes the allocation of radio resources, call establishment and handover.

A Mobile Station (MS) roaming in an MSC area is assigned to a Visitor Location Register (VLR). A VLR is in charge of temporarily storing subscription data for the MSs registered in the MSC area. A VLR may be collocated with an MSC and may be in charge of one or several MSC areas.

In the case of incoming calls to the PLMN, if the delivering network(s) is unable to interrogate the Home Location Register (HLR), the call is routed to an MSC. This MSC will interrogate the appropriate HLR and then route the call to the MSC where the mobile station is located. The MSC which performs the interrogation and routing function to the actual location of the mobile is called the Gateway MSC (GMSC).

6.1.6 Number Portability Administration Center Service Management System (NPAC-SMS)

The NPAC-SMS is a Service Management System responsible for storing and broadcasting to the Local Service Management System(s) NP data updates within a service provider's area.

6.1.7 Number Portability – Global Title Translation (NP GTT)

The NP GTT function is an extension to the existing SCCP functionality defined in ANSI T1.112 and as described in the ATIS Technical Requirement Document (see clause 2). The NP GTT function provides SCCP Global Title Translation and routing for portable numbers. The NP GTT function translates all digits of any portable number (i.e., translates either a complete 10-digit NPA-NXX-XXXX number or 11-digit 1-NPA-NXX-XXXX number). The translation result is the 24-bit ANSI DPC of either the destination endpoint or some other entity capable of routing the message to the destination endpoint.

The NP GTT function may be provided by any suitable node, such as an STP or SCP and it may reside in any network (e.g., originating, donor, transit, or recipient network).

6.1.8 Service Center (SC)

The SC is responsible for storing and forwarding short messages to the SMS-GMSC.

6.1.9 Short Message Service – Gateway Mobile Switching Center (SMS-GMSC)

The SMS-GMSC supports the MAP procedures (defined in ANSI J-STD-023) to deliver an SMS-PP message received from an associated SC to the called party identified by an MSISDN in the SM. One of these procedures requires interrogating the HLR of the called party to obtain the E.164 address of the MSC (MSC) currently serving the subscriber.

6.1.10 Short Message Service Interworking MSC (SMS-IWMSC)

A Short Message Service Interworking MSC (SMS-IWMSC) is an MSC capable of receiving a Short Message from the PLMN and submitting it to the SC.

6.2 Message Flows

6.2.1 SCCP Message Routing Using NP GTT

The NP GTT function is used to route SCCP messages for PCS 1900 services such as SMS-PP and CNAP.

Figure 2 shows an example of how the NP GTT function is used to route an SCCP Unitdata (UDT) message when the GTA in the SCCP called party address contains a portable number.
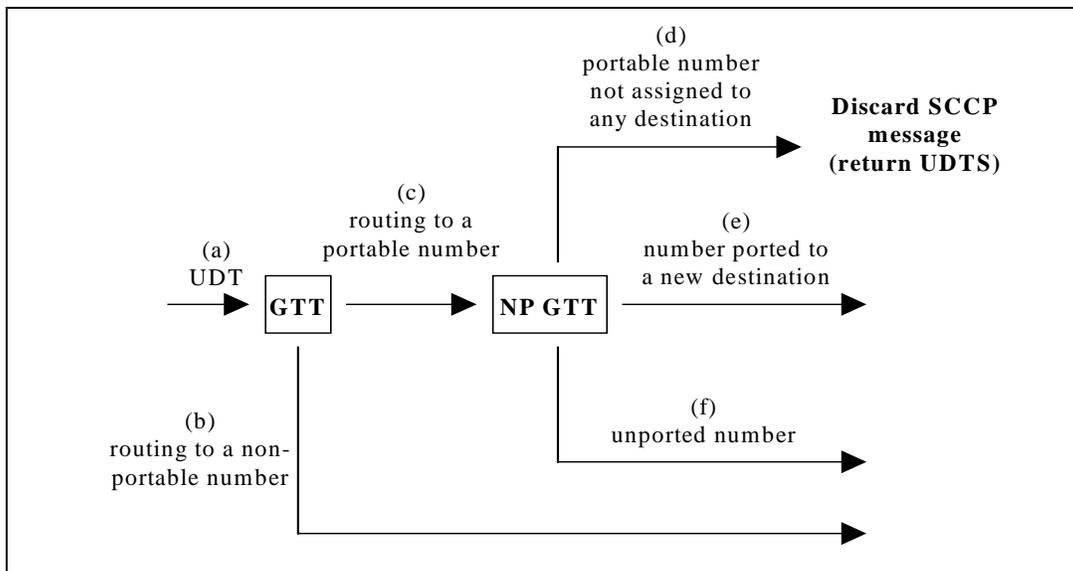

Figure 2 - Routing an SCCP UDP to a Ported Number using the NP GTT Function

Routing steps

(a) An SCCP UDT message is received at the GTT function.

(b) If the GTA in the SCCP called party address contains a nonportable number, the SCCP message is default routed either to its final destination or to an intermediate STP.

(c) If the GTA in the SCCP called party address contains a portable number, the SCCP message is routed to an NP GTT function. This step may not be necessary if the NP GTT function is resident in this node.

(d) The NP GTT function translates all digits in the SCCP called party address (i.e., translates either a complete 10-digit NPA-NXX-XXXX or 11-digit 1-NPA-NXX-XXXX depending on the service).

The NP GTT function discards the SCCP message if:

- No ported and default information is found, or
- The "null" value is found.

The NP GTT function also returns an SCCP UDTS message to the originating node if this was requested in the UDT message. The return cause value in the UDTS message should indicate "no translation for this specific address".

(e) If the portable number in the SCCP called party address is ported, the NP GTT function routes the message to either the final destination or to an intermediate STP. For the former, the address indicator in the SCCP called party address should indicate routing on the DPC and SSN (i.e., final translation); for the latter, the address should indicate routing on the Global Title (i.e., non-final translation).

(f) If the portable number in the SCCP called party address is not ported, the NP GTT function default routes the message to either the final destination or to an intermediate STP. For the former, the address indicator in the SCCP called party address should indicate routing on the DPC and SSN (i.e., final translation); for the latter, the address indicator should indicator route on the Global Title (i.e., nonfinal translation).

6.2.2 MSC to HLR NP GTT Message Flows

This subclause provides scenarios showing HLR interrogation for inter-PLMN terminated SMS-PP transfer to ported and nonported MSISDN numbers. Application of these scenarios to intra-PLMN terminated SMS-PP transfer is optional. In the following scenarios, when applicable, the NP GTT function is shown to route directly to a HLR for simplicity. Routing to an intermediate node(s) is also allowed but not shown.

6.2.2.1   Nonportable Destination MSISDN Assigned to a PCS 1900 Network

This scenario shows the delivery of a Short Message where the destination MSISDN is not portable and is assigned to a PCS 1900 network.
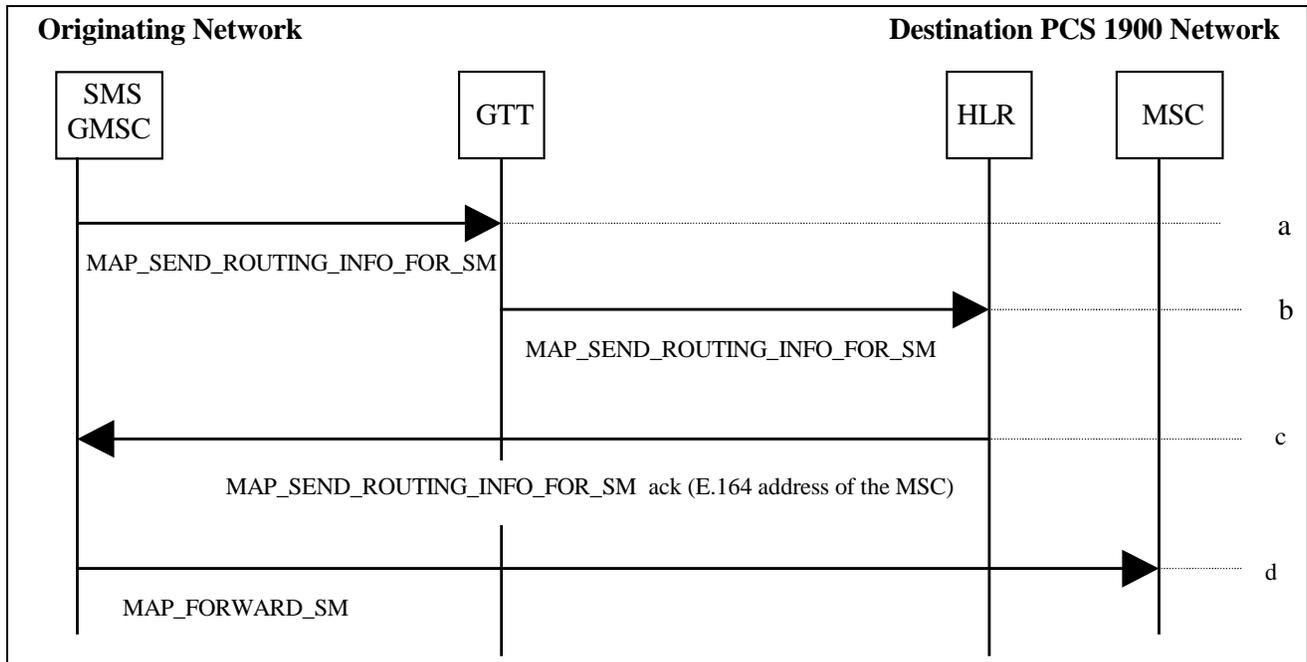
Figure 3 - Nonportable destination MSISDN assigned to a PCS 1900 network

a)   The SMS-GMSC in the originating network sends a MAP_SEND_ROUTING_INFO_FOR_SM message to a GTT function. The GTA in the SCCP called party address contains Translation Type 14 and the nonportable MSISDN of the destination MS.

b)   The GTT function translates and routes upon the 1-NPA-NXX portion of the MSISDN. Because the NPA-NXX is nonportable, the message is MTP routed to the destination HLR or to an intermediate STP.

c)   The HLR locates the MS subscriber data using the supplied MSISDN. The E.164 address of the MSC currently serving the MS is returned in a MAP response.

d)   The SMS-GMSC SCCP routes the Short Message to the MSC using Translation Type 10.

6.2.2.2 Ported Destination MSISDN Assigned to a PCS 1900 Network

This scenario shows the delivery of a Short Message where the destination MSISDN is portable and has been ported into a PCS 1900 network.
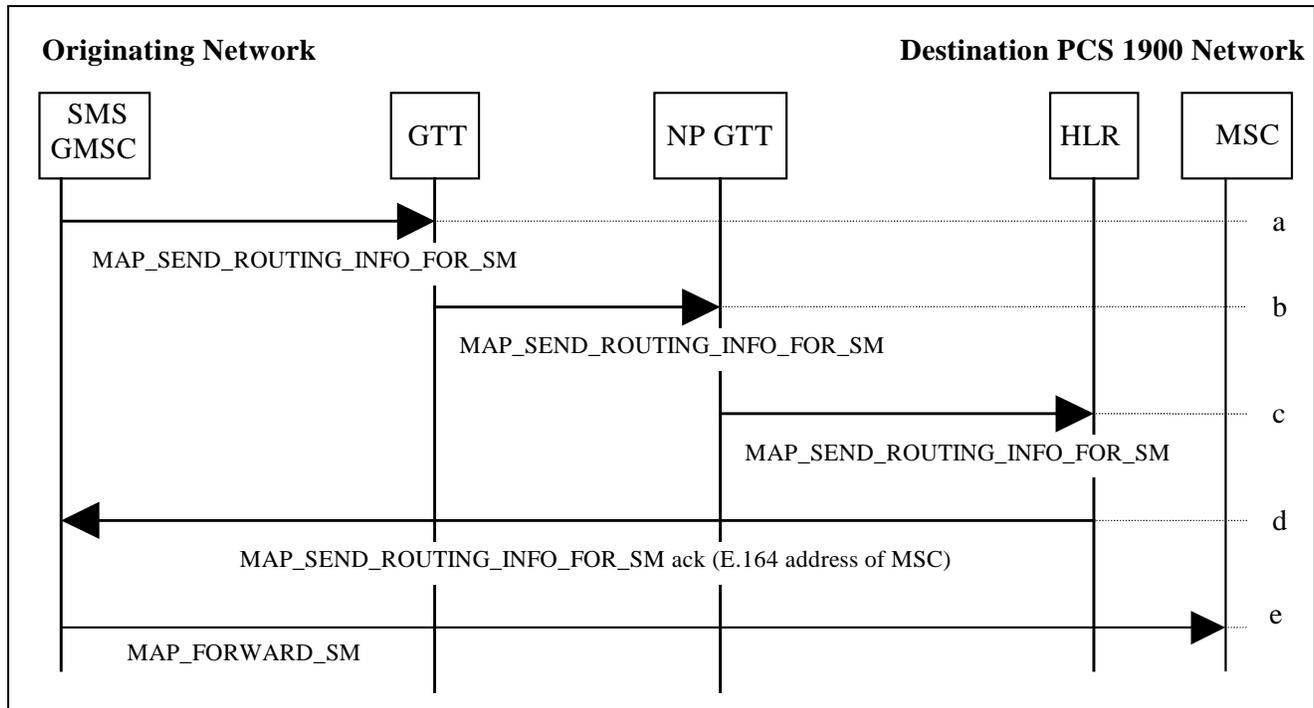

Figure 4 - Ported Destination MSISDN assigned to a PCS 1900 network

(a) The SMS-GMSC in the originating network sends a MAP_SEND_ROUTING_INFO_FOR_SM message to a GTT function. The GTA in the SCCP called party address contains Translation Type 14 and the ported MSISDN of the destination MS.

(b) The GTT function translates and routes upon the 1-NPA-NXX portion of the ported MSISDN. Because the NPA-NXX is portable, the message is MTP routed to an NP GTT function.

(c) The NP GTT function translates and routes upon the entire 1-NPA-NXX-XXXX digits in the ported MSISDN. Because the MSISDN has been ported into a PCS 1900 network, the translation result will be the DPC and SSN of the destination HLR in this network. The message is MTP routed to this HLR.

(d) The HLR locates the MS subscriber data using the supplied MSISDN. The E.164 address of the MSC currently serving the MS is returned in a MAP response.

(e) The SMS-GMSC SCCP routes the Short Message to the MSC using Translation Type 10.

6.2.2.3 Nonported Portable Destination MSISDN Assigned to a PCS 1900 Network

This scenario shows the delivery of a Short Message for a portable MSISDN that is non-ported and assigned to a PCS 1900 network.
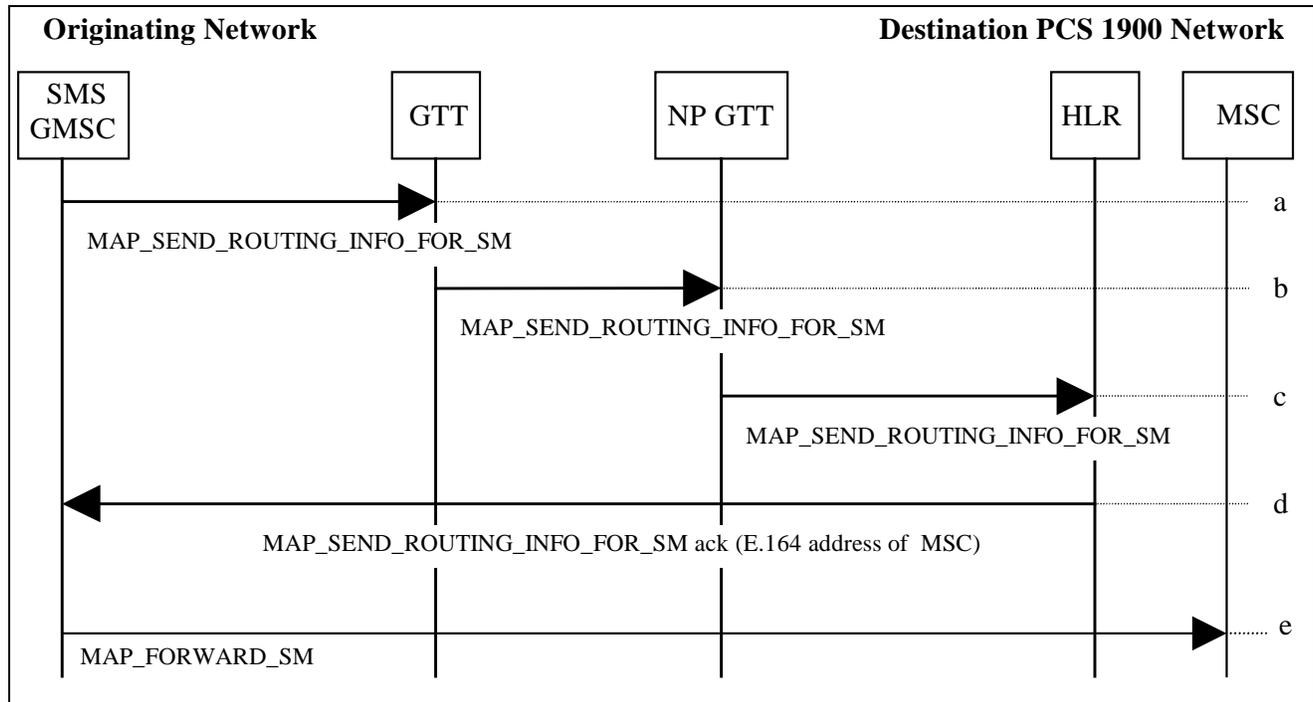

Figure 5 - Nonported Portable Destination MSISDN assigned to a PCS 1900 network

(a) The SMS-GMSC in the originating network sends a MAP_SEND_ROUTING_INFO_FOR_SM message to a GTT function. The GTA in the SCCP called party address contains Translation Type 14 and the nonported MSISDN of the destination MS.

(b) The GTT function translates and routes upon the 1-NPA-NXX portion of the nonported MSISDN. Because the NPA-NXX is portable, the message is routed to an NP GTT function.

(c) The NP GTT function translates and routes upon the entire 1-NPA-NXX-XXXX digits in the MSISDN. Because the MSISDN is nonported and assigned to a PCS 1900 network, the default portion of the NP GTT function finds a routing entry containing the DPC and SSN of the destination HLR in the PCS 1900 network. The message is MTP routed to this HLR.

(d) The HLR locates the MS subscriber data using the supplied MSISDN. The E.164 address of the MSC currently serving the MS is returned in a MAP response.

(e) The SMS-GMSC SCCP routes the Short Message to the MSC using Translation Type 10.

6.2.2.4   Portable Destination MSISDN Assigned to a Non-PCS 1900 Network

This scenario shows an attempt to interrogate a PCS 1900 HLR for a portable MSISDN assigned to a non-PCS 1900 network. This situation could arise if an SMS originator enters either an incorrect MSISDN or the MSISDN of a former PCS 1900 subscriber who has recently ported to a non-PCS 1900 network with the originator unaware of this.
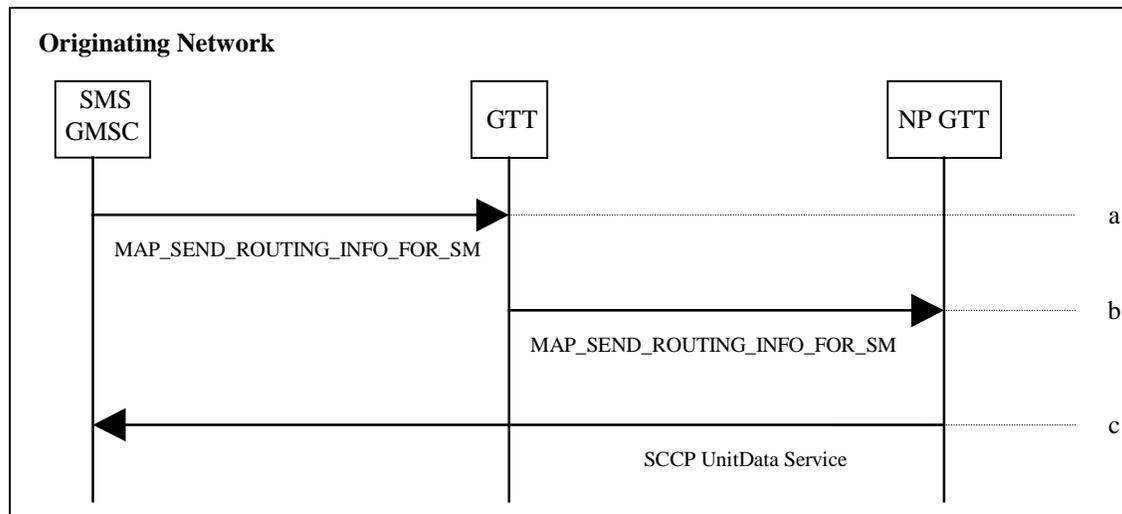

Figure 6 - Portable Destination MSISDN assigned to a Non-PCS 1900 network

(a) The SMS-GMSC in the originating network sends a MAP_SEND_ROUTING_INFO_FOR_SM message to a GTT function. The GTA in the SCCP called party address contains Translation Type 14 and the non-PCS 1900 MSISDN of the intended destination MS.

(b) The GTT function translates and routes upon the 1-NPA-NXX portion of the MSISDN. Because the NPA-NXX is portable, the message is routed to an NP GTT function.

(c) The NP GTT function translates and routes upon the entire 1-NPA-NXX-XXXX digits in the MSISDN. Because the MSISDN is assigned to a non-PCS 1900 network, the NP GTT function does not find a routing entry or finds a "null" value. The NP GTT function therefore discards the MAP interrogation and returns an SCCP Unitdata Service (UDTS) message if requested in the received SCCP message. The cause value in the UDTS would indicate "no translation for this specific address". The SMS-GMSC will determine that the MAP message was not delivered from either the returned UDTS or a timeout on the expected MAP response.

6.2.2.5 Portable Destination MSISDN Assigned to a PCS 1900 Network – Originated Network is GSM

This scenario shows the delivery of a Short Message to a portable destination MSISDN assigned to a PCS 1900 network, where the interrogation originates from an SMS-GMSC in a GSM network (either GSM 900 or DCS 1800).
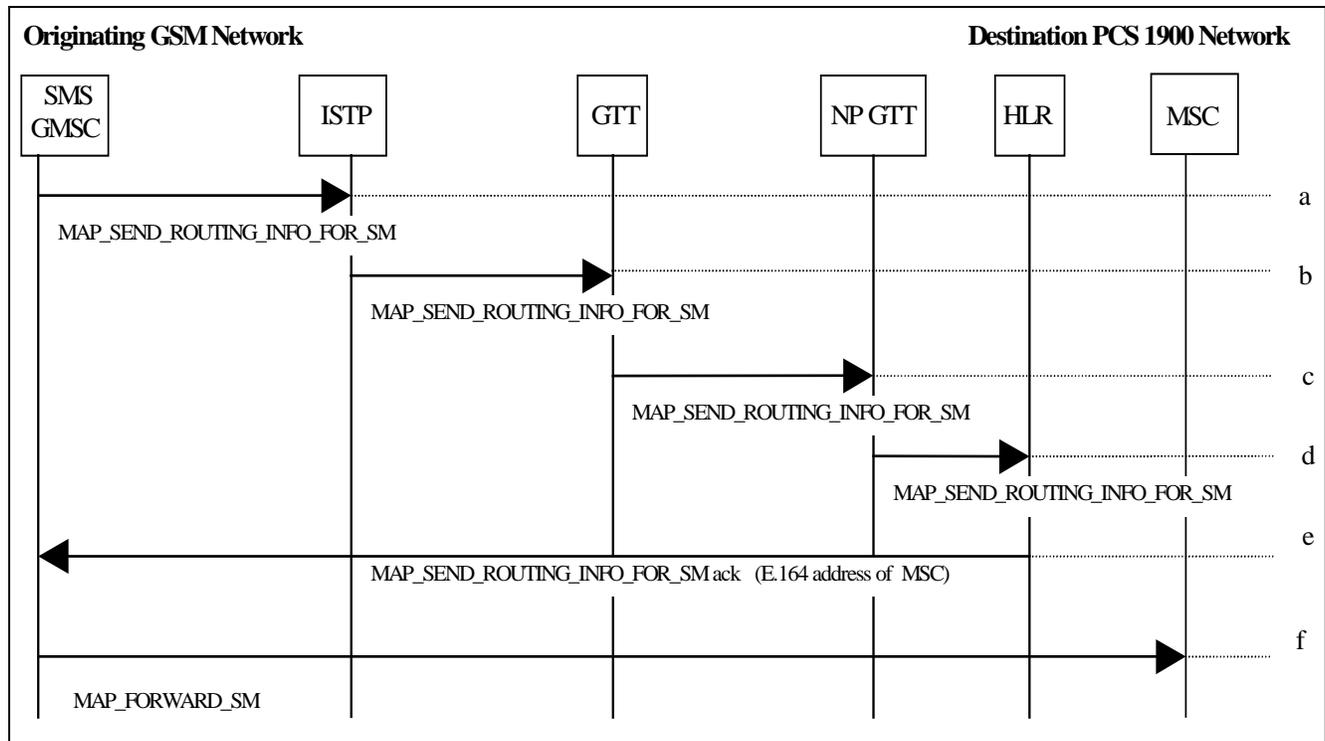

**Figure 7 - Portable destination MSISDN assigned to a
PCS 1900 network – Originating network is GSM**

(a) The SMS-GMSC in the originating GSM network sends a MAP_SEND_ROUTING_INFO_FOR_SM message to an International STP (ISTP).

(b) The ISTP converts the message from ITU to ANSI format by changing the MTP and SCCP headers. The GTA containing the destination MSISDN in the SCCP called party address is converted from ITU format to ANSI format by mapping the ITU Global Title Indicator type 4 which includes numbering plan, nature of address indicator and Translation Type to an ANSI Global Title Indicator type 2 which includes Translation Type only. The ISTP can determine that the destination MSISDN is a PCS 1900 MSISDN either through a suitable international routing agreement (e.g. whereby certain ITU STPs send only GSM SCCP messages to ISTP) or by processing the contents of the message.

Having determined that the destination MSISDN is a PCS 1900 MSISDN, the ISTP should assign Translation Type 14[3]. The converted ANSI SS7 message is then routed to an NP GTT function.

(c) The GTT function translates and routes upon the 1-NPA-NXX portion of the portable MSISDN. Because the NPA-NXX is portable, the message is MTP routed to an NP GTT function.

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[3] An ISTP should assign Translation Type 14 to any SCCP message addressed to a PCS 1900 E.164 GTA, whether the GTA denotes a PCS 1900 network entity or an MSISDN, because the ISTP will generally be unable to distinguish these two types of GTA. Although this will invoke the NP GTT function for messages addressed to a PCS 1900 network entity, where the network entity address lies in a portable NPA-NXX, the additional load on the NP GTT will be limited due to the relatively small number of such international GSM to PCS 1900 SCCP messages.

(d) The NP GTT function translates and routes upon the entire 1-NPA-NXX-XXXX digits in the portable MSISDN. Because the MSISDN is assigned to a PCS 1900 network, the translation result will be the DPC and SSN of the HLR in the destination network. The message is MTP routed to this HLR.

(e) The HLR locates the MS subscriber data using the supplied MSISDN. The E.164 address of the MSC currently serving the MS is returned in a MAP response.

(f) The SMS-GMSC SCCP routes the Short Message to the MSC using Translation Type 10.

6.2.3 Calling Name Presentation Message Flows

This call flow shows a query from a PCS 1900 network to a Calling Name Database (CNDB) serving the originating MSISDN (calling party) that is ported. The call flow shown in Figure 8 illustrates the case where a calling name query is originated in the wireless network and the CNDB is located in the originating subscriber's network.
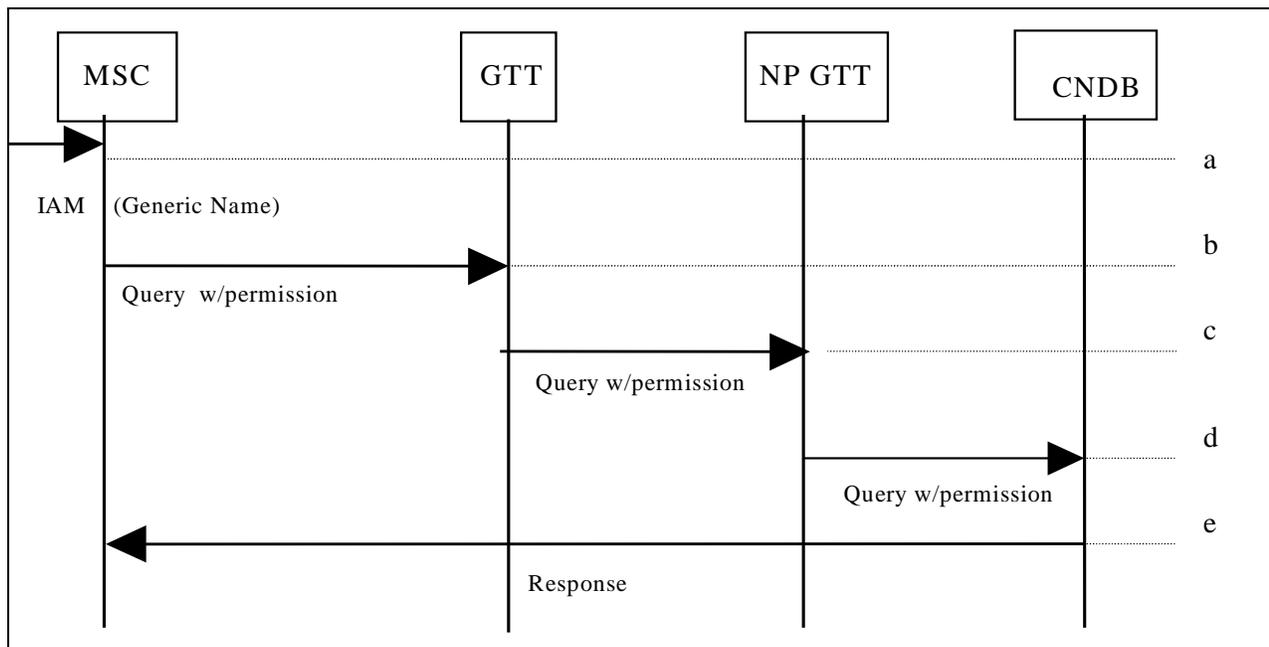

Figure 8 - PCS 1900 network query to a Name Database for a ported originated MSISDN

(a) An incoming call (an Initial Address Message with Generic Name parameter set to "presentation allowed") is received at an MSC. The MSC interrogates the VLR to determine if the called party is subscribed to the CNAP service. The VLR response indicates that the called party is subscribed to CNAP.

(b) The MSC sends a TCAP message "Query - With Permission" to the GTT function as specified in GSM 03.96. The MSC populates the SCCP GTA of the query with the 10-digit NPA-NXX-XXXX of the calling party and sets the SCCP Translation Type value to 5.

(c) The GTT function translates and routes upon the NPA-NXX portion of the GTA. Because the NPA-NXX is portable, the message is MTP routed to an NP GTT function.

(d) The NP GTT function translates and routes upon the entire NPA-NXX-XXXX digits of the GTA. The result of this translation will be the DPC and SSN of the CNDB. The message is MTP routed to the CNDB.

(e) The CNDB returns the calling party's name information in a "Response" message as specified in GSM 03.96. The message is MTP routed back to the serving MSC.

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7 Procedures

7.1 NP GTT Function

The NP GTT function may need to be performed on SS7 SCCP messages originated within the service provider's network that are to be routed on a GTT basis where the NPA-NXX within the GTA represents a portable NPA-NXX. There are at least two ways for systems within the service provider's network to route messages requiring the NP GTT function as shown below (see *ATIS Technical Requirements for Number Portability* for more information) 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.

2) The systems originating the messages may MTP address the messages to a system that performs a 1-NPA-NXX based GTT (i.e., GTT on either the NPA-NXX or the 1-NPA-NXX portion of the GTA dependent on the service). The system performing the NPA-NXX based GTT would selectively route (nonfinal GTT) messages with an SCCP Called Party Address representing a portable NPA-NXX (i.e., either an NPA-NXX or a 1-NPA-NXX of the GTA) to the system performing the NP GTT function.

The NP GTT function should perform nonfinal GTTs, and may perform final GTTs, depending on the network configuration. A service provider is expected to perform nonfinal GTTs for messages destined for other networks.

Also, the NP GTT function may need 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 GTA represents a portable NPA-NXX.

The system performing the NP GTT function should support SCCP routing procedures as defined in ANSI T1.112.4.

The NP GTT function should invoke GTT procedures when all of the following apply:

- an SS7 message is received that contains an MTP point code (or alias point code) assigned to NP GTT function,
- the SCCP Global Title address contains a Translation Type that is recognized by the NP GTT function as a supported service (e.g., PCS 1900 SMS, Calling Name Presentation), and
- the SCCP Called Party Address indicates "route on global title".

Based on the information provided in the GTA, the NP GTT function will look for a matching NPA-NXX-XXXX in the NP GTT table. 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 NP GTT data for numbers assigned to one particular network for any NPA-NXX (e.g. for all numbers in any NPA-NXX) that are not ported. If a match is found (i.e., the DN in the SCCP called party GTA is ported), the NP GTT function routes the message to either the destination entity or to an intermediate STP capable of routing to the destination entity. For the former, the address indicator in the SCCP called party address will indicate routing on the DPC and SSN (i.e., final translation); for the latter, the address indicator will indicate routing on the GTT (i.e., nonfinal translation). See 7.1.3 for more details.

7.1.1 Errors and Exceptions

General SS7 protocol errors of format and coding (MTP, SCCP) should be processed as defined in ANSI T1.111 and ANSI T1.112.

If the system performing the NP GTT function is not performing STP functions, it should initiate error procedures as defined in ANSI T1.111.4 when

- it receives messages not MTP addressed to its point code or alias point code, or
- it receives messages which indicate SCCP routing is to be performed by point code.

If the translation type received at the NPDB is not supported by that NP GTT function, then SCCP error procedures should be invoked as defined in ANSI T1.112.4.

If neither a DN match is found in the NP GTT table, nor a default NPA-NXX match is found in the default data, it should be treated as a nonexistent translation, and the message return procedure should be initiated with a Return Cause of "no translation for this specific address" as defined in ANSI T1.112.4.

7.1.2 Handling of Nonsupported Services

Some networks may not support all the signaling services impacted by NP. If a service is not supported by a service provider, the NPAC-SMS will download "null" data for the DPC and SSN fields associated with the nonsupported service for the ported DN. If the NP GTT function finds a DN match in the NP GTT tables, but the GTT data associated with the service is "null", the SCCP message return error procedure will be initiated with a Return Cause indicating "No translation for this specific address" as defined in ANSI T1.112.4.

7.1.3 NP GTT Data Processing

7.1.3.1 Performing Final GTT for a Ported DN

If the GTT data associated with the ported DN indicates final translation (i.e., SSN is nonzero), the NP GTT function will repopulate the existing SCCP Called Party Address with the received GTA (DN) and the SSN from the global title tables. It will also include an indication that further SCCP routing is to be based on the DPC and SSN. It will retransmit the message with the repopulated SCCP Called Party Address, an MTP DPC set to the DPC derived from the translation and with the MTP OPC of the NP GTT function.

7.1.3.2 Performing Nonfinal GTT for a Ported DN

If the GTT data associated with the ported DN indicates a translation that is not final (i.e., SSN is set to zero), the NP GTT function will populate the SCCP called party address with the received GTA. The NP GTT function will indicate further SCCP routing is to be based on GTT. It will retransmit the message with the MTP DPC derived from the translation and with the MTP OPC of the NP GTT function.

7.1.3.3 Performing Final GTT for a Nonported DN

If no ported DN match is found for the GTA in the NP GTT translation tables, the NP GTT function should use the data in the default GTT table to route the message. If the default record indicates a final translation (i.e., SSN is nonzero), the NP GTT function will repopulate the SCCP Called Party Address with the received GTA digits and the SSN derived from the default record. It will indicate that further SCCP routing is to be based on the DPC and SSN derived from the translation. It will retransmit the message with this repopulated SCCP Called Party Address, an MTP DPC set to the DPC derived from the translation and with the MTP OPC of the NP GTT function.

7.1.3.4 Performing Nonfinal GTT for a Nonported DN

If no DN match is found for the GTT in the NP GTT translation tables, and a DN match in the default table indicates a nonfinal translation (i.e., SSN is zero), the NP GTT function should copy the SCCP Called Party Address which contains the received GTA value. The NP GTT function will indicate further SCCP routing is to be based on GTT. It will retransmit the message with the repopulated SCCP Called Party Address, and an MTP DPC derived from the translation and with the MTP OPC of the NP GTT function.

7.1.4 Global Title Translation Requirements

ANSI T1.112 should be used for SCCP information on the format and translation procedures used for each specific service.

7.1.4.1 Calling Name Service

Translation Type 5 has been assigned to Calling Name Presentation. Please refer to ANSI T1.112 for detailed information on this assignment.

The format of the SCCP GTA for Calling Name service is a 10-digit value in the form of NPA-NXX-XXXX.

7.1.4.2 PCS 1900 Short Message Service

Translation Type 10 will be used for delivering originated SMS-PP to the SC.

Translation Type 14 will be used for routing queries to the destination HLR for PCS 1900 Short Message Service.

The format of the SCCP GTA for PCS 1900 Short Message Service is an 11-digit value within North America (1-NPA-NXX-XXXX).

When Country Code (CC) equals 1, the MSISDN in the E.164 GTA contains 11 digits (1-NPA-NXX-XXXX). Global title translation on the first seven digits is required to route to the boundaries (defined by GTT databases) of an area of portability. Within the area of portability, an 11-digit GTT is required for delivery to the final destination network. The output of the final GTT is the DPC and SSN of the destination to which the message is being routed.

When CC is not equal to 1, the E.164 GTA information may contain the maximum number of digits allowed by the numbering plan.

Figure 9 shows an example of delivering terminated SMS-PP using Translation Type 14 to a PCS 1900 ported DN. In this example, it is assumed that the terminating MS is served by the home PLMN and that the NP GTT function is provided in a transit network.
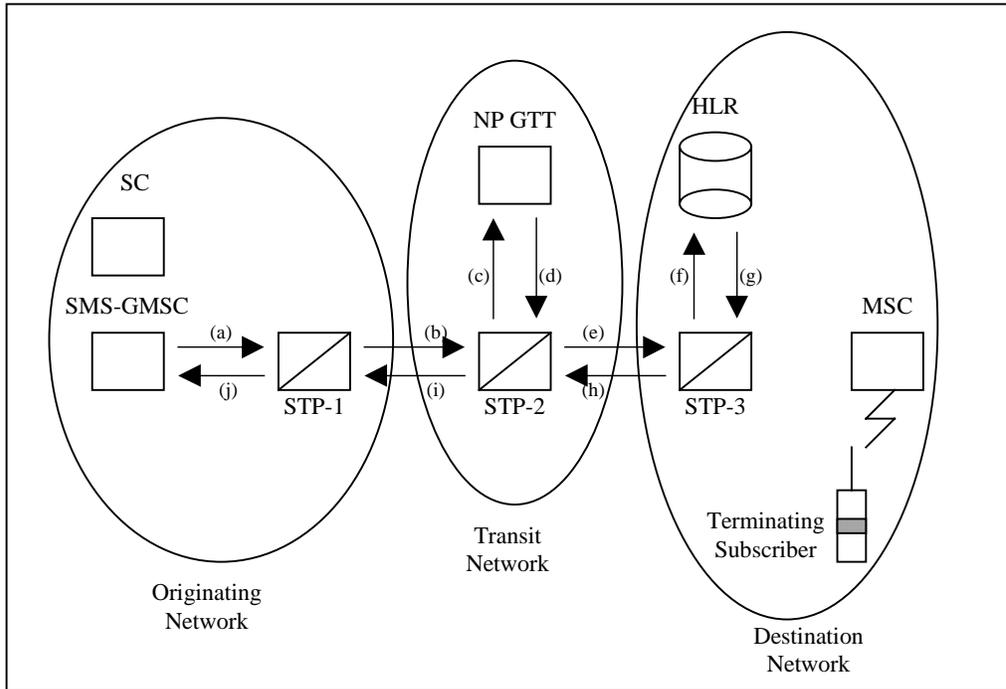

Figure 9 - Delivering PCS 1900 terminated SMS-PP to a ported subscriber

(a) The SMS-GMSC that is responsible for delivering an SMS message to a terminating PCS 1900 subscriber sends a MAP interrogation message (MAP_SEND_ROUTING_INFO_FOR_SM) towards the destination HLR. This message contains the MSISDN of the subscriber in the global title of the SCCP called party address. Because this is a MSISDN address, the SCCP Translation Type is set to 14. The message is MTP routed to STP-1.

(b) STP-1 translates the 1-NPA-NXX portion of the SCCP MSISDN address. The translation result is the destination point code of STP-2 to which the message is then MTP routed.

(c) STP-2 translates the 1-NPA-NXX portion of the SCCP MSISDN address. Because the NPA-NXX is portable, the translation result is the destination point code of an NP GTT function. If the NPA-NXX is not portable, it would be unnecessary to route to an NP GTT function. In this case, routing steps 3 and 4 to the NP GTT function would be omitted.

(d) The NP GTT function translates the entire 1-NPA-NXX-XXXX digits of the SCCP MSISDN address. The translation result is the SSN and the DPC of the terminating subscriber's HLR. The message is MTP routed via STP-2.

(e) STP-2 MTP routes the message to STP-3.

(f) STP-3 MTP routes the message to the HLR.

(g) The HLR retrieves the E.164 address of the MSC currently serving the called party and returns this in the MAP response to the SMS-GMSC. The response message can be either MTP or SCCP routed back to the SMS-GMSC. If MTP routing is used, the message is routed using DPC and SSN, and steps h to j are skipped. If SCCP routing is used, the GTA will contain the SMS-GMSC E.164 address and the SCCP Translation Type is set to 10. The message is routed first to STP-3.

(h) STP-3 translates the SMS-GMSC E.164 address and routes the message to STP-2.

(i) STP-2 translates the SMS-GMSC E.164 address and routes the message to STP-1.

(j) STP-1 translates the SMS-GMSC E.164 address and routes the message to the SMS-GMSC. The SMS-GMSC can now complete the terminating SMS-PP transfer by sending the SMS message to the MSC address returned by the HLR.

7.1.5 NP GTT Provisioning

For each service supported by an NP GTT, two sets of data should be provided to support the NP GTT function. The first set of data, which provides ported subscriber information, is provided via the NPAC-SMS to the LSMS for provisioning the NP GTT. For any service, this data would generally be updated in the NPAC-SMS whenever a subscriber ports into or out of any network supporting the service.

The second set of data represents default GTT information. Default GTT information is not provided by the NPAC-SMS. Each service provider is required to set up their own default GTT database. This may be achieved by deploying one of the following:

- Manually provisioning the default tables.
- Use of existing network specific provisioning systems.
- Provisioning via the LSMS dependent on the service provider's LSMS capabilities.

The default information for any given service contains the SCCP routing information used for routing to non-ported subscribers and to subscribers outside the area of portability covered by the NP GTT. It may be based on 6, 7 or more digits (e.g., NPA-NXX or 1-NPA-NXX) depending on the service and the needs of the individual service provider.

7.2 Short Message Service (SMS)

SMS-PP is a service that allows an entity to send a short message to a PCS 1900 mobile subscriber. SMS-PP comprises of two basic parts: Mobile Originated SMS-PP and Mobile Terminated SMS-PP.

For a Mobile Originated SMS-PP, the following scenarios may be supported:

- The originating Short Message (SM) is sent to the Service Center (SC) serving the originating mobile subscriber. This is the case when the Subscriber Identity Module (SIM) based SC-address is used or the Mobile subscriber inputs the address of the SC.

- The originating SM is sent to the SC currently serving the ported mobile called party. This is the case when the entity originating the SMS-PP inputs the address of the SC that serves the mobile called party. The originating entity in this case could be a mobile access or a fixed access.

For a Mobile Originated SMS-PP, it is recommended that the MAP_FORWARD_SM message is either MTP routed or SCCP routed using Translation Type 10 to the SC.

For a Mobile Terminated SMS-PP, the following scenarios are supported:

- SMS-PP sent to a MSISDN that has ported from one PCS 1900 PLMN into another PCS 1900 PLMN.

- SMS-PP sent to a MSISDN that has ported into a PCS 1900 PLMN from another non-PCS 1900 PLMN or PSTN.

For a Mobile Terminated SMS-PP, the SMS-GMSC interrogates the HLR using the called party number (MSISDN) received from the SC.

The interrogation consists of a MAP_SEND_ROUTING_INFO_FOR_SM message that is routed to the HLR (see Figure 10) using the subscriber MSISDN received from the SC in the SCCP called party address. If the MSISDN is a portable number, an NP GTT function is used to translate the entire MSISDN which comprises an 11-digit 1-NPA-NXX-XXXX number. The translation result of the NP GTT function gives the DPC and SSN of the destination HLR or the DPC of another node capable of routing to the destination HLR.

Routing using the subscriber MSISDN in the SCCP called party address may also be used for an SMS-PP Delivery Status report when sending a MAP_REPORT_SM_DELIVERY_STATUS message from the SMS-GMSC to the HLR. This will also use the NP GTT function to correctly route the message when the MSISDN is portable.

Figure 10 shows the principal interactions in supporting the PCS 1900 SMS-PP in a Number Portability environment. For simplicity, the SC, SMS-IWMSC, and SMS-GMSC entities are assumed to be part of the SC, and the NP GTT function is not shown. The highlighted arrow indicates the single PCS 1900 SMS related message that is affected by NP.
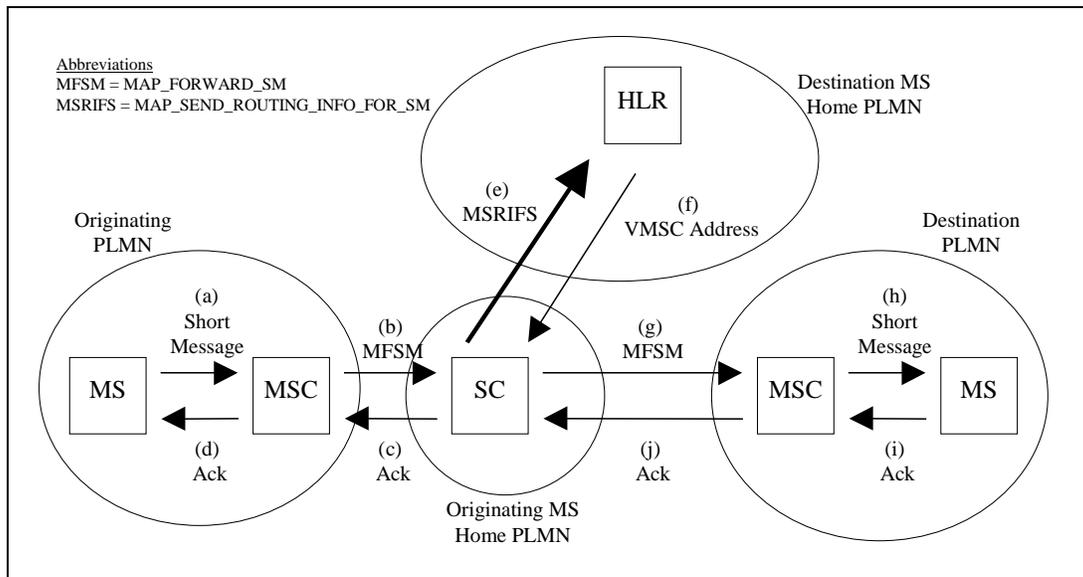
Figure 10 - PCS 1900 SMS-PP origination and termination

(a) The originating MS sends a short message to its MSC.

(b) The MSC forwards the short message to the originator's SC in the originator's home PLMN.

(c) The SC acknowledges receipt of the short message.

(d) The MSC confirms delivery of the short message to the originator's SC.

(e) The SC interrogates the destination MS's HLR for the address of the MSC serving the destination MS. The interrogation consists of a MAP_SEND_ROUTING_INFO_FOR_SM message that is routed to the HLR using the subscriber MSISDN received from the SC in the SCCP called party address. Because this is a MSISDN address, the SCCP translation type is set to Translation Type 14. If the MSISDN is a portable number, an NP GTT function is used to translate the entire MSISDN, which comprises an 11-digit 1-NPA-NXX-XXXX number.

(f) The HLR returns the MSC E.164 address to the SC.

(g) The SC forwards the short message to the destination MSC.

(h) The MSC delivers the short message to the destination MS over the air interface.

(i) The MS acknowledges receipt of the short message.

(j) The destination MSC confirms delivery of the short message.

7.3   Calling Name Presentation (CNAP)

If the calling party number is ported, the switch sends a query to the correct CNDB by using the 10-digit NP GTT (i.e., the GTA contains 10 digits). The MSC populates the SCCP GTA of the query with the 10-digit NPA-NXX-XXXX of the calling party and sets the SCCP Translation Type to 5 (see Figure 8).

7.4   Call Forwarding Unconditional (CFU)

If the translation of either a nonported number in the called party number parameter or the ported number in the GAP parameter of a received ISUP IAM yields a terminating party with CFU active, and the "forwarded to" number is a portable number, an NP query is initiated using the "forwarded to" number. The response to this query is processed as given below.

If the "forwarded to" number is ported (i.e., LRN is returned), the call is routed using the LRN as specified in section 5.3.2.1(d) of ANSI T1.708.

If the "forwarded to" number is not ported (i.e., forwarded to number is returned), the call is routed using the "forwarded to" number as follows:

> If the selected outgoing trunk uses ISUP signaling, then in addition to the existing ISUP optional parameters, the Initial Address Message (IAM) for the "forwarded to" leg will be populated as:
>
> - The ISUP Called Party Number (CdPN) parameter is populated with the "forwarded to" number, and
> - The FCI parameter bit M is set to "number translated" to indicate to succeeding switches that a query to the NP database has been done.
> - Any "Ported Number" GAP in the received IAM is removed.
>
> If the selected outgoing trunk group uses MF signaling, then the FCI information is not outpulsed. Only the new number is sent.

If an error or time-out occurs, the call is routed using the "forwarded to" number as specified in 5.3.2.3(d) and 5.3.2.4(d) of ANSI T1.708.

If the "forwarded to" number is not a portable number, the call setup to the "forwarded to" leg should not contain the "Ported Number" GAP and the FCI parameter bit M should be set to "number not translated".

7.5   Call Forwarding Busy (CFB)

If the translation of either a nonported number in the called party number parameter or a "ported number" in the GAP parameter of a received ISUP IAM yields a terminating party with CFB active, and the "forwarded to" number is a portable number, an NP query is initiated using the "forwarded to" number. The response to the query is processed as specified in 7.4.

If the "forwarded to" number is not a portable number, the call setup to the "forwarded to" leg should not contain the "Ported Number" GAP and the FCI parameter bit M should be set to "number not translated".

7.6 Call Forward No Reply (CFNRy)

If the translation of either a nonported number in the called party number parameter or a "ported number" in the GAP parameter of a received ISUP IAM yields a terminating party with CFNRy active, and the "forwarded to" number is a portable number, an NP query is initiated using the "forwarded to" number. The response to the query is as specified in 7.4.

If the "forwarded to" number is not a portable number, the call setup to the "forwarded to" leg should not contain the "Ported Number" GAP and the FCI parameter bit M should be set to "number not translated".

7.7 Call Forward on mobile subscriber not reachable (CFNRc)

If the translation of either a non-ported number in the called party number parameter or a "ported number" in the GAP parameter of a received ISUP IAM yields a terminating party with CFNRy active, and the "forwarded to" number is a portable number, an NP query is initiated using the "forwarded to" number. The response to the query is processed as specified in section 7.4.

If the "forwarded to" number is not a portable number, the call setup to the "forwarded to" leg should not contain the "Ported Number" GAP and the FCI parameter bit M should be set to "number not translated".

7.8 Multiparty Service (Conference)

If the called number of the member being added to the conference is a portable number, the NP database should be queried. The response to this query is processed given below.

If the new number is ported (i.e., LRN is returned), the call is routed using the LRN as specified in 5.3.2.1(d) of ANSI T1.708.

If the new number is not ported (i.e., the new number is returned), the call is routed using the number as follows:

> If the selected outgoing trunk uses ISUP signaling, then in addition to the existing ISUP optional parameters, the Initial Address Message (IAM) for the new leg will be populated as:
>
> - The ISUP Called Party Number (CdPN) parameter is populated with the new number, and
> - The FCI parameter bit M is set to "number translated" to indicate to succeeding switches that a query to the NP database has been done.
>
> If the selected outgoing trunk group uses MF signaling, then the FCI information is not outpulsed. Only the new number is sent.

If an error or time-out occurs, the call is routed using the new number as specified in 5.3.2.3(d) and 5.3.2.4(d) of ANSI T1.708.