

# Oracle® Communications

## DSR Mobile Number Portability User Guide



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# Contents

## 1 Introduction

---

1.1	Overview	1-1
1.2	Scope and Audience	1-1
1.3	Manual Organization	1-1
1.4	My Oracle Support	1-1

## 2 Mobile Number Portability Feature Description

---

2.1	G-Port MNP Overview	2-1
2.1.1	G-Port Message Handling	2-9
2.1.2	G-Port Functions	2-19
2.2	ATI NP Overview	2-21
2.2.1	ATI NP Message Handling	2-22
2.3	INPQ Overview	2-27
2.3.1	INPQ Message Handling	2-28

## 3 MNP Configuration

---

3.1	MMI Managed Objects for MNP	3-1
3.2	MMI Managed Objects for ATI NP	3-2
3.3	MMI Managed Objects for INPQ	3-5
3.4	Configuration for UDR	3-9
3.4.1	Network Redundancy for UDR Using Multiple Prioritized Comagent Connection Groups	3-12

## 4 MNP Alarms and Measurements

---

## 5 vSTP IDP Relay and MOSMS

---

5.1	Prepaid IDPR Overview	5-1
5.1.1	Prepaid IDP Query Relay Overview	5-1
5.1.1.1	IDP Relay High Level Message Flow	5-2

5.1.1.2	NPP Processing for IDP Relay	5-12
5.1.1.3	Post-NPP Processing	5-25
5.1.2	IDP Relay Additional Subscriber Data Feature	5-26
5.1.3	IDP Relay Generic Routing Number Feature	5-26
5.1.4	IDP A-Party Blacklist Feature	5-27
5.1.4.1	Feature Description	5-27
5.1.5	IDP A-Party Routing and IDP Service Key Routing Features	5-28
5.1.5.1	Feature Description	5-28
5.1.6	IDP Screening for Prepaid Feature	5-32
5.1.6.1	Feature Description	5-32
5.1.6.2	Call Flow	5-33
5.2	MOSMS Overview	5-35
5.2.1	System Options for MO SMS Features in GSM Networks	5-37
5.2.2	MO-Based GSM SMS NP	5-39
5.2.2.1	Options	5-39
5.2.2.2	MO-Based GSM SMS NP Protocol Handling	5-39
5.2.2.3	MO-Based GSM SMS NP Call Flows	5-40
5.2.3	Portability Check for Mobile Originated SMS	5-42
5.2.4	Prepaid Short Message Service Intercept	5-44
5.2.4.1	Prepaid Short Message Service Intercept Call Flows	5-47
5.2.5	Numbering Plan Processor for MO SMS Features	5-50
5.2.5.1	NPP Provisioning	5-53
5.3	IDPR and MOSMS Configurations	5-57
5.3.1	MMI Managed Objects for IDPR and MOSMS	5-57
5.3.2	Configuration for UDR	5-61
5.3.3	IDPR and MOSMS Alarms and Measurements	5-64

## 6 vSTP G-Flex Feature

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6.1	Feature Overview	6-1
6.1.1	Number Conditioning	6-2
6.1.2	G-Flex Call Flows	6-3
6.2	G-Flex Relay Function Description	6-6
6.2.1	Conversion of National/Local Numbers to International Numbers	6-8
6.2.2	Conversion of E.214 MGT to E.212 IMSI	6-9
6.2.3	GDB Lookup	6-10
6.2.4	Message Forwarding	6-10
6.3	G-Flex MAP Layer Routing (G-Flex MLR) Feature	6-12
6.3.1	G-Flex MAP Layer Routing	6-12
6.4	G-Flex Configurations	6-17
6.4.1	MMI Managed Objects for IDPR and MOSMS	6-18

6.4.2	G-Flex Alarms and Measurements
6.4.3	Dependencies

6-20
6-21

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# What's New in This Guide

This section lists the documentation updates for Release 9.0.0.0.0 in Oracle Communications Diameter Signaling Router Mobile Number Portability User Guide.

## **Release 9.0.0.0.0 - F79730-01, April 2023**

There is no update done in this release.

# 1

## Introduction

This chapter provides a brief description of the Mobile Number Portability (MNP) feature for Oracle Communications Diameter Signaling Router (DSR). The chapter also includes the scope, audience, and organization of the manual; how to find related publications; and how to contact Oracle for assistance.

### 1.1 Overview

This manual describes the Mobile Number Portability (MNP) feature for DSR using vSTP. MSN allows subscribers to retain their original MSISDN when subscribing to another network.

MNP is an optional feature on DSR and can be enabled and disabled administratively using the `VstpMnpOptions` in vSTP.

### 1.2 Scope and Audience

This manual is intended for anyone responsible for installing, maintaining, and using the MNP feature on Oracle Communications DSR. Users of this manual and the others in the DSR family of documents must have a working knowledge of telecommunications and network installations.

### 1.3 Manual Organization

This manual is organized into the following chapters:

- [Introduction](#) contains general information about the MNP documentation, the organization of this manual, and how to get technical assistance.
- [Mobile Number Portability Feature Description](#) provides a functional description of the MNP feature, including network perspectives, assumptions and limitations, a database overview, describes MNP functionality, and MNP user interface.
- [MNP Configuration](#) provides procedures for configuring the MNP feature for use in DSR.
- [MNP Alarms and Measurements](#) describes where to find information about MNP-related events, alarms, and measurement.

### 1.4 My Oracle Support

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Call the Customer Access Support main number at 1-800-223-1711 (toll-free in the US), or call the Oracle Support hotline for your local country from the list at <http://www.oracle.com/us/support/contact/index.html>. When calling, make the selections in the sequence shown below on the Support telephone menu:

1. Select **2** for New Service Request.

2. Select **3** for Hardware, Networking and Solaris Operating System Support.
3. Select one of the following options:
  - For Technical issues such as creating a new Service Request (SR), select **1**.
  - For Non-technical issues such as registration or assistance with My Oracle Support, select **2**.

You are connected to a live agent who can assist you with My Oracle Support registration and opening a support ticket.

My Oracle Support is available 24 hours a day, 7 days a week, 365 days a year.

# 2

## Mobile Number Portability Feature Description

This chapter provides a functional description of the Mobile Number Portability (MNP) feature, including network perspectives, assumptions and limitations, and a database overview. MNP is implemented on both vSTP and diameter networks.

MNP consists of several features described in this chapter; however, this manual concentrates on MNP in general rather than any specific feature.

### 2.1 G-Port MNP Overview

The Global System for Mobile Communications (GSM) Mobile Number Portability (G-Port) feature implements MNP for GSM networks according to ETSI GSM 03.66. In response to governmental mandates for telecommunication networks, this feature focuses on service provider number portability on GSM networks.

G-Port minimizes the challenges for GSM network operators while enabling them to meet regulatory obligations. G-Port supports the Signaling Relay Function (SRF) for direct and indirect routing. SRF-based MNP processing examines MAP messages for ported numbers. For call-related messages, G-Port acts as an NP HLR for exported number by responding with a MAP SRI message; G-Port performs a message relay function for calls to imported numbers and non-call related messages.

The G-Port feature allows subscribers to be moved easily from one Home Location Register (HLR) to another. The G-Port feature applies to ANSI, ITU-I (international), and ITU-N (national) networks.

G-Port performs a number of actions based on the message received and the number status:

- If the number is ported-out or not known to be ported and the message received is a call-related SRI (not-SOR), G-Port sends the SRI Ack message to the MSC with the Routing Number (RN) information in the MAP portion of the message.
- If the number is ported-out and the message received is non-call related (non-SRI), G-Port relays the message and forwards the translated message based on the RN information.
- If the number is non-porting or ported-in, then G-Port performs an HLR translation and forwards the translated message to the HLR.

An additional user option allows the user to configure the G-Port to modify the processing. If the number is not found in the UDR (Number Portability Database) NPDB (individual or range), then G-Port returns a negative acknowledgement in response to an SRI.

#### Message Verification/Decode

- MTP/SCCP Verification  
vSTP does not perform any additional MTP/SCCP verification for G-Port. G-Port uses the information decoded by SCRC.
- General TCAP/MAP Verification  
TCAP/MAP verification is performed on all messages.

Any error found in the message verification process does not generate any error responses. G-Port aborts verification and performs message relay on the message using the decoded SCCP information. The Event information is printed to report the error.

- **MAP Verification**  
G-Port performs no MAP verification like validation of ACN or decoding of user information. G-Port looks at the operation code of the message to distinguish SRI messages from all other messages. After determining the operation code to be SRI, G-Port looks for the presence of an OR Interrogation Parameter to further distinguish an SRI from an SRI for Optimal routing (SRI-SOR) message. If the OR Interrogation is present or if operation code is not an SRI, then the G-Port message relay is performed. Otherwise, SRI-specific verification is performed.
- **SRI-Specific Verification**  
This verification is performed only for SRI messages. G-Port looks for only the MSISDN parameter. It does not look for the existence of any other parameter even if they are mandatory.

Any error found in this part of the verification process would cause the SRI message to be discarded and an appropriate SRI negative response message is sent back.

### Message Handling

- **RN Prefix Deletion**
  - **SRIDN = 'SCCP'**  
The decoded SCCP CdPA digits may have an RN concatenated with the MSISDN number in two forms 1) RN+DN 2) CC+RN+DN. So, when the SNAI is either RNIDN or RNNNDN or RNLNDN, G-Port compares the decoded MSISDN number with the list of provisioned home RN prefixes defined in the NPDB. If a match is found, then G-Port strips the RN digits from the number. Number conditioning (if required) is performed after deleting the RN. When SNAI is CCRNDN, G-Port first compares the CC to DEFCC/MultCC list. If CC does not equal DEFCC/MultCC, then no prefix deletion is performed and G-Port processing continues. If CC equals DEFCC/MultCC then, G-Port compares the digits after CC with the list of provisioned home RN prefixes defined in the NPDB. If a match is found, then G-Port strip the RN digits from the number. If no match, then no prefix deletion is performed and G-Port processing continues.
  - **SRIDN = 'TCAP'**  
The decoded MAP MSISDN digits may have an RN concatenated with the MSISDN number in two forms. 1) RN+DN 2) CC+RN+DN. The MAP NAI is used to determine the type: international, national, or subscriber. If VstpMnpOptions:MNPCR is *OFF*, RN prefix deletion is not attempted. If VstpMnpOptions:MNPCR is *ON*, then RN prefix deletion is attempted on all MSISDNs. If the MAP NAI indicates international, then a check is performed for DEFCC/MultCC prefix on the MSISDN. If DEFCC/MultCC is detected, then HomeRN deletion is attempted using the CC+RN+DN format. All other MSISDNs use the RN+DN format. G-Port compares the decoded MSISDN number with the list of provisioned home RN prefixes defined in the NPDB. If a match is found, the G-Port strip the RN digits from the number. Number conditioning (if required) is performed after deleting the RN. If CC+RN+DN search is performed, G-Port compares the digits after CC with the list of provisioned home RN prefixes defined in the NPDB. If a match is found, G-

Port strips the RN digits from the number. If no match is found, then no prefix deletion is performed and G-Port processing continues.

The RN Prefix deletion for SRI\_SM, when SRISMDN= SCCP or TCAP, will work in the same manner as it works for SRI message when SRIDN=SCCP or TCAP respectively.

- **Number Conditioning**  
UDR NPDB stores international MSISDNs only. The received MSISDN number or SCCP CdPA digits may need to be converted to an international number to do a database lookup. When G-Port is required to be performed on a message and the number is not international (for example, NAI of MSISDN number is National (Significant) Number or Subscriber Number or SNAI is NATL or SUB or RNNDN or RNLDN), then the national/local to international number is triggered. For a national (significant) number, the received CdPA/MAP MSISDN digits are prepended with the default country code; and for a subscriber number, the CdPA/MAP MSISDN digits are prepended with the default country code and the default network code.
- **Database Lookup**  
G-Port performs the UDR NPDB database lookup using the international MSISDN. The individual number database is searched first and if the number is not found, then the number range database is searched. If a match is not found in individual and range based database, then GTT is performed on the message. In case of MSISDN numbers in the UDR NPDB database being odd and CdPA GTI of the incoming being 2 and the last digit of the number is zero, G-Port first performs a database lookup once using the even number. If no match is found then G-Port again performs the database lookup now using the odd number (without the last digit).

**Table 2-1 Action on Database Lookup Result**

Message Type	MSISDN Found	Entity Result	Portability Type Result	VstpMnpOptions:MNPCR P ON and HomeRN Deleted from Received DN	Action
SRI	Yes	RN	N/A	No	<p>SRI Ack message using RN prefix.</p> <p>NPS is encoded only if these PT values are present with MSISDN:</p> <ul style="list-style-type: none"> <li>- PT=0,1,2 and VstpMnp Options table option ENCOD ENPS is ON OR</li> <li>- PT=null and VstpMnp Options table option ENCDNP SPTNONE is ON.</li> </ul> <p>For PT=null, NPS has a value of 0</p>
SRI	Yes	RN	N/A	Yes	Issue Event #70304 and fall through to GTT
SRI	Yes	SP	N/A	N/A	Forward SRI message to the destination using SP data

Table 2-1 (Cont.) Action on Database Lookup Result

Message Type	MSISDN Found	Entity Result	Portability Type Result	VstpMnpOptions:MNPCR P ON and HomeRN Deleted from Received DN	Action
SRI	Yes	None	0, 1, 2, or null	No	SRI Ack message using MSISDN. PT=none maps to NPS=0 in response. PT=0/1/2 has the values of 0/1/2
SRI	Yes	None	>2	N/A	Fall through and perform GTT
SRI	Yes	None	0, 1, 2, or null	Yes	Issue Event #70304 and fall through to GTT
SRI	No	N/A	N/A	N/A	Fall through and perform GTT
Non-SRI or SRI-SOR	Yes	RN	N/A	No	Forward the message to the next node using RN data
Non-SRI or SRI-SOR	Yes	RN	N/A	Yes	Issue Event #70304 and fall through to GTT
Non-SRI or SRI-SOR	Yes	SP	N/A	N/A	Forward the message to the destination using SP data
Non-SRI or SRI-SOR	Yes	None	N/A	No	Fall through and perform GTT
Non-SRI or SRI-SOR	Yes	None	N/A	Yes	Issue Event #70304 and fall through to GTT
Non-SRI or SRI-SOR	No	N/A	N/A	N/A	Fall through and perform GTT

- Modification of SCCP CdPA

vSTP supports the configuration for new Numbering Plan (NP), Translation Type (TT), and Nature of Address Indicator (NAI) at UDR. UDR also provides an option to cancel GT in the **Base Set** field of Subscriber Entity for MnpSPRN and MnpGRN Entities. This allows G-Port to modify entire SCCP CdPA part of relayed messages. The SCCP CdPA part of a message consists of the following configurations:

- Translation Type
- Numbering Plan
- Nature of Address Indicator

If new values are specified for NAI, NP, or TT, message relay modifies that particular field of the CdPA part. Also, the entire CdPA Global Title is deleted when the **Cancel GT** option is specified. This is applicable, when the Signaling Point (SP) entity received after UDR lookup has  $RI = 1$ , such as route ON SSN.

This functionality also enables configuration of MXXSETID in SP entity data to be used further if the data related to the same ID is configured in vSTP MAP or MRN Set Tables.

The following points must be considered for this functionality:

- CGGT option is applicable on CDPA part of the relayed message if  $RI = 1$ . For example, route ON SSN
- New Numbering Plan, New Translation Type, New Nature Address Indicator can only be applied to CDPA part of the relayed message if entity data has  $RI = 0$ . For example, route on GT
- MXXSETID can be applicable on CDPA part of the relayed message if  $RI = 1$ . For example, route ON SSN
- Both New Number plan and New Nature of Address Indicator can be applied to the CDPA of relayed message if  $GTI = 4$  in the incoming Message

The new fields can be configured in SRPN entity data in **UDR > Configuration > Subscriber Query and Provisioning > Create Profile / Add Entity** section for MNP SPRN select type.

**Example:**

```
<?xml version="1.0" encoding="UTF-8"?>
<MnpSPRN>
  <Type>SP</Type>
  <EDigit>654321</EDigit>
  <RI>0</RI>
  <PC>0-255-4</PC>
  <PCDom>itui</PCDom>
  <SSN>7</SSN>
  <SRFIMSI>11232311</SRFIMSI>
  <DigAct>INSERTENTITYID</DigAct>
  <NNP>3</NNP>
  <NTT>8</NTT>
  <NNAI>23</NNAI>
  <MXXSETID>2</MXXSETID>
</MnpSPRN>
```

### Mobile Terminated GSM SMS NP

MT-SMS messaging involves the SMSC or MMSC querying the HLR for destination subscriber for SMS delivery. For the GSM network, these query messages are called SRI\_SM. The HLR response to these messages includes routing information that can be used by the query generator (SMSC) to deliver the SMS message. The G-Port service intercepts these MT-SMS messages destined to the HLR and replies with routing information for out-of-network destination subscribers.

The MT-SMS NP feature:

- Intercepts SMS routing information request from SMSC/MMSC before it reaches the HLR.
- Extracts the message destination address (MAP MSISDN or SCCP Called Party GTA based on SRISMDN parameter value in VstpMnpOptions table), conditions the digits, and performs the lookup in the NPDB.
- For destination address/subscribers belonging to foreign networks, sends a reply message to the SMSC/MMSC with routing information. This information can be used by the SMSC to route the message to their recipient networks using protocols like SMPP.
- For in-network destination addresses, the SMS routing information request is relayed to the HLR.

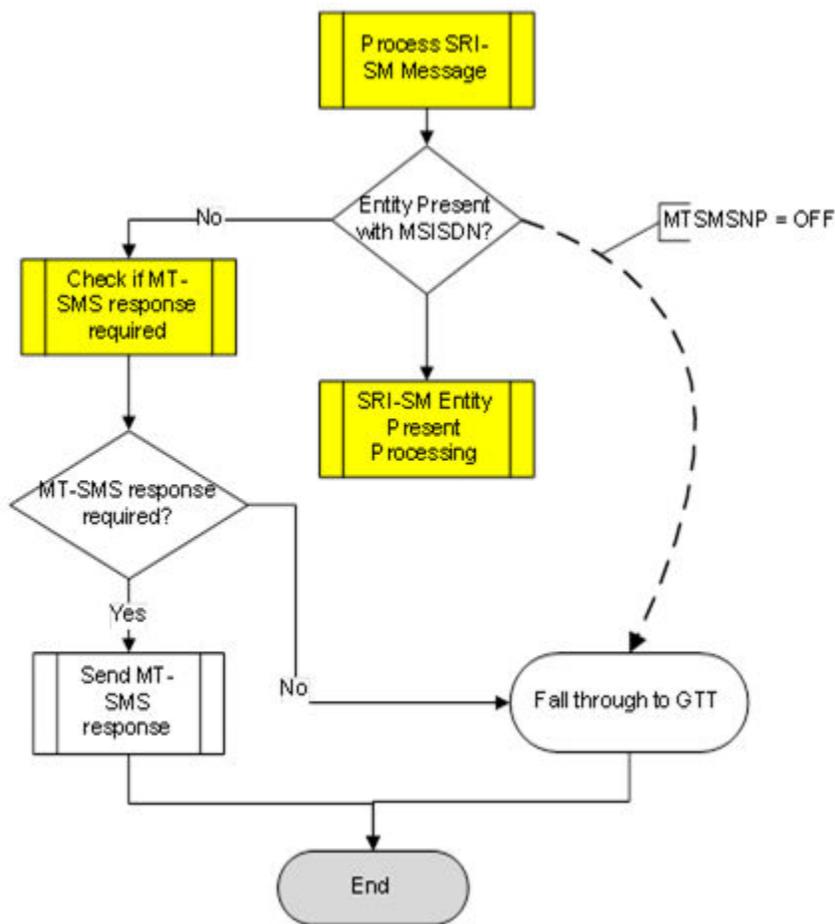
### MT-SMS NP Processing

The SMSC (or MMSC) sends the SRI\_SM message to vSTP (with a destination of the HLR) with SCCP CdPA GTA (or MAP MSISDN based on SRISMDN parameter value in VstpMnpOptions table) as the DN of the destination subscriber to be GT routed to the HLR.

The service selector configured to channel MSUs to the G-Port service has a service NAI (SNAI) parameter.

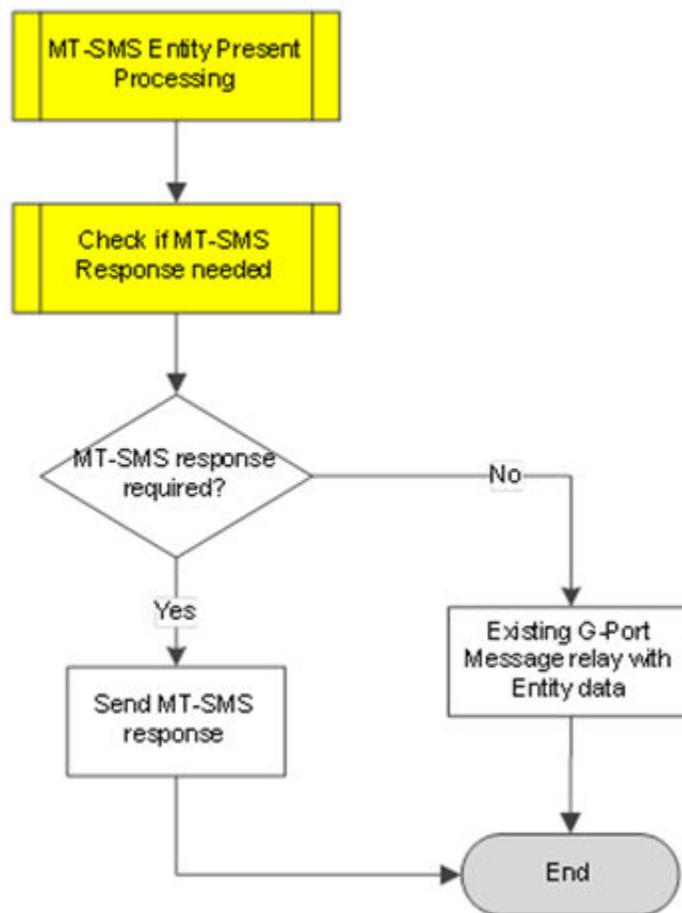
Existing handling of SRI\_SM for GT-routed, ANSI/ITU MTP/SCCP, ITU TCAP/MAP, encapsulated in either non-segmented XUDT or UDT SCCP message type, matching G-Port service Selector involves detailed MSU decode/encode information.

Figure 2-1 G-Port SMS-MT Processing for No Entity Case



If an entity was found in the UDR NPDB lookup, the existing behavior of G-Port is to check for MNP Circular Route Prevention, or generate SRI\_SM\_NACK. If NACK is not required, relay the message to the node specified by EPAP entity. In case G-Port fails to relay the message, it falls through to the GTT. This is the default existing G-Port relay mechanism for SRI\_SM message.

Figure 2-2 G-Port SMS-MT Processing for Entity Found Case



## 2.1.1 G-Port Message Handling

This procedure describes how G-Port handles a message.

1. The message arrives at vSTP route-on-gt. vSTP decodes the SCCP portion and uses the data to perform G-Port Selection based on the CdPA GT fields other than the ES and GTAI. The result of this selection provides service indicator. The service indicator is G-Port if MNP-SRF is required. If a service selector does not match the incoming GT fields, then GTT selection is attempted.
2. If step 1 indicates MNP-SRF is required and the message is not a UDTs generated by vSTP, vSTP then performs SSN-based discrimination. If the message is a UDTs generated by the vSTP, then regular GTT is performed on the message.
3. MNP-SRF first decodes the Operation Code of the MAP message to distinguish SRI/ SRI\_SM message from the rest. If the Operation Code is SRI and the OR Interrogation indicator is absent, and the VstpMnpOptions:SRIDN = "TCAP", then the MSISDN parameter is decoded from the MAP portion of the message. If the Operation Code is SRI\_SM, and the VstpMnpOptions parameter SRISMDN = "TCAP", then the MSISDN parameter is decoded from the MAP portion of the message. If the VstpMnpOptions parameter SRIDN (for SRI message) / SRISMDN (for SRI\_SM message) = "SCCP", or if

the message is not SRI or not SRI\_SM, then digits available in the SCCP CdPA GTAI are used for the database lookup.

4. The decoded DN (either from MAP MSISDN or from SCCP CdPA) is conditioned to an international number before performing the UDR NPDB lookup. The conditioning is different based on whether the digits are obtained from TCAP or MAP part of the message.
  - If the digits are from the SCCP part, then number conditioning is based on SNAI value. RN prefix deletion is performed first and then converted to international based on its value. Conversion to international format is based on DefCC and DefNDC, as required. If the incoming number is CCRNDN, DefCC and MultCC is used to determine the Best Match CC to locate the RN digits for RN prefix deletion.
  - If the digits are from the MAP part, then number conditioning is based on NAI of MSISDN parameter. Home RN prefix deletion is performed if VstpMnpOptions:MNPCR is *ON*. The number is converted to international, if needed. Conversion to international format is based on DefCC and DefNDC, as required. If the incoming number is international, DefCC and MultCC is used to determine if the format is CCRNDN or RNIDN. If a Best Match CC is located, then it is used to locate the RN digits for RN prefix deletion.
5. The UDR NPDB database lookup involves:
  - The exception or individual number database is searched for a match. If the match is found, then the data associated with this entry is considered.
  - If the conditioned number is absent in the exception (individual) database, then the number range database is searched. If the match is found, then the data associated with this range entry is considered. If the search is unsuccessful, then the result is no match.
6. If the number is found, and a RN prefix is present for this entry, then:
  - If the message is SRI, and VstpMnpOptions:MNPCR is *OFF*, or if VstpMnpOptions:MNPCR is *ON* and a HomeRN was not present in the incoming DN (for example, a HomeRN was not deleted from the SCCP CdPA/MAP MSISDN), then G-Port generates an SRI Ack message with the RN prefix in the RN parameter.
  - If the message is non-SRI, and VstpMnpOptions:MNPCR is *OFF*, or if VstpMnpOptions:MNPCR is *ON* and a HomeRN was not present in the incoming DN (for example, a HomeRN was not deleted from the SCCP CdPA), then G-Port uses the translation data for the number to alter the CdPA digits and route the message to the destination.
  - If the message is SRI or non-SRI, and VstpMnpOptions:MNPCR is *ON*, and a HomeRN was present in the incoming DN (for example, a HomeRN was deleted from the SCCP CdPA/MAP MSISDN), then G-Port generates Event #70304 and the message falls through to the GTT. In most network implementations, since the message contains RN+DN, this should cause a GTT failure, which results in vSTP sending a UDTs to the originator if the return message on error flag was set in the incoming UDT.
  - If VstpMnpOptions:SRISMGTTTRTG is *ON*, then the SRI\_SM and ReportSMDeliveryStatus messages is not relayed. Instead, the CdPA GTA in the message is modified in CC+RN+DN format (or RN+IDN format if CC match is not found in leading digits). The NAI of CdPA GTA is set to international and the message falls through to the GTT.

7. If the number is found and an SP entity is present for this entry, then G-Port uses the SP translation data for the number to route the message to the destination. This is true whether or not the VstpMnpOptions:MNPCR option is *ON*. However, if GRN is also associated (along with SP entity) with the DN and the GRN is not present in the HomeRN table and VstpMnpOptions:SRISMGTTTRTG is *ON*, then the SRI\_SM and ReportSMDeliveryStatus messages are not relayed. Instead, the CdPA GTA in the message is modified in CC+GRN+DN format (or GRN+IDN format if the CC match is not found in leading digits). The NAI of CdPA GTA is set to international and the message falls through to the GTT.
8. If the number is found and neither SP nor RN data is associated with it (this is a direct routing case with the number not known to be ported or not identified to be ported), then
  - If the message is SRI, and VstpMnpOptions:MNPCR is *OFF*, or if VstpMnpOptions:MNPCR is *ON* and no HomeRN was present in the incoming DN (for example, a HomeRN was not deleted from the SCCP CdPA/MAP MSISDN), and if the portability type associated with the DN entry is other than 3-35, then G-Port generates a SRI Ack message with the MSISDN in the RN parameter. If the message is SRI, and VstpMnpOptions:MNPCR is *OFF*, or if VstpMnpOptions:MNPCR is *ON* and no HomeRN was present in the incoming DN (for example, a HomeRN was not deleted from the SCCP CdPA/MAP MSISDN), and the portability type associated with the DN entry is 3-35, then the SRI falls through to GTT (that is, no SRI Ack message is generated).
  - If NPS parameter is encoded in the SRI Ack message
    - VstpMnpOptions:ENCODENPS=ON and DN is associated with PT =0, 1, 2 (foreign number)
    - VstpMnpOptions:ENCDNPSPTNONE=ON and DN is associated with PT = null (deemed foreign number)
  - If the message is non-SRI, and VstpMnpOptions:MNPCR is *OFF*, or if VstpMnpOptions:MNPCR is *ON* and no HomeRN was present in the incoming DN (for example, a HomeRN was not deleted from the SCCP CdPA), then the message falls through to the GTT.
  - If the message is SRI or non-SRI, and VstpMnpOptions:MNPCR is *ON*, and a HomeRN was present in the incoming DN (for example, a HomeRN was deleted from the SCCP CdPA/MAP MSISDN), then G-Port generates Event #70304 and the message falls through to the GTT. In most network implementations, since the message contains RN+DN, this should cause a GTT failure, which results in vSTP sending a UDTs to the originator if the return message on error flag was set in the incoming UDT.
9. If the number is not found in the UDR NPDB, then the VstpMnpOptions:SRIDNNOTFOUND option is consulted if query is not SRI prepaid. If the query is identified to be an SRI prepaid, then an SRI Ack message is sent back. NPS is encoded in the SRI Ack message if VstpMnpOptions:ENCDNPSDNNOTFOUND is ON.
10. If the VstpMnpOptions:SRIDNNOTFOUND option is set to SRINACK, then a negative acknowledgement is generated in response to the given message.
11. If the VstpMnpOptions:SRIDNNOTFOUND option is set to GTT, then GTT is performed on the message.

Figure 2-3 vSTP MNP G-Port Function Flowchart - Sheet 1 of 2

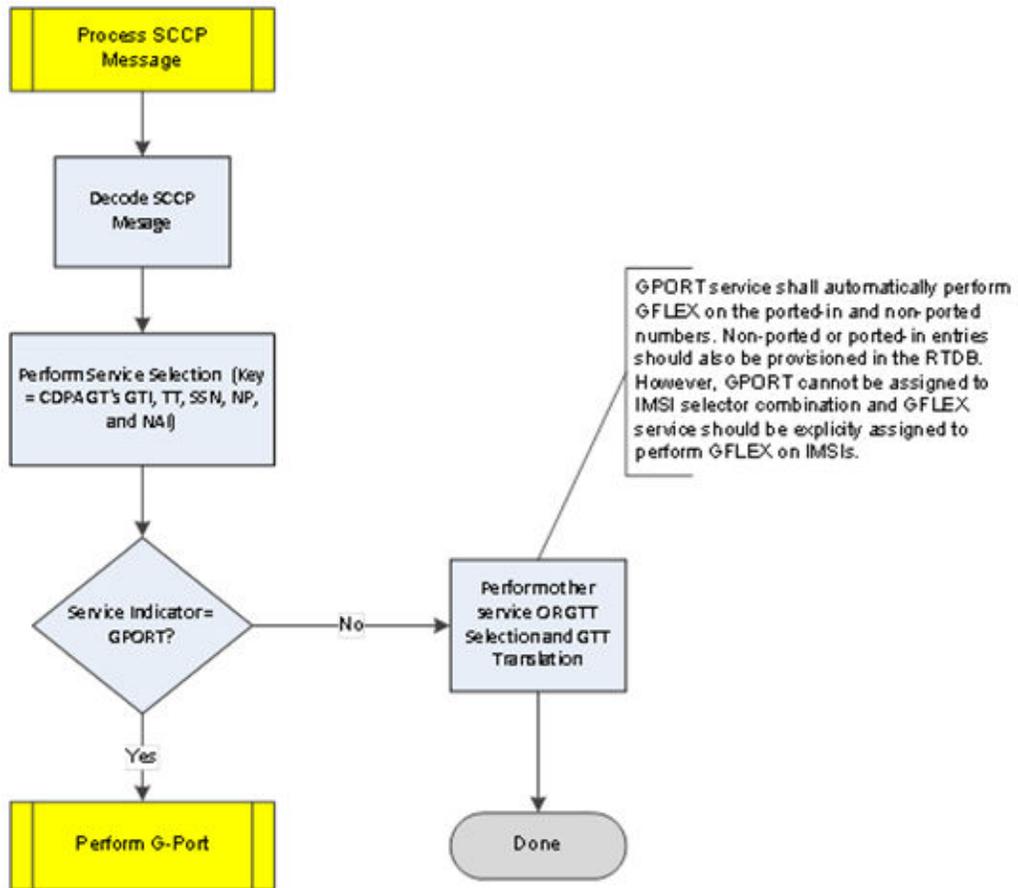


Figure 2-4 vSTP MNP G-Port Function Flowchart - Sheet 2 of 2

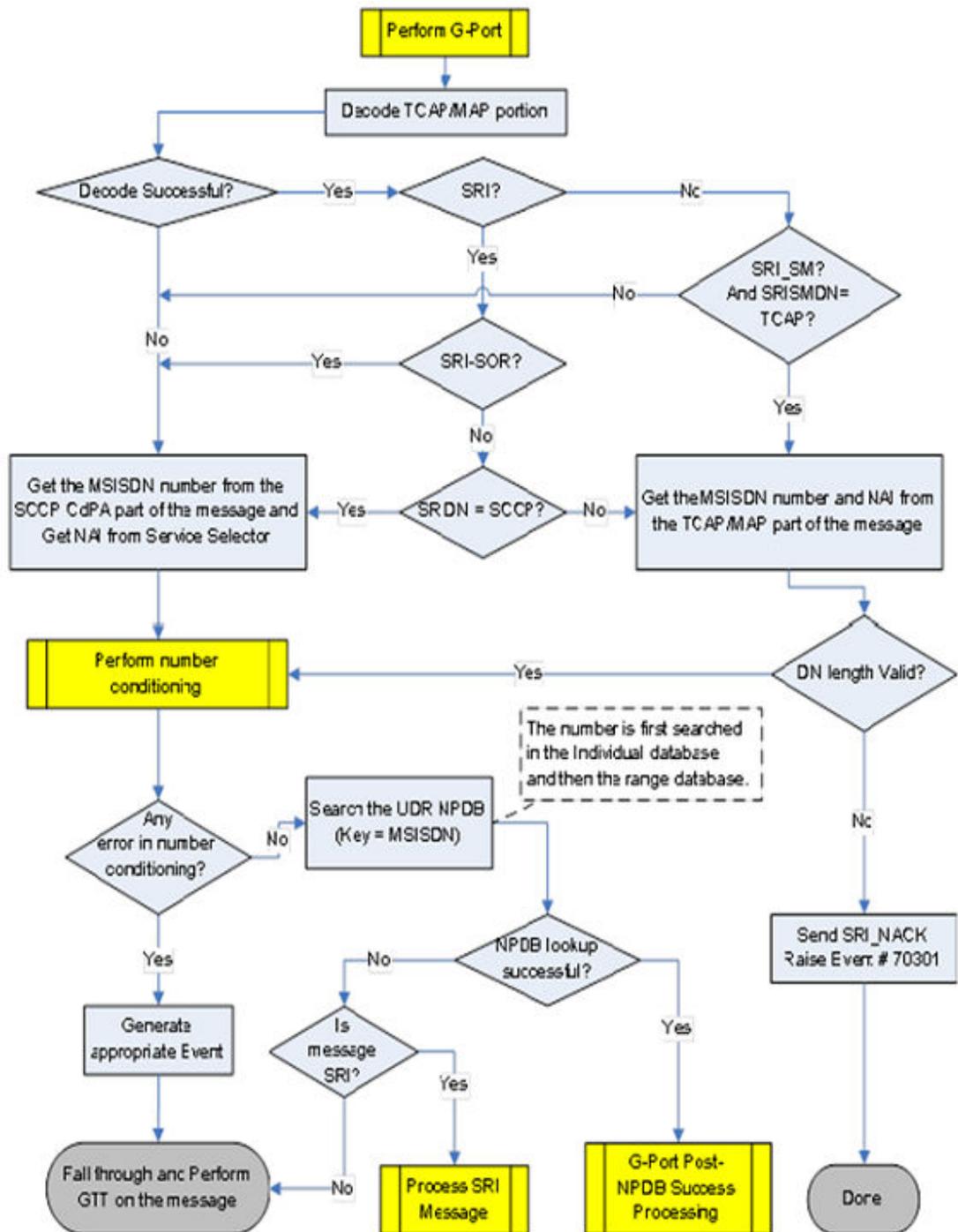


Figure 2-5 G-Port Number Conditioning Flowchart

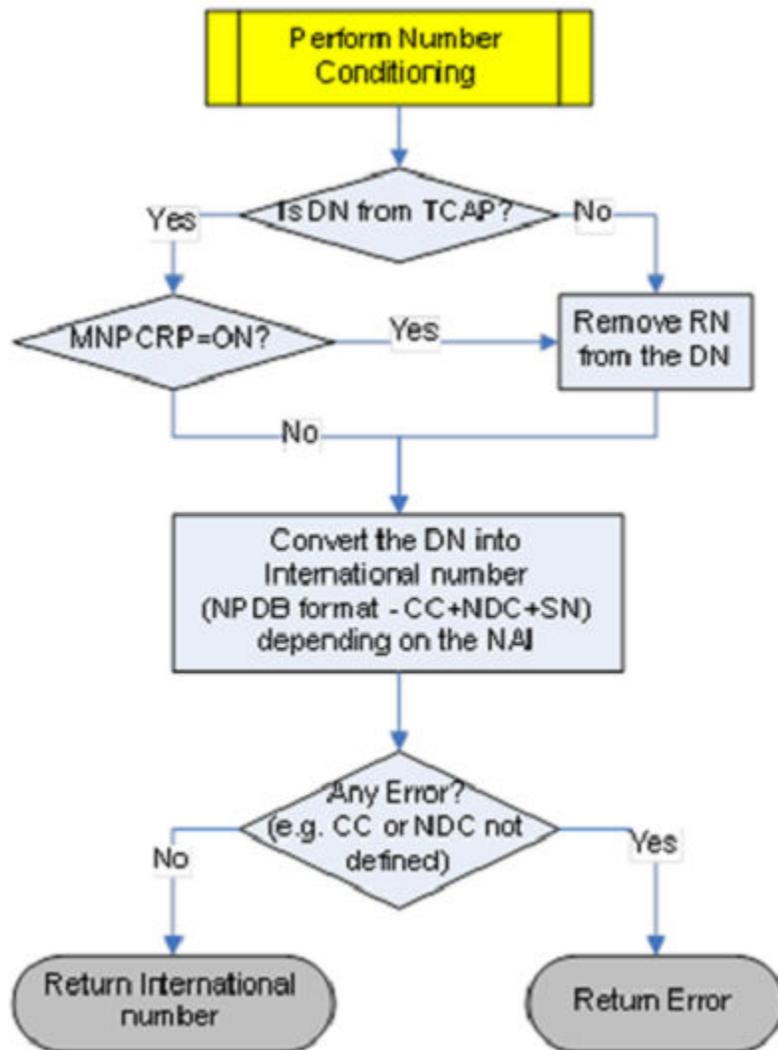


Figure 2-6 G-Port Post-NPDB Lookup Processing Flowchart

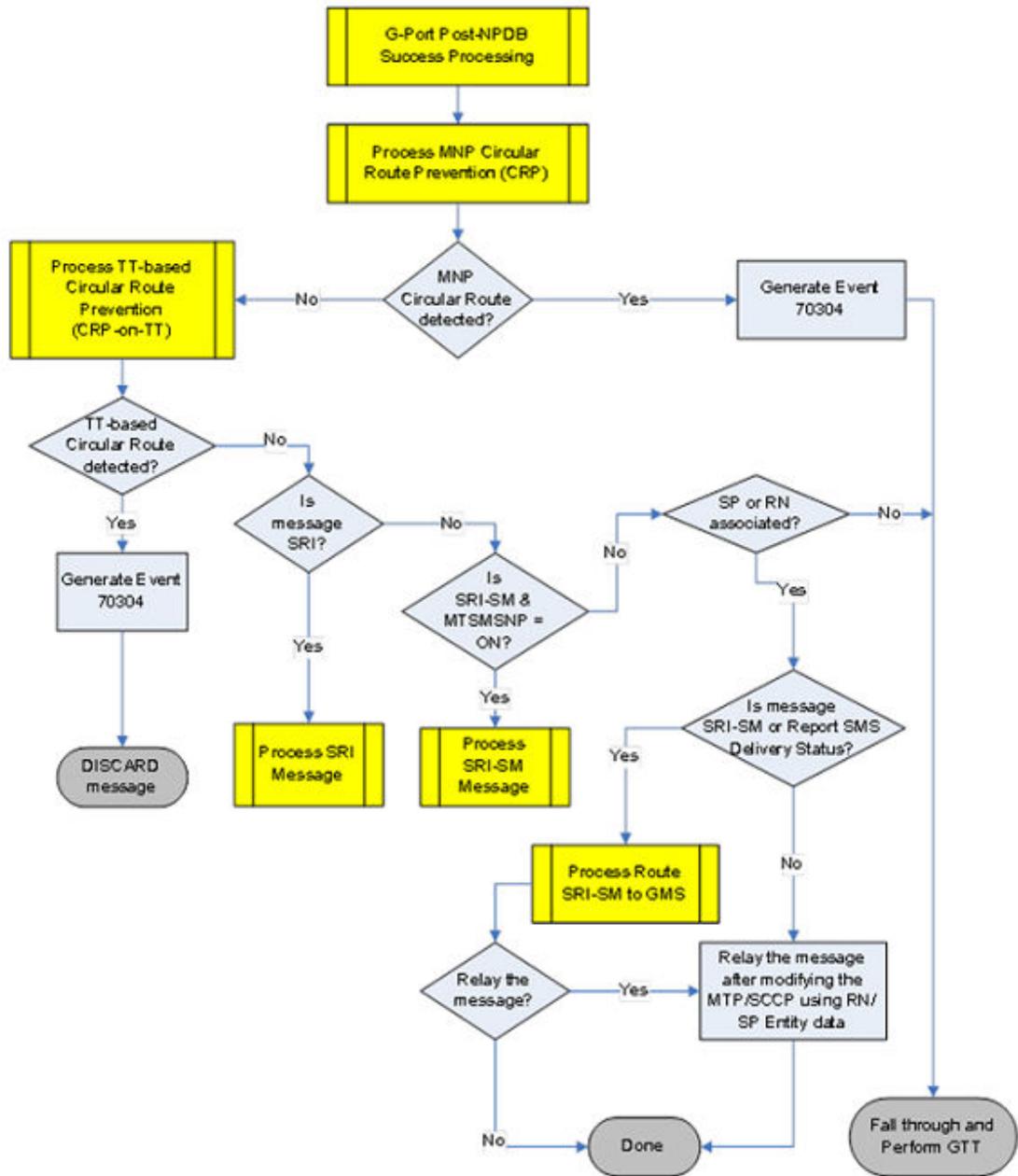


Figure 2-7 G-Port MNP CRP Flowchart

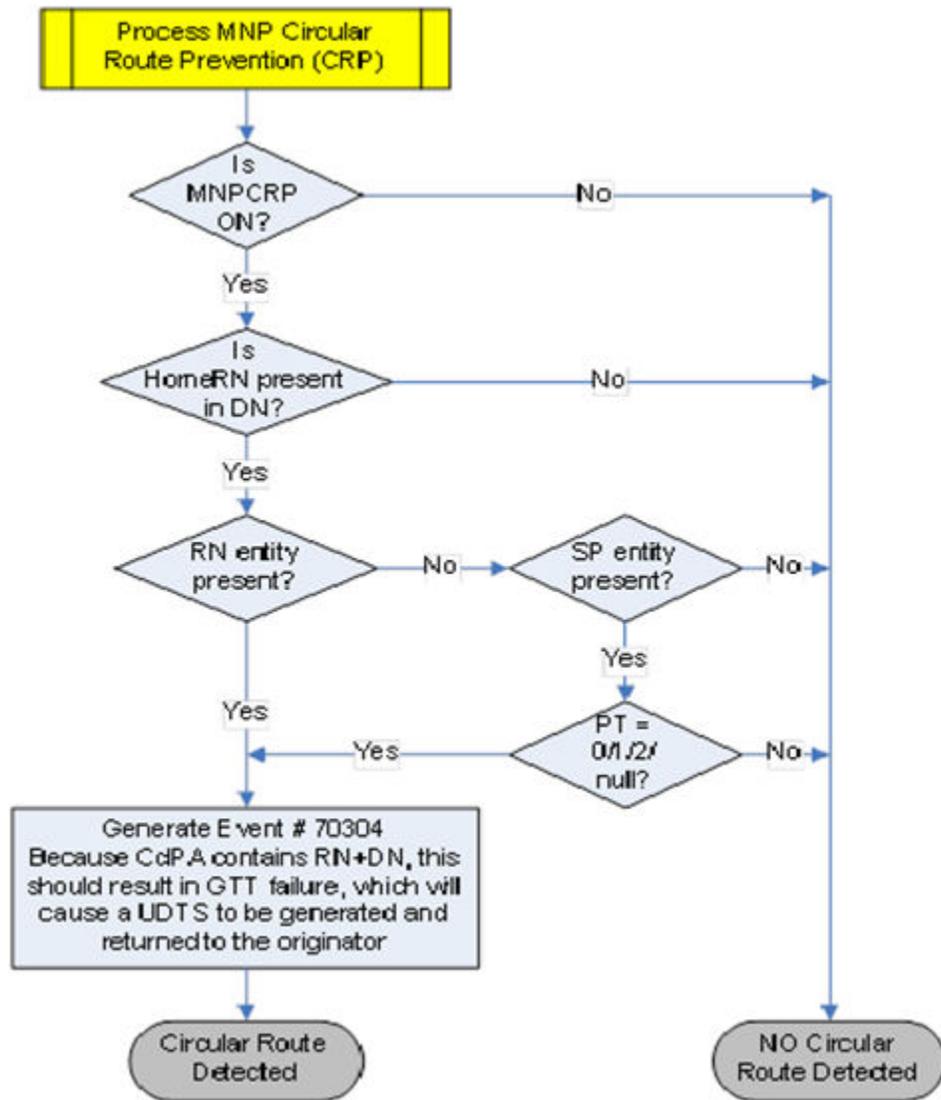


Figure 2-8 G-Port CRP on TT Flowchart

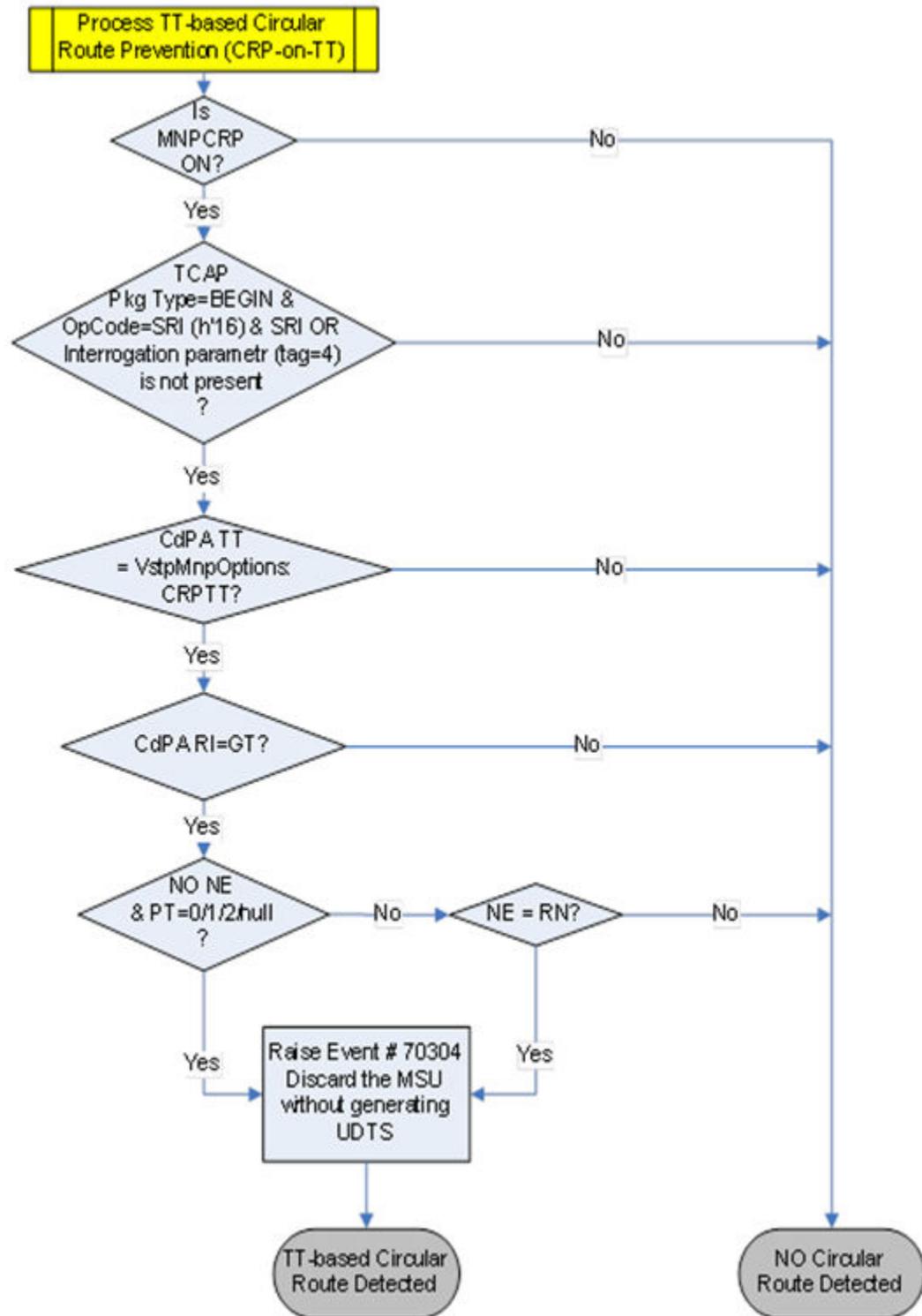


Figure 2-9 G-Port SRI Processing Flowchart

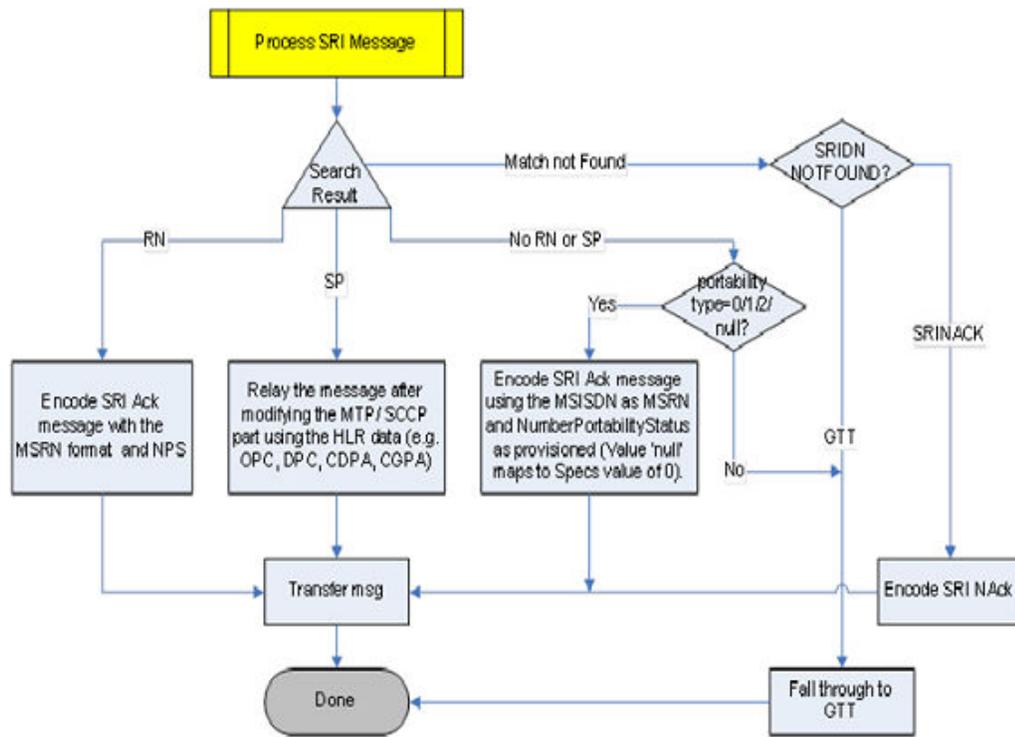
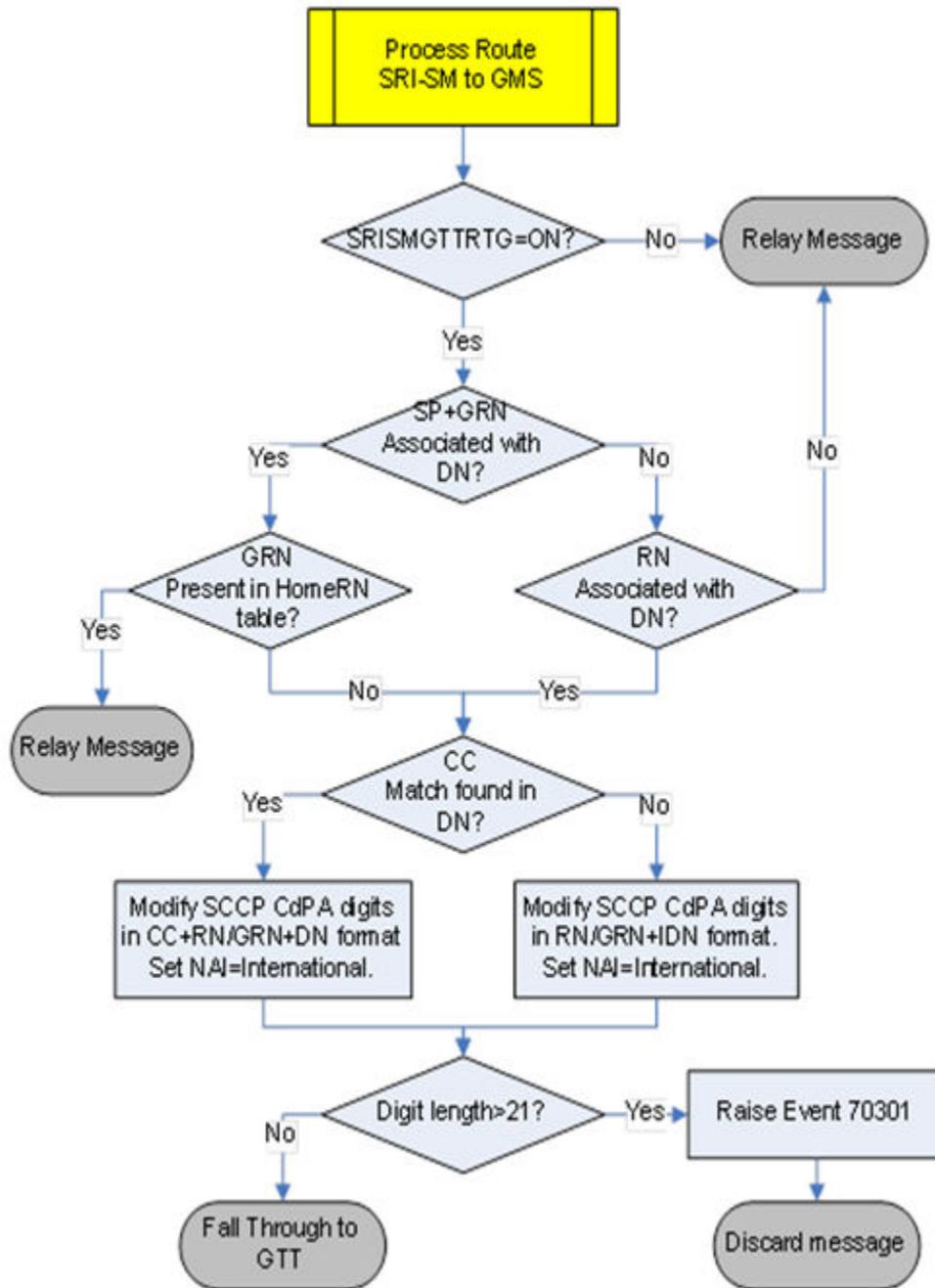


Figure 2-10 G-Port Function Flowchart (VstpMnpOptions:SRISMGTTRTG to GMSC)



## 2.1.2 G-Port Functions

G-Port involves these main functions.

### Message Discrimination

Since G-Port is currently only used for translation of ported numbers. It provides a method to identify which messages should receive G-Port versus GTT. This is provided using a service

selector table where one can define the G-Port service for a combination of selectors. If a selector match is not found, then G-Port falls through to GTT.

### Number Conditioning

Since the UDR NPDB stores International MSISDNs only, G-Port provides the capability to condition incoming numbers to be international MSISDNs (for example, delete routing number prefix or insert CC or/and NDC ) for the database lookup. Also, messages with a ported-in number in SCCP CdPA or MAP MSISDN might have an RN prefix. G-Port strips the RN prefix and conditions the non-international numbers to international numbers, if needed, before performing a database lookup.

### SRI Response

When the incoming SRI message does not already contain an RN in the SCCP portion, or if the VstpMnpOption:MNPCR is Off, G-Port generates an SRI Ack message for an SRI message when the number is a foreign number and an RN is associated with the DN in the database. When neither an RN nor SP is associated with a MSISDN in the database, G-Port formulates an SRI Ack message ONLY for null PT or foreign number PT. For all other cases, the SRI falls through to the GTT. When formulating an SRI Ack message, G-Port uses the RN prefix associated with the MSISDN entry to build the MSRN number or, based on the VstpMnpOption:MSRNDIG to not prefix, returns the RN only. G-Port generates a negative SRI Ack message when encountering any MAP SRI problems. If VstpMnpOption:MNPCR is On and the SRI message already contains an RN in the SCCP portion or MAP MSISDN, then G-Port issues Event #70304 and the message falls through to the GTT. Since the CdPA/MAP MSISDN contains RN+DN, this should result in a GTT failure, which causes a UDTS to be returned to the originator if the Return Message on Error flag was set in the incoming UDT. If MSISDN is provisioned in UDR NPDB with PT values of 0/1/2 (foreign number), the SRI response has an NPS value of 0/1/2. When the PT value is defined as null, it is mapped to an NPS value of (0) in the SRI response.

### G-Port Message Relay

G-Port performs message relay on non-SRI or SRI-SOR (SRI messages with OR Interrogation Indicator present) messages when the MSISDN number is ported. Message relay provides an ability to prefix the routing number to the CdPA digits or replace the CdPA digits with an RN prefix based on the digit actions. If VstpMnpOptions:SRISMGTTTRTG is On, then the SRI\_SM and ReportSMDeliveryStatus messages are not relayed. Instead, the CdPA GTA in the message is modified in CC+RN+DN format (or RN+IDN format if the CC match is not found in leading digits). The NAI of CdPA GTA is set to International and the message falls through to the GTT.

### Message Relay on Ported-In Numbers

G-Port automatically performs SCCP relay on SRI and non-SRI messages for its own numbers (for example, an SP is associated with the DN in the database). However, the non-porting (PT=4) or ported-in (PT=5) entries should be present in the UDR NPDB and SP entity should have been defined for this entry. This applies even in the case when VstpMnpOptions:MNPCR is On and the message contains an RN in the incoming SCCP. If GRN is also associated (along with SP entity) with the DN and the GRN is not present in the HomeRN table and S VstpMnpOptions:SRISMGTTTRTG is On, then the SRI\_SM and ReportSMDeliveryStatus messages are not relayed. Instead, the CdPA GTA in the message is modified in CC+GRN+DN format (or

GRN+IDN format if CC match is not found in leading digits). The NAI of CdPA GTA is set to International and the message falls through to the GTT.

## 2.2 ATI NP Overview

The AnyTime Interrogation Number Portability (ATI NP) feature. An ATI message allows an external server to interrogate an HLR and obtain information about the location and/or state of a GSM subscriber.

Before number portability, SCPs and other querying nodes could easily determine which network the subscriber belonged to based on the digits dialed by the caller. With number portability, subscriber digits cannot be relied upon to determine the subscriber's network.

Anytime Interrogation Number Portability (ATINP) query feature provides a method for querying entities to obtain number portability and routing information for subscribers.

ATINP provides number portability functions for decoding the information in the incoming ATI query message, number conditioning before the Real Time Database (RTDB) lookup, determining the success or failure of the RTDB lookup, and formatting the Return Result or Error Response based on the result of the lookup. ATINP is fully compliant with the ATI standards for Global Number Portability in 3GPP TS 23.066V7.0.0 (2007-06), *Support of Mobile Number Portability*.

ATINP supports the use of Additional Subscriber Data (ASD) in formatting response messages.

ATINP supports Service Portability functions that allow a subscriber to keep the same phone number when switching from one type of network or service technology to another within the same operator's network. With Service Portability, the subscriber remains with the same operator, but receives service from a different network technology supported by that operator or moves from one physical network to another, with both networks operated by the same service provider. The Service Portability (S-Port) feature allows RTDB GRN Entity digits to be used as Service Portability prefixes for own-network GSM and IS41 subscribers in response digit formats.

ATINP supports functions to cluster CNLs into groups referred to as ROPs, which can be used to simplify routing and simple billing analysis in cases where the number of supported CNLs is very large. The Generic Routing Number field is used to store ROP information.

The ATI NPQ local subsystem in vSTP processes ITU-TCAP ATI messages with the requested information **MNP Requested Info** parameter. The vSTP responds with an ATIACK message that contains number portability and routing information, or with an ATINACK message if the requested information cannot be provided. The original ATI query is discarded.

ATINP is an EPAP-based feature that requires EPAP provisioning data from the RTDB. Subscriber data is transferred from customer databases to the UDR. The UDR formats the RTDB and loads it to vSTP MP. The RTDB data is used in obtaining number portability information and in determining how to correctly format the ATI ACK response message.

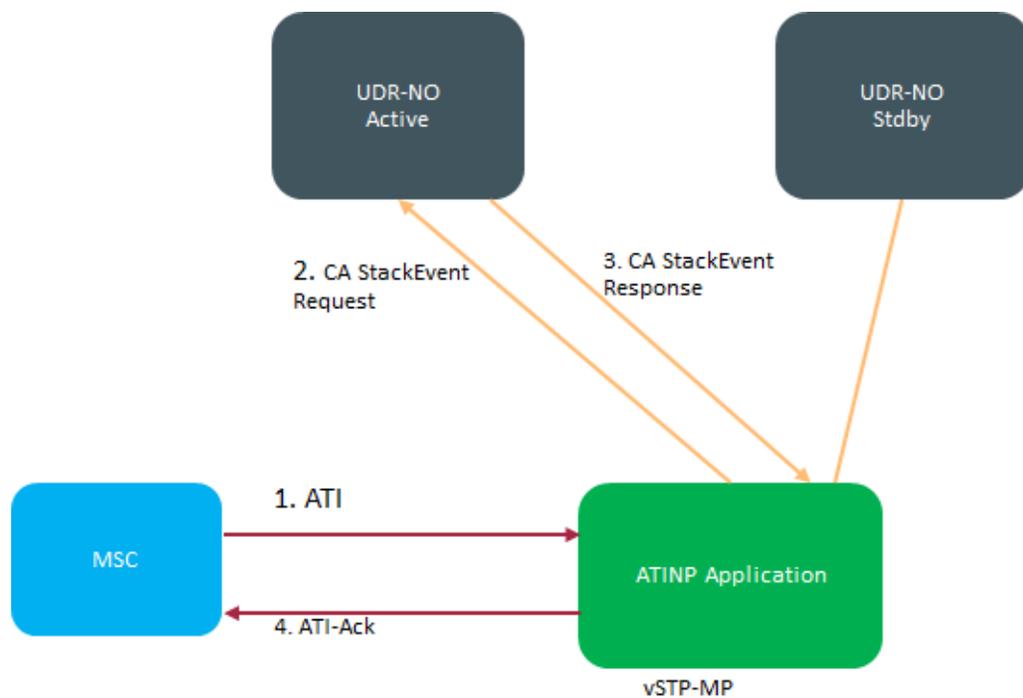
ATI NP performs these actions based on the message received.

- If the incoming ATI query message requested MNP information, ATI NP sends the ATI Ack message to the MSC with the routing number and number portability status information in the MAP portion of the message.
- If the incoming ATI query message requested location information, ATI NP sends the ATI Ack message to the MSC with the location information of the VLR.

An overview of the message handling procedure includes:

1. MSC sends an ATI request to vSTP MP over SS7 links.
  - a. vSTP MP decodes and verifies the ATI message.
  - b. It checks ATI message to make sure it is a valid request.  
The requestedInfo parameter must be MNPRequestedInfo and/or Location Information.
  - c. It decodes the MSISDN parameter from the Subscriber Identity parameter.
  - d. It conditions the MSISDN to the international format.
2. vSTP MP queries the UDR NOAM for conditional MSISDN DB.
3. UDR NOAM looks up MSISDN DB and sends a response to the vSTP MP.
4. Determines if the lookup is considered successful based on provisioned options. If yes, it uses the entity information to encode ATI ACK response and routes the response to the originator.  
If no, it sends an ATI NACK response with an appropriate error code.

**Figure 2-11 Message Flow for ATINP Solution on vSTP**



## 2.2.1 ATI NP Message Handling

ATI NP performs these actions based on the message received.

- If the incoming ATI query message requested MNP information, ATI NP sends the ATI Ack message to the MSC with the routing number and number portability status information in the MAP portion of the message.

- If the incoming ATI query message requested location information, ATI NP sends the ATI Ack message to the MSC with the location information of the VLR.

This procedure describes how ATI NP handles a message.

1. The ATI query message arrives at vSTP with routing determined by either route-on-gt or route-on-SSN.
  - If the message is route-on-SSN and the SSN number in Called Party Subsystem field in the matches to the ATINP SSN provisioned on vSTP, the message is sent to ATINP subsystem for further processing.
  - If the message is route-on-GT, vSTP decodes the SCCP portion and uses the data to perform ATINP selection based on the CdPA GT fields. The result of this selection provides a service indicator. If the service selector is ATINP, the message is sent to ATINP subsystem for further processing.
2. The message is decoded to verify the opcode and mandatory parameters.
  - If the MAP message opcode is ATI, the MSISDN and requested information parameters are decoded.
  - If MSISDN is valid and either MNPinfo or LocationInfo or both parameters are present, further number conditioning is performed.
  - Otherwise, an error message is sent back to originator.
3. The decoded DN is conditioned to an international number before performing a UDR NPDB lookup.

The DN is considered to be in international format if either of the following conditions are true.

- VstpMnpOptions:ATISNAI = INTL  
OR
- VstpMnpOptions:ATISNAI = NAI and NAI field from MSISDN is INTL (0x1) or Network Specific Number (0x3).

If the incoming DN is in national format, VstpMnpOptions:DefCC is prepended to the DN to condition it to international format.

4. The UDR NPDB database lookup involves two steps:
  - a. First the exception or individual number database is searched for a match.  
If the match is found, then the data associated with this entry is considered.
  - b. If the conditioned number is absent in the exception (individual) database, then the number range database is searched.  
If the match is found then the data associated with this range entry is considered. If the search is unsuccessful then the result is no match.
5. UDR NPDB lookup is considered successful if:
  - VstpMnpOptions:ATINPTYPE = ANY and MSISDN is found in the NPDB with entity type = RN, SP, or GRN.  
OR
  - VstpMnpOptions:ATINPTYPE = ALWAYS and MSISDN is not found in individual or range entries.

6. If the UDR NPDB lookup is successful and if the ATI query contains the MNP request information parameter, ATINP sends the ATI ACK response message with these fields in the message:
  - Routing Number: Formatting is determined by VstpMnpOptions:ATIACKRN option
  - IMSI: Formatting is determined by VstpMnpOptions:ATIACKIMSI option
  - MSISDN: Formatting is determined by VstpMnpOptions:ATIACKMSISDN option
  - Number Portability Status:
    - Not Known To Be Ported (0)
    - Own Number Ported Out (1)
    - Foreign Number Ported To Foreign Network (2)
    - Own Number Not Ported Out (4)
    - Foreign Number Ported In (5)
7. If UDR NPDB lookup is successful and if the ATI query contains the Location Information request information parameter, ATINP sends the ATI ACK response message with these fields in the message:

VLR Number: Formatting is determined by VstpMnpOptions:ATIACKVLRNUM option
8. If UDR NPDB lookup is unsuccessful, ATINP sends the ATI NACK response message with the error code = "UnknownSubscriber".

Figure 2-12 ATI NP Function Flow Chart - Sheet 1 of 3

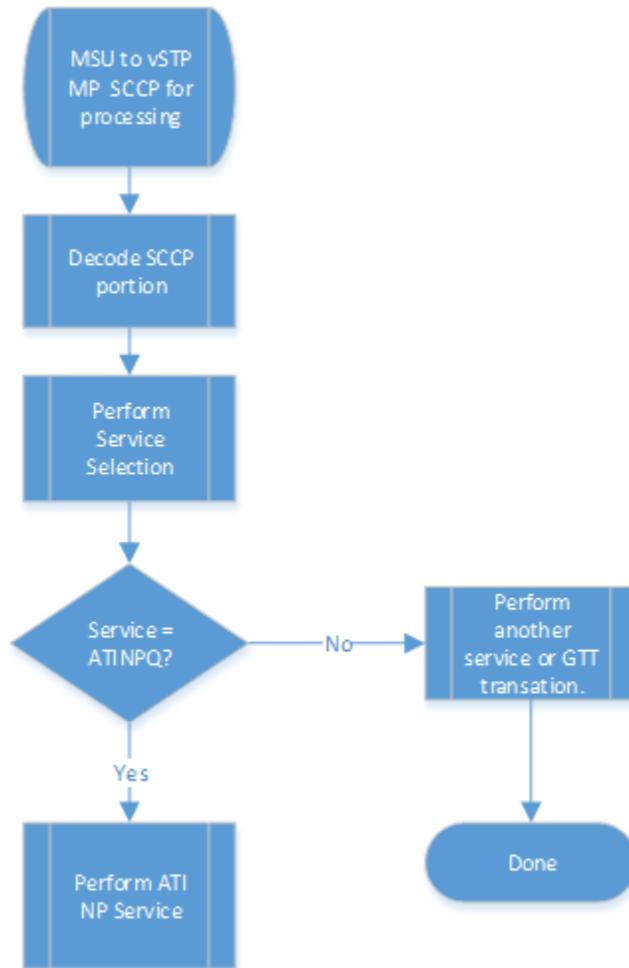


Figure 2-13 ATI NP Function Flow Chart - Sheet 2 of 3

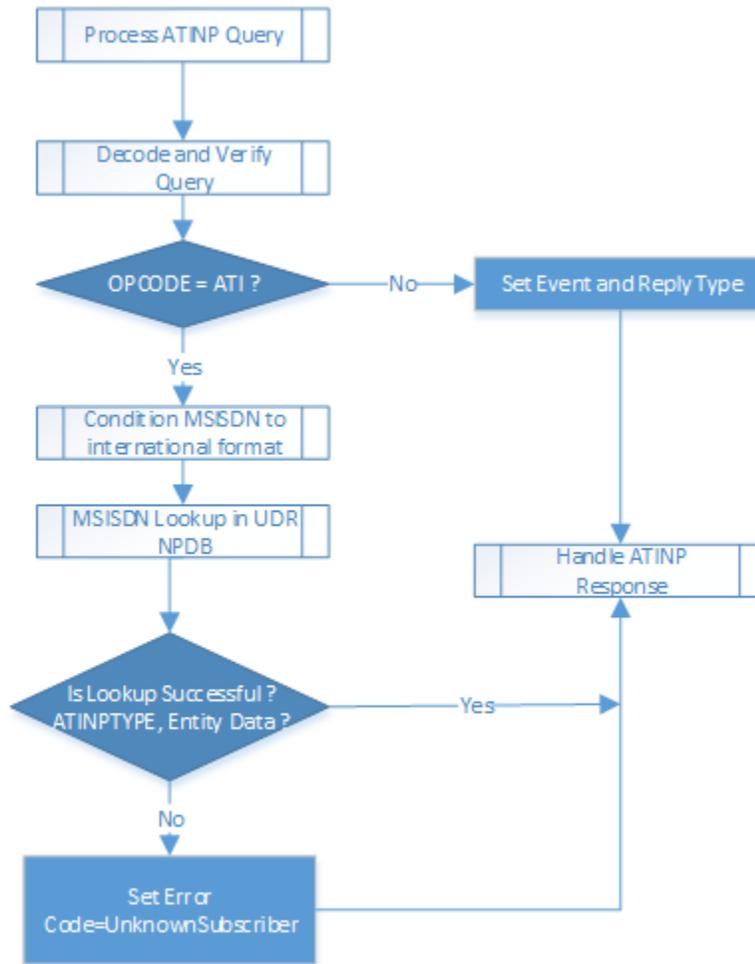
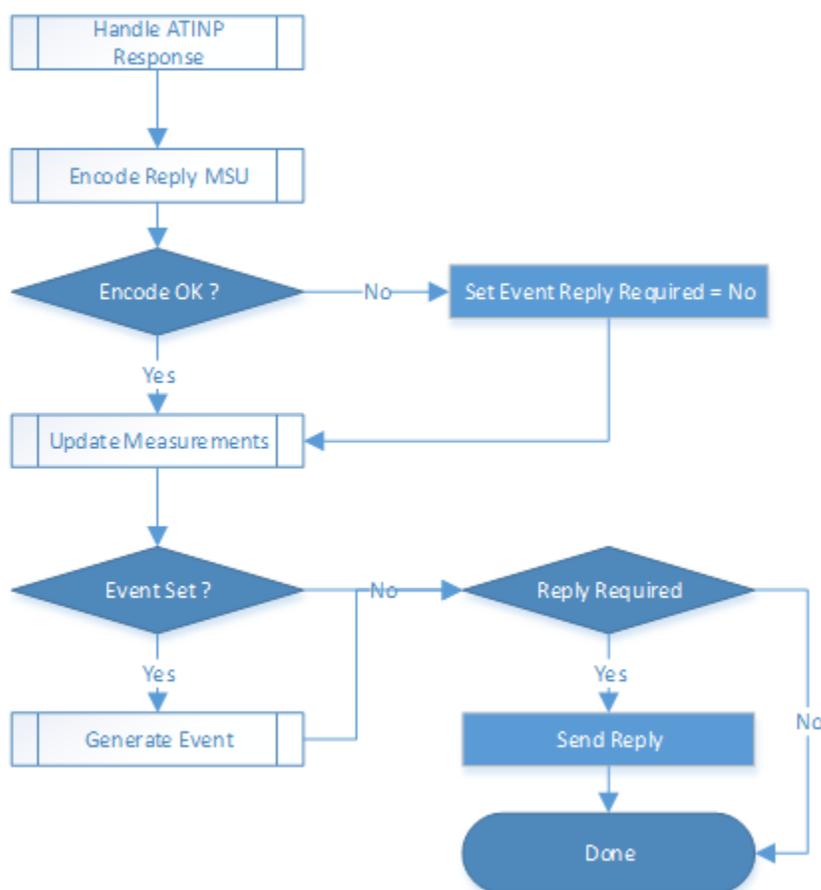


Figure 2-14 ATI NP Function Flow Chart - Sheet 2 of 3



## 2.3 INPQ Overview

The Intelligent Network Application Part (INAP) Number Portability Query (INPQ) feature supports number portability in the network, which allows subscribers to switch their telephone service provider while retaining their original telephone number.

INPQ performs these actions based on the message received.

- If the incoming INPQ message requested MNP information, INPQ sends the INPQ Ack message to the MSC with the routing number and number portability status information in the MAP portion of the message.
- If the incoming INPQ message requested location information, INPQ sends the INPQ Ack message to the MSC with the location information of the VLR.

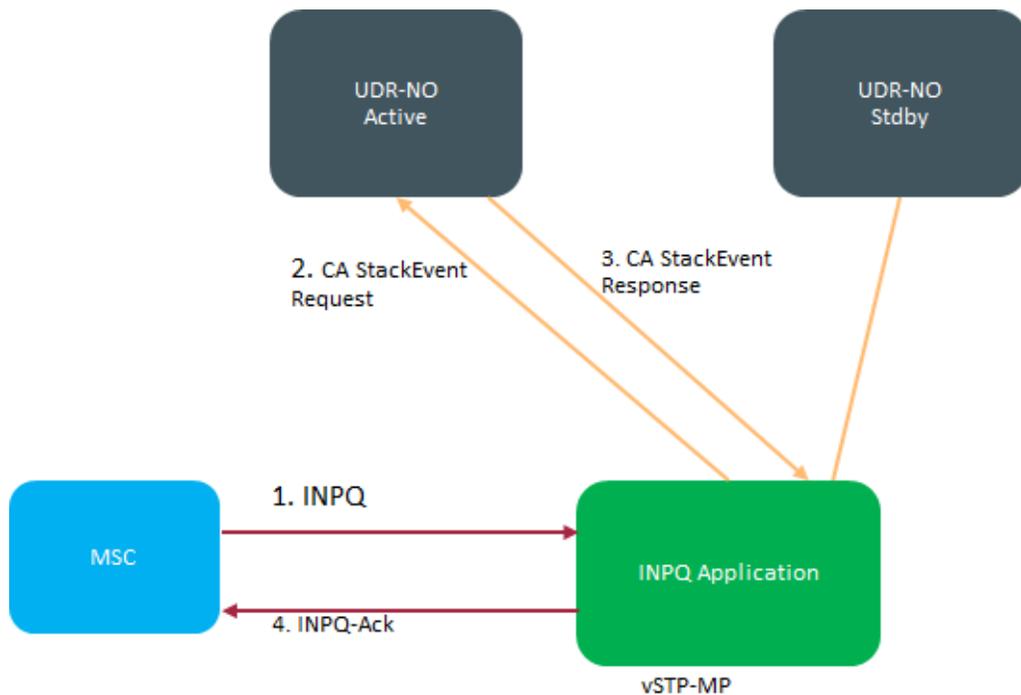
An overview of the message handling procedure includes:

1. MSC sends an INPQ request to vSTP MP over SS7 links.
  - a. vSTP MP decodes and verifies the INPQ message.
  - b. It checks INPQ message to make sure it is a valid request.

The requestedInfo parameter must be MNPRequestedInfo and/or Location Information.

- c. It decodes the MSISDN parameter from the Subscriber Identity parameter.
  - d. It conditions the MSISDN to the international format.
2. vSTP MP queries the UDR NOAM for conditional MSISDN DB.
  3. UDR NOAM looks up MSISDN DB and sends a response to the vSTP MP.
  4. Determines if the lookup is considered successful based on provisioned options. If yes, it uses the entity information to encode INPQ ACK response and routes the response to the originator. If no, it sends an INPQ NACK response with an appropriate error code.

**Figure 2-15 Message Flow for INPQ Solution on vSTP**



### 2.3.1 INPQ Message Handling

INPQ performs these actions based on the message received.

- If the incoming INPQ query message requested MNP information, INPQ NP sends the INPQ Ack message to the MSC with the routing number and number portability status information in the MAP portion of the message.
- If the incoming INPQ query message requested location information, INPQ NP sends the INPQ Ack message to the MSC with the location information of the VLR.

This procedure describes how INPQ NP handles a message.

1. The INPQ query message arrives at vSTP with routing determined by either route-on-gt or route-on-SSN.
  - If the message is route-on-SSN and the SSN number in Called Party Subsystem field in the matches to the INPQ SSN provisioned on vSTP, the message is sent to INPQ subsystem for further processing.

- If the message is route-on-GT, vSTP decodes the SCCP portion and uses the data to perform INPQ selection based on the CdPA GT fields. The result of this selection provides a service indicator. If the service selector is INPQ, the message is sent to INPQ subsystem for further processing.
2. The message is decoded to verify the opcode and mandatory parameters.
    - If the MAP message opcode is INPQ, the MSISDN and requested information parameters are decoded.
    - If MSISDN is valid and either MNPinfo or LocationInfo or both parameters are present, further number conditioning is performed.
    - Otherwise, an error message is sent back to originator.
  3. The decoded DN is conditioned to an international number before performing a UDR NPDB lookup.

The DN is considered to be in international format if either of the following conditions are true.

- VstpMnpOptions:INPQSNAI = INTL  
OR
- VstpMnpOptions:INPQSNAI = NAI and NAI field from MSISDN is INTL (0x1) or Network Specific Number (0x3).

If the incoming DN is in national format, VstpMnpOptions:DefCC is prepended to the DN to condition it to international format.

4. The UDR NPDB database lookup involves two steps:
  - a. First the exception or individual number database is searched for a match.  
If the match is found, then the data associated with this entry is considered.
  - b. If the conditioned number is absent in the exception (individual) database, then the number range database is searched.  
If the match is found then the data associated with this range entry is considered. If the search is unsuccessful then the result is no match.
5. UDR NPDB lookup is considered successful if:
  - VstpMnpOptions:INPQTYPE = ANY and MSISDN is found in the NPDB with entity type = RN, SP, or GRN.  
OR
  - VstpMnpOptions:INPQTYPE = ALWAYS and MSISDN is not found in individual or range entries.
6. If the UDR NPDB lookup is successful and if the INPQ query contains the MNP request information parameter, INPQ sends the INPQ ACK response message with these fields in the message:
  - Routing Number: Formatting is determined by VstpMnpOptions:INPQACKRN option
  - IMSI: Formatting is determined by VstpMnpOptions:INPQACKIMSI option
  - MSISDN: Formatting is determined by VstpMnpOptions:INPQACKMSISDN option
  - Number Portability Status:
    - Not Known To Be Ported (0)
    - Own Number Ported Out (1)

- Foreign Number Ported To Foreign Network (2)
  - Own Number Not Ported Out (4)
  - Foreign Number Ported In (5)
7. If UDR NPDB lookup is successful and if the INPQ query contains the Location Information request information parameter, INPQ sends the INPQ ACK response message with these fields in the message:
- VLR Number: Formatting is determined by VstpMnpOptions:INPQACKVLRNUM option
8. If UDR NPDB lookup is unsuccessful, INPQ sends the INPQ NACK response message with the error code = "UnknownSubscriber".

**Figure 2-16 INPQ Function Flow Chart - Sheet 1 of 3**

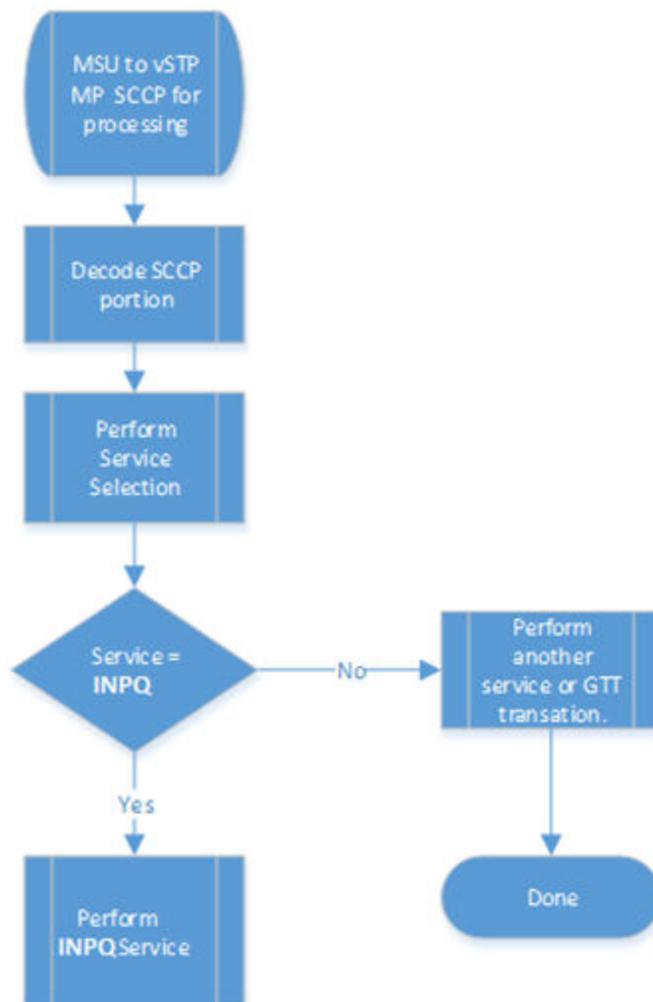


Figure 2-17 INPQ Function Flow Chart - Sheet 2 of 3

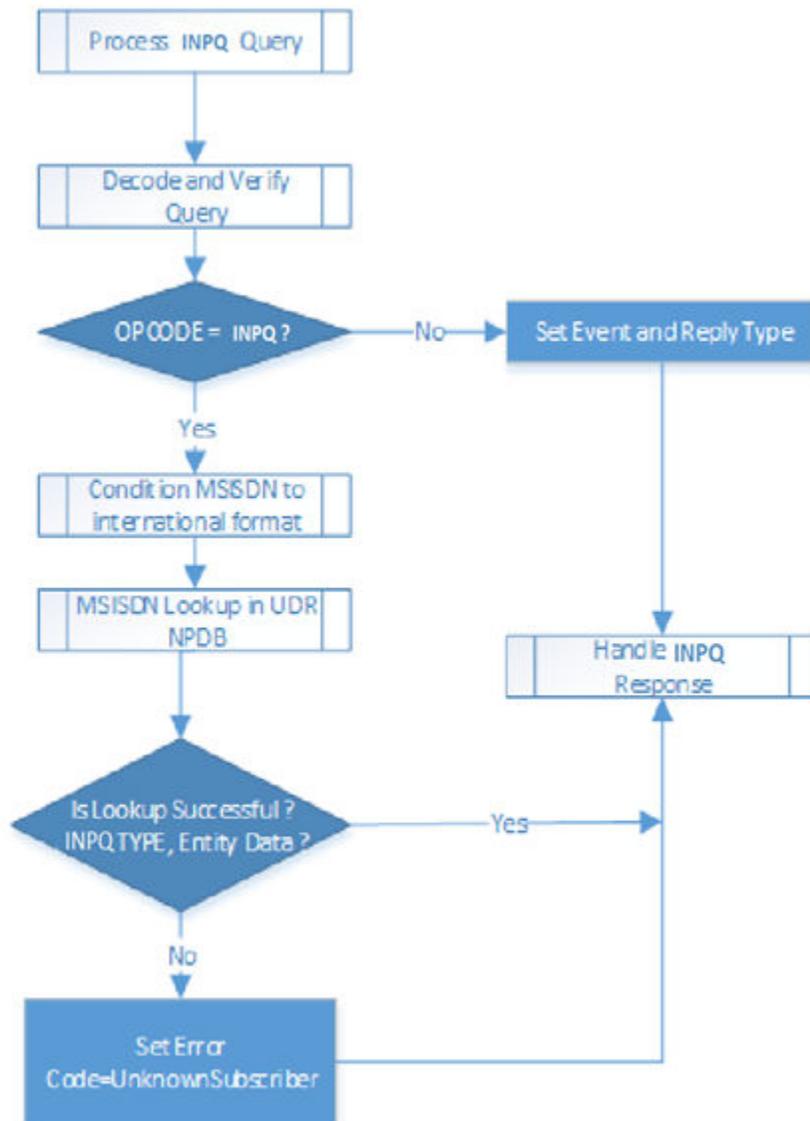
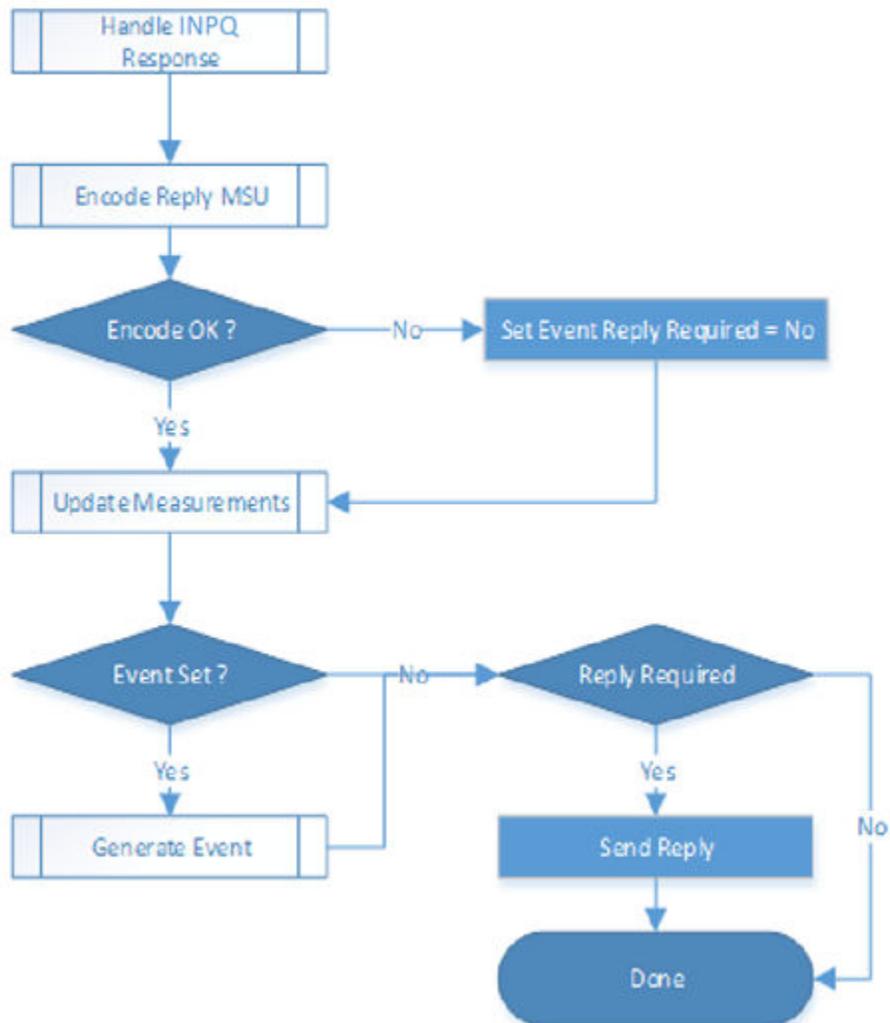


Figure 2-18 INPQ Function Flow Chart - Sheet 3 of 3



# 3

## MNP Configuration

This chapter provides procedures to configure the connection required for MNP to access the database.

MNP is configured using the vSTP managed objects. The MMI API contains details about the URI, an example, and the parameters available for each managed object.

### 3.1 MMI Managed Objects for MNP

MMI information associated with MNP is accessed from a DSR NOAM or SOAM from **Main Menu**, and then **MMI API Guide**.

Once the *MMI API Guide* displays, use the application navigation to locate specific vSTP managed object information.

[Table 3-1](#) lists the managed objects and operations supported for vSTP MNP G-Port feature.

**Table 3-1 vSTP MNP Managed Objects and Supported Operations**

Managed Object Name	Supported Operations
VstpSccpMnpOptions	Update
VstpSccpSrcSel	Insert, Update, Delete
VstpSccpHomeEntity	Insert, Delete

#### VstpSccpMnpOptions - Update

Create a file as shown. The file name can be anything, fo example, the option name:

```
$ vim MnpoptsUpdate.json
{
  "<optionName1>": "<OptionValue1>",
  "<optionName2>": "<OptionValue2>",
  "<optionNameX>": "<OptionValueX>"
}
```

On an action SOAM, update the MnpOptions:

```
> /vstp/sccpmnpoptions -v PUT -r /<Absolute Path>/<filename>
```

Example output for this update command would be:

```
[admusr@veir-soal filemgmt]$ /vstp/sccpmnpoptions -v PUT -r
MnpoptsUpdate.json
{
  "data": true,
  "links": {},
}
```

```

    "messages": [],
    "status": true
}

[admusr@veir-soal filemgmt]$ vim /tmp/conf
{
    "defcc": "8",
    "sridn": "tcap"
}
[admusr@veir-soal filemgmt]$ /vstp/sccpmnptions -v PUT -r /tmp/conf

```

### Add/Modify Service Selector

```

[admusr@veir-soal filemgmt]$ vim /tmp/conf
{
    "domain": "Itui",
    "globalTitleIndicator": "TtNumEncodingNature",
    "serviceName": "Gport",
    "name": "GportSe99",
    "natureOfAddressIndicatorValue": 3,
    "ssn": "9",
    "numberingPlan": "E164",
    "translationType": 54,
    "serviceNai": "Nat1",
    "serviceNP": "E164",
    "fallbackToGtt": true
}

[admusr@veir-soal filemgmt]$ /vstp/sccpserviceselectors -v POST -
r /tmp/conf

```

### Add Home RN

```

[admusr@vmnp-soal ~]$ cat homeentity
{
    "entityType": "HomeRn",
    "entityAddress": "C441234"
}

[admusr@vmnp-soal ~]$ /vstp/homeentities -v POST -r /tmp/ homeentity

```

## 3.2 MMI Managed Objects for ATI NP

MMI information associated with MNP is accessed from a DSR NOAM or SOAM from **Main Menu**, and then **MMI API Guide**.

Once the *MMI API Guide* displays, use the application navigation to locate specific vSTP managed object information.

[Table 3-2](#) lists the managed objects and operations supported for vSTP ATI NP feature.

**Table 3-2 vSTP MNP Managed Objects and Supported Operations**

Managed Object Name	Supported Operations
VstpSccpMnpOptions	Update
VstpSccpSrvSel	Insert, Update, Delete

**VstpSccpMnpOptions - Display**

VstpSccpMnpOptions has these default entries since it only supports the Update operation. Execute the MMI Client command from an active SOAM.

```
$ /vstp/sccpmnptions
[admusr@aricen-soal data]$ /vstp/sccpmnptions
{
  "data": [
    {
      "atiackimsi": "none",
      "atiackmsisdn": "msisdn",
      "atiackrn": "rn",
      "atiackvlrnum": "rnspsmsisdn",
      "atidfltrn": "None",
      "atidlm": "None",
      "atientitylen": "None",
      "atinptype": "any",
      "atisnai": "nai",
      "atisuppllocinfo": "Off",
      "ativlrnumlen": 40,
      "ccnc1-mccmnc1": "None",
      "ccnc10-mccmnc10": "None",
      "ccnc2-mccmnc2": "None",
      "ccnc3-mccmnc3": "None",
      "ccnc4-mccmnc4": "None",
      "ccnc5-mccmnc5": "None",
      "ccnc6-mccmnc6": "None",
      "ccnc7-mccmnc7": "None",
      "ccnc8-mccmnc8": "None",
      "ccnc9-mccmnc9": "None",
      "crptt": "None",
      "defcc": "12",
      "defmapvr": 1,
      "defmcc": "919",
      "defmnc": "None",
      "defndc": "55",
      "delccprefix": "pfxwcc",
      "dngtzerofill": "No",
      "encdnpsdnotfound": "Off",
      "encdnpsptnone": "Off",
      "encodecug": "Off",
      "encodenps": "On",
      "inpcutnpaste": "Off",
      "inpdra": "rndn",
      "inpdranai": "unknown",
      "inpdranp": "E164",
```

```
    "inp nec": "None",
    "inprelcause": 31,
    "inpsnai1-cdpanai1": "None",
    "inpsnai2-cdpanai2": "None",
    "inpsnai3-cdpanai3": "None",
    "inpsnai4-cdpanai4": "None",
    "inpsnai5-cdpanai5": "None",
    "inpsprestype": "continue",
    "mnp crp": "Off",
    "mnp npdbunavl": "dnnotfound",
    "msidntrunc": 0,
    "msrndig": "rndn",
    "msrnl en": 30,
    "msrnnai": 1,
    "msrnp": 1,
    "mtmmsackn": "ack",
    "mtmmsent ylen": "None",
    "mtmmsgta": "1233445566",
    "mtmmslen": "None",
    "mtmmstype": "all",
    "mtsmsackn": "nack",
    "mtsmschksrc": "No",
    "mtsmsdltr": "no",
    "mtsmsdltrv": "9876",
    "mtsmsimsi": "rn",
    "mtsmsnakerr": 1,
    "mtsmsnni": "rn",
    "mtsmsnp": "On",
    "mtsmstype": "all",
    "multcc1": "11",
    "multcc10": "10",
    "multcc2": "2",
    "multcc3": "3",
    "multcc4": "4",
    "multcc5": "5",
    "multcc6": "6",
    "multcc7": "7",
    "multcc8": "None",
    "multcc9": "9",
    "serverpfx": "None",
    "srfaddr": "None",
    "srfnai": 0,
    "srfnp": 0,
    "sridn": "tcap",
    "sridnnotfound": "gtt",
    "srismdn": "sccp",
    "srismgttrtg": "Off",
    "srvcrelaymapset": "None"
  }
},
"links": {},
"messages": [],
"status": true
}
```

### VstpSccpMnpOptions - Update

Execute this command on an active SOAM to update EirOptions:

```
/vstp/sccpmnpoptions -v PUT -r /<Absolute Path>/<filename>
```

Create a file with this content. The filename can be anything, for example the option name can be used:

```
$ Cat atickarn
{"atiackrn": "rn",}
```

Example output:

```
[admusr@veir-soal filemgmt]$ /vstp/sccpmnpoptions -v PUT -r atickarn
{
  "data": true,
  "links": {},
  "messages": [],
  "status": true
}
```

## 3.3 MMI Managed Objects for INPQ

MMI information associated with MNP is accessed from a DSR NOAM or SOAM from **Main Menu**, and then **MMI API Guide**.

Once the *MMI API Guide* displays, use the application navigation to locate specific vSTP managed object information.

[Table 3-3](#) lists the managed objects and operations supported for vSTP ATI NP feature.

**Table 3-3 vSTP MNP Managed Objects and Supported Operations**

Managed Object Name	Supported Operations
VstpSccpMnpOptions	Update
VstpSccpSrvSel	Insert, Update, Delete
Vstp: HomeEntity	Insert, Update, Delete

### VstpSccpMnpOptions - Display

VstpSccpMnpOptions has these default entries since it only supports the Update operation. Execute the MMI Client command from an active SOAM.

```
$ /vstp/sccpmnpoptions
[admusr@aricen-soal data]$ /vstp/sccpmnpoptions
{
  "data": [
    {
      "atiackimsi": "none",
      "atiackmsisdn": "msisdn",
```

```
"atiackrn": "rn",
"atiackvlnum": "rnspsmsisd",
"atidfltrn": "None",
"atidlm": "None",
"atientitylen": "None",
"atinptype": "any",
"atisnai": "nai",
"atisuppllocinfo": "Off",
"ativlnumlen": 40,
"ccnc1-mccmnc1": "None",
"ccnc10-mccmnc10": "None",
"ccnc2-mccmnc2": "None",
"ccnc3-mccmnc3": "None",
"ccnc4-mccmnc4": "None",
"ccnc5-mccmnc5": "None",
"ccnc6-mccmnc6": "None",
"ccnc7-mccmnc7": "None",
"ccnc8-mccmnc8": "None",
"ccnc9-mccmnc9": "None",
"crptt": "None",
"defcc": "12",
"defmapvr": 1,
"defmcc": "919",
"defmnc": "None",
"defndc": "55",
"delccprefix": "pfxwcc",
"dngtzerofill": "No",
"endcnpsdnotfound": "Off",
"endcnpsptnone": "Off",
"encodecug": "Off",
"encodenps": "On",
"inpcutnpaste": "Off",
"inpdra": "rndn",
"inpdranai": "unknown",
"inpdranp": "E164",
"inp nec": "None",
"inprelcause": 31,
"inpsnai1-cdpanai1": "None",
"inpsnai2-cdpanai2": "None",
"inpsnai3-cdpanai3": "None",
"inpsnai4-cdpanai4": "None",
"inpsnai5-cdpanai5": "None",
"inpsprestype": "continue",
"mnp crp": "Off",
"mnpnpdbunavl": "dnotfound",
"msisdntrunc": 0,
"msrndig": "rndn",
"msrnl en": 30,
"msrnnai": 1,
"msrnp": 1,
"mtmmsackn": "ack",
"mtmmsentylen": "None",
"mtmmsgta": "1233445566",
"mtmmslen": "None",
"mtmmstype": "all",
```

```

        "mtsmsackn": "nack",
        "mtsmschksrc": "No",
        "mtsmsdltr": "no",
        "mtsmsdltrv": "9876",
        "mtsmsimsi": "rn",
        "mtsmsnakerr": 1,
        "mtsmsnni": "rn",
        "mtsmsnp": "On",
        "mtsmstype": "all",
        "multcc1": "11",
        "multcc10": "10",
        "multcc2": "2",
        "multcc3": "3",
        "multcc4": "4",
        "multcc5": "5",
        "multcc6": "6",
        "multcc7": "7",
        "multcc8": "None",
        "multcc9": "9",
        "serverpfx": "None",
        "srfaddr": "None",
        "srfnai": 0,
        "srfnp": 0,
        "sridn": "tcap",
        "sridnnotfound": "gtt",
        "srismdn": "sccp",
        "srismgttrtg": "Off",
        "srvcrelaymapset": "None"
    }
},
    "links": {},
    "messages": [],
    "status": true
}

```

### VstpSccpMnpOptions - Update

Execute this command on an active SOAM to update EirOptions:

```
/vstp/sccpmnpoptions -v PUT -r /<Absolute Path>/<filename>
```

Create a file with this content. The filename can be anything, for example the option name can be used:

```
$ Cat atickarn
{"atiackrn": "rn",}
```

Example output:

```
[admusr@veir-soal filegmt]$ /vstp/sccpmnpoptions -v PUT -r atickarn
{
    "data": true,
    "links": {},

```

```
    "messages": [],  
    "status": true  
}
```

### Home Entity - Insert

The vSTP Home Entity table holds different configuration options for the INPQ feature.

Execute this command on an active SOAM to insert a *homeentities*:

```
/vstp/homeentities/ -v POST -r /<Absolute Path>/<filename>
```

Create a file with this content. The filename can be anything, for example the option name can be used:

```
$ Cat inpqfl  
{  
  "entityType": "HomeRn",  
  "entityAddress": "C441234",  
  "name": "homeEnt1"  
}
```

Example output:

```
[admusr@aricen-soal data]$ /vstp/homeentities/  
{  
  "data":  
    "6961034c-6439-43da-b935-5238d6616f84",  
  "messages":  
    [  
    ],  
  "links":  
    {  
    },  
  "status":  
    true  
}
```

### Home Entity - Display

Execute this command on an active SOAM to display entries.

```
/vstp/homeentities/{name}
```

Example output:

```
[admusr@aricen-soal data]$ /vstp/homeentities/  
{ "data":  
  {  
    "entityType": "HomeRn",  
    "entityAddress": "C441234",  
    "name": "homeEnt1"  
  },  
}
```

```
"messages": [],  
"links": {},  
"status": true  
}
```

### Home Entity - Update

Execute this command on an active SOAM to update:

```
/vstp/homeentities/ -v PUT -r /<Absolute Path>/<filename>
```

Create a file with this content. The filename can be anything, for example the option name can be used:

```
$ Cat inpqf2  
{"name": "homeEnt2",  
 "entityType": "CdpnPfx"  
}
```

Example output:

```
[admusr@veir-soal filemgmt]$ /vstp/homeentities/ -v PUT -r inpqf2  
{  
  "data": true,  
  "links": {},  
  "messages": [],  
  "status": true  
}
```

### Home Entity - Delete

This deletes the specified Home Entity from the SOAM configuration. A Home Entity can only be deleted if all delete validation checks pass. An attempt to delete a Home Entity that cannot be deleted results in an error message returned within the HTTP response.

Execute this command to delete an entry.

```
- /vstp/homeentities/{name} -v DELETE
```

Where name is the name of the homeentity.

Example output:

```
/vstp/homeentities/homeEnt2 -v DELETE  
No output returned by URI: https://localhost/mmi/dsr/v2.0/vstp/homeentities/  
homeEnt2? for 'DELETE' operation
```

## 3.4 Configuration for UDR

Configuring IDPR and MOSMS for UDR involves adding vSTP MP(s) to UDR and then configuring UDR on the ComAgent server.

**Assumptions:**

- The user is aware of UDR and ComAgent functionality, and
- UDR is already installed and UDR topology is already configured

Perform the following steps to configure IDPR and MOSMS for UDR:

1. Add details about the vSTP MP on the ComAgent Remote Servers screen as a client by navigating to **Communication Agent**, and then **Configuration**, and then **Remote Servers** and clicking **Insert** on an active OCUDR NOAMP.
2. Select the OCUDR server group from the *Available Local Server Groups* that needs to communicate with vSTP MP.
3. From the active OCUDR GUI, navigate to **Communication Agent**, and then **Maintenance**, and then **Connection Status** and verify connection are InService.
4. From the active OCUDR GUI, navigate to **Communication Agent**, and then **Maintenance**, and then **Routed Services Status** and verify the *STPDbSvc* status is Normal.
5. From an active DSR NOAM, navigate to **Communication Agent**, and then **Configuration**, and then **Remote Servers** and click **Insert**.
6. Add the UDR NO IP in the ComAgent Remote Server screen as a Server.
7. Select the STP MP server group from the *Local SG* that needs to communicate with UDR.
8. Also add the Standby and DR NOs to the Local SG.
9. Navigate to **Communication Agent**, and then **Configuration**, and then **Connection Groups**, select *STPSvcGroup* and click **Edit**.
10. Add all available UDR NO servers.
11. Navigate to **Communication Agent**, and then **Maintenance**, and then **Connection Status**, select the server name, and check the connection status.

UDR Configuration: SOAP Provisioning Request for MSISDN

**Steps to Enable MNP Feature on UDR:**

Enable MNP feature on UDR by running the **enablevMNPsec** loader on the Active NOAM Server console. Follow the below steps:

1. Go to the path: `/usr/TKLC/udr/prod/maint/loaders/upgrade`
2. On the path, execute the **enablevMNPsec** script.

The following snippet provides an example of provisioning MNP data with the Type as SPRN and GRN in an individual MSISDN:

**Adding GRNID:**

Insert:

```
<req name="insert" resonly="y" inputType="mnpGrnId">
  <ent name="Subscriber"/>
  <set>
    <expr><attr name="GRNID"/><value val="10000"/></expr>
    <expr><attr name="MnpDataGRN"/><op value="="/>
    <CDATA>&lt;![CDATA[<?xml version="1.0" encoding="UTF-8"?>
```

```

        <MnpGRN>
          <EDigit>10000</EDigit>
          <RI>1</RI>
          <PC>111-222-333</PC>
          <PCDom>ansi</PCDom>
          <SSN>3</SSN>
          <SRFIMSI>222222222</SRFIMSI>
          <DigAct>INSERTENTITYID</DigAct>
        </MnpGRN>]]&gt;
      </cdata>
    </expr>
  </set>
</req>

```

### Adding SPRNID :

```

<req name="insert" resonly="y" inputType="mnpSprnId">
  <ent name="Subscriber"/>
  <set>
    <expr><attr name="SPRNID"/><value val="68547777"/></expr>
  <expr>
<attr name="MnpDataSPRN"/><op value="="/>
  <cdata>&lt;![CDATA[<?xml version="1.0" encoding="UTF-8"?>
    <MnpSPRN>
      <Type>RN</Type>
      <EDigit>68547777</EDigit>
      <RI>0</RI>
      <PC>111-222-444</PC>
      <PCDom>ansi</PCDom>
      <SSN>3</SSN>
      <SRFIMSI>111111111</SRFIMSI>

```

### Adding MNP Subscriber with SPRNID & GRNID:

```

<req name="insert" resonly="y" inputType="mnpSubscriber">
  <ent name="Subscriber"/>
  <set>
    <expr><attr name="MSISDN"/><value val="22222222333"/></expr>
    <expr><attr name="CLDBL"/><value val="1"/></expr>
    <expr><attr name="CLNBL"/><value val="1"/></expr>
    <expr><attr name="PType"/><value val="1"/></expr>
    <expr><attr name="ASD"/><value val="abcd"/></expr>
    <expr><attr name="SPRNID"/><value val="68547777"/></expr>
    <expr><attr name="GRNID"/><value val="10000"/></expr>
  </set>
</req>

```

### Enabling Split feature and Self Heal feature for MNP on UDR:

Enable Split feature and self heal on UDR by running the `enableSplitFeature` and `enableMNPwithSplit` loaders on the Active NOAM Server console with the following steps:

1. Navigate to the `/usr/TKLC/udr/prod/maint/loaders/upgrade` path on the Active NOAM Server console.

## 2. Execute the `enableSplitFeature` and `enableMNPwithSplit` scripts.

### Note:

There is no need to restart any of the servers after running the loader.

The following snippet shows an example of provisioning MNP data with the Type as SPRN and GRN in an individual MSISDN:

```
<req name="insert" resonly="y" inputType="mnpSubscriber" type="range">
<ent name="Subscriber"/>
<set>
<expr><attr name="MSISDN"/><value val="22222222000"/></expr>
<expr><attr name="MSISDN"/><value val="222222223000"/></expr>
<expr><attr name="CLDBL"/><value val="1"/></expr>
<expr><attr name="CLNBL"/><value val="1"/></expr>
<expr><attr name="PType"/><value val="1"/></expr>
<expr><attr name="ASD"/><value val="abcd"/></expr>
<expr><attr name="SPRNID"/><value val="685477777"/></expr>
<expr><attr name="GRNID"/><value val="10000"/></expr>
<expr><attr name="Split"/><value val="1"/></expr>

</set>
</req>
```

### The `enableSplitFeature` Feature Flag Behavior

The `enableSplitFeature` Feature flag behavior for different scenarios is described as follows:

- When the Feature flag is enabled:
  - When no value is set: By default Split field with value **1** is added to subscriber profile.
  - Split field value is **0**: Subscriber profile with Split field value **0** (non splitable range) is inserted.
  - Split field value is **1**: Subscriber profile with Split field value **1** is inserted.
- When the Feature flag is disabled:
  - When no value is set: Subscriber profile will not have split field.
  - Split Field with value is **1**: Create or Update requests are rejected with **invalid XML** error message.
  - Split Field with value is **0**: Create or Update requests are rejected with **invalid XML** error message.

## 3.4.1 Network Redundancy for UDR Using Multiple Prioritized Comagent Connection Groups

In cases where there is one Connection Group on **vSTP NO** with default priority set to **10**, there was no provision to configure one interface as the priority route and another interface as the secondary (when the primary interface fails).

The Connection Group feature provides redundancy between local site and remote site for MNP, where the following three priorities are provided for Connection group for UDR lookup on Vstp NO GUI:

- STPSvcGroup=30 (default value) indicates highest priority.
- STPSvcBackGroup=20 indicates a lesser priority.
- STPSvcSpareGroup=10 indicates a much lesser priority.

**Figure 3-1 Priorities for Connection Group**

STPDbSvc	3 Connection Groups	-
	- STPSvcGroup	30
	- STPSvcBackupGroup	20
	- STPSvcSpareGroup	10

**Table Description:** Connection Groups Table

Connection Group	Server
STPSvcBackupGroup	2 Servers <a href="#">Mul26Soam1-UDR00-xsi</a> <a href="#">Mul26Soam1-UDR01-xsi</a>
STPSvcGroup	2 Servers <a href="#">Mul26Soam1-UDR00-imi</a> <a href="#">Mul26Soam1-UDR01-imi</a>
STPSvcSpareGroup	2 Servers <a href="#">Palla1Soam1-UDR00-XSI2</a> <a href="#">Palla1Soam1-UDR01-XSI2</a>
UDRSvcGroup	0 Servers

Operator can add UDR connected with primary route in the highest priority Connection Group. For redundancy, the other UDR can be added in other connection groups.



**Note:**

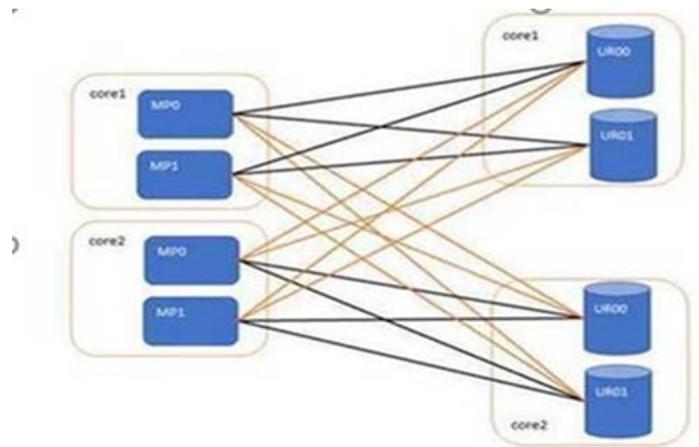
These priority values are hardcoded through the loader and cannot be modified. If all UDRs are added to the same Connection Group, then the load is shared between these UDRs.

*For example:*

To configure the IMI as the priority route, the UDR connected with this Interface must be added in STPSvcGroup (highest priority) Connection Group.

The UDR connected with another Interface(XSI2) can be added to another Connection Group (STPSvcBackGroup) for redundancy.

Figure 3-2 IMI as the Priority Route



**⚠ Caution:**

During connection group switch over, all UDRs in that connection group might go down. This occurs when a message transfers from a UDR in one connection group to a UDR in another connection group. During such a switch over, message can be lost due to ComAgent limitation.

**✎ Note:**

For **vSTP UDR connection redundancy** feature, on **vSTP NOAM**, ComAgent service should be set to **unspecified**.  
Go to **Main Menu: Configuration**, then **Networking**, and click **Services** and select **unspecified**.

# 4

## MNP Alarms and Measurements

### **Alarms and Events**

New alarms and events have been added to the Alarms and KPIs reference guide. See the MNP sections.

### **Measurements**

New measurements have been added to the Measurements reference guide. See the MNP section.

# 5

## vSTP IDP Relay and MOSMS

### 5.1 Prepaid IDPR Overview

The Prepaid IDP Query Relay feature (IDP Relay) provides a mechanism to ensure the correct charging for calls from prepaid subscribers in a portability environment.

#### 5.1.1 Prepaid IDP Query Relay Overview

IDP Relay processes GT-routed INAP or CAP messages with ITU MTP/SCCP/TCAP parts and Opcode=IDP.

IDP Relay provides functions that handle complex numbering schemes and number conditioning, such as the following examples:

- The Nature of Address Indicator (NAI) could be used in a non-compliant manner (the NAI is set to International and the number format is not international).
- The Local Area Code (LAC) 2- byte field of the Local Area Identification (LAI) information element is used in one of the following ways:
  - As the Area Code in cases where the AC is needed but not provided in the CdPN
  - To determine how to format the outgoing CdPN in the IDP query
- The collect call Escape Codes 90 and 90909 might need to be stripped and re-inserted after the RN.
- The Carrier Selection Point (CSP) can be removed from the incoming number and sometimes re-inserted (as when the LAC is not equal to the AC).
- The RN for the CgPN might be needed when the call is identified as a collect call.
- Service Key selection could vary, and could require a change in the number of bytes present the Service Key.
- Unsegmented XUDT messages might be required.
- Sometimes the RN but not the SP, or the SP but not the RN, or both the RN and SP are required in the outgoing number format.

When Mobile Switching Centers (**MSCs**) in the network are configured to send IDP prepaid query messages through vSTP, the vSTP intercepts the IDP query based on a set of configurable criteria, performs a number portability (UDR) lookup on the called number, inserts the portability information (Routing Number or **HLR** Address), and forwards the IDP query to a prepaid **SCP** for processing. When a respective entry is found in the UDR, any processing is controlled by NPP Service Actions and configuration option provisioning in the IDPROPTS table. The CdPN can be modified with the portability information (Routing Number or HLR address) and the CgPN.

In standard IDP Relay processing, regardless of any actions performed on the IDP query by the IDP Relay feature, the query is always forwarded to the prepaid SCP (**PPSCP**) for processing. When the SCP receives the IDP query, all information necessary for call

processing and billing is present. The IDP Relay feature alleviates the need to launch a separate number portability database query.

IDP Relay also provides the following functions:

- CONNECT, CONTINUE, or RELEASECALL responses - Provisioning can allow CONNECT, CONTINUE, or RELEASECALL responses to be sent based on the UDR lookup results. A configuration option determines whether the CutAndPaste parameter is included in a CONNECT message that is sent from the Prepaid IDP Query Relay feature.
- Service Key-based GTA Routing (SK GTA Routing) - A provisioned Service Control Point (SCP) Global Title Address (GTA) value based on the Service Key can be used to replace the SCCP Called Party Address (CdPA) GTA in a message. This allows the IDP or IDPSMS message to be GTT routed to the provisioned SCP GTA instead of to the incoming SCCP Called Party Address (CdPA) GTA.

### Number Portability Types

IDP Relay supports the following types of Number Portability:

- Provider NP - the subscriber can move to another service provider and keep the same number
- Location NP - the subscriber can move to another location within the same service provider network and keep the same number  
This manual describes Provider NP and Location NP together as "NP".

## 5.1.1.1 IDP Relay High Level Message Flow

IDP Relay processes messages in the following high-level message flow, as shown in [Figure 5-1](#), [Figure 5-2](#), and [Figure 5-3](#):

- Service Selection
  - Component match
  - Service Selector IDPR
- Identify number type and context
  - ITU TCAP message with Op Code = IDP
  - SCCP CdPA GTA matches an entry in the CSL GT list
  - SK+BCSM present and matches a DS entry for the CSL SKBCSM list
  - If the IDPROPTS CGPACCK configuration option indicates that an SCCP CgPA Check for a Country Code match (STPOPTS DEFCC) is to be made, the SCCP GTI must indicate that GT is present and the SCCP NAI must be International to allow the check to made.
- NPP Pre-processing
  - TCAP DN present
  - Number conditioning
- NPP Processing
  - The IDPRCDPN, IDPRCDPN2, IDPRCDPN3, or IDPRCDPN4 service is called
    - \* Conditioning Actions

- \* Service Actions
- \* Formatting Actions
- CgPN Lookup needed - IDPRCGPN service is called
  - \* Conditioning Actions
  - \* Service Actions
  - \* Formatting Actions
- Post NPP Processing
  - Encode outgoing IDP message
- Peg measurements
- Pass message to GTT for routing; send CONNECT, CONTINUE or RELEASECALL response; or determine if IDP A-Party Routing is applicable.

**Figure 5-1 Message Flow for IDP Relay - Sheet 1 of 3**

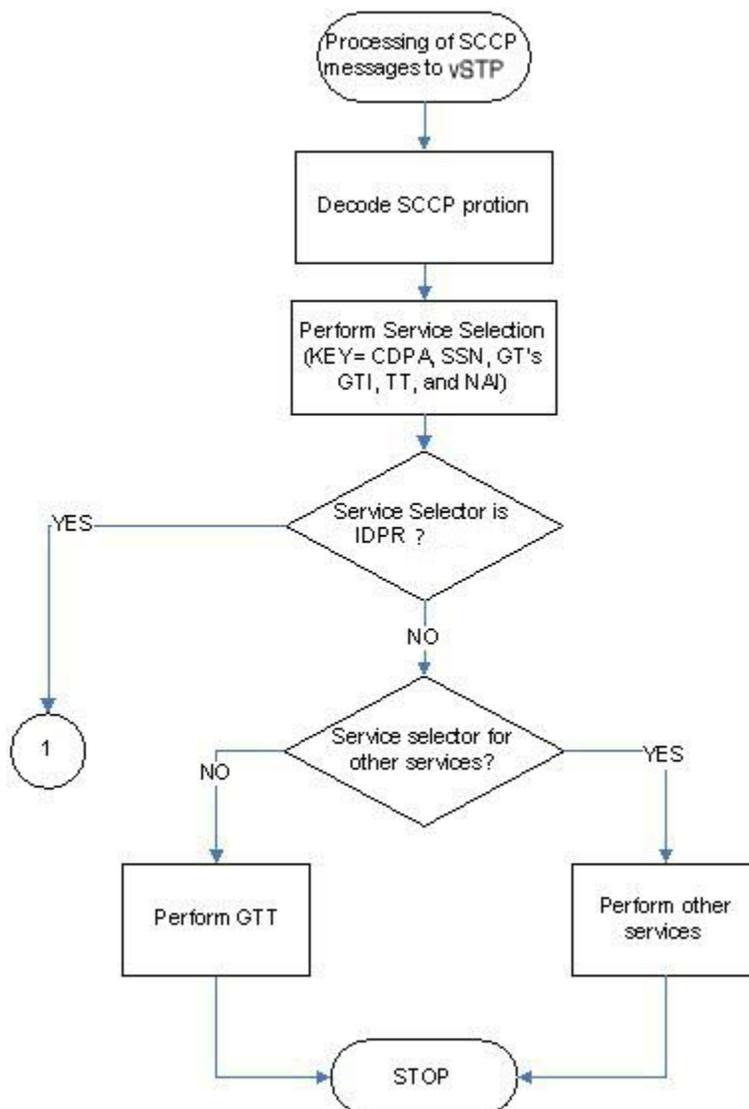


Figure 5-2 Message Flow for IDP Relay - Sheet 2 of 3

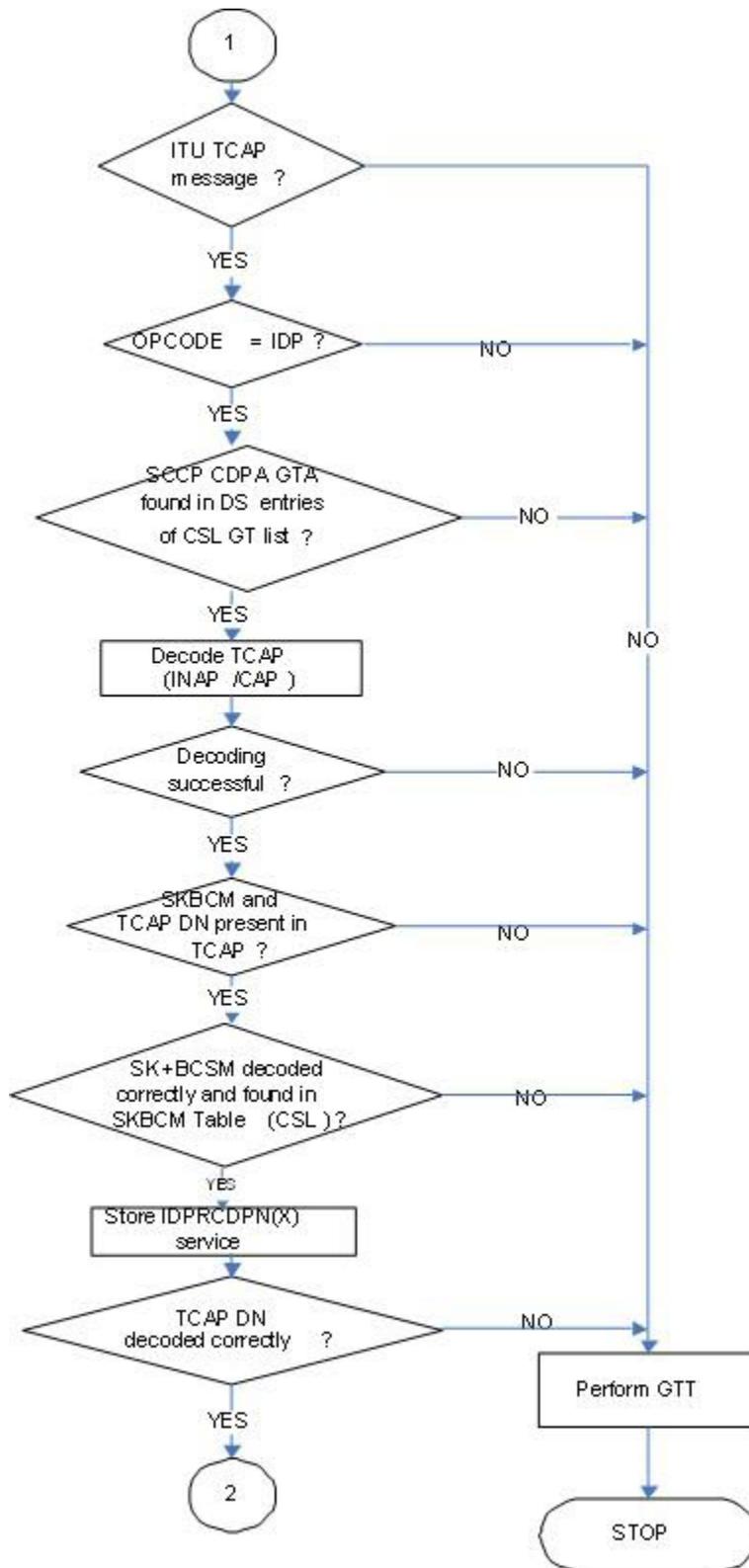
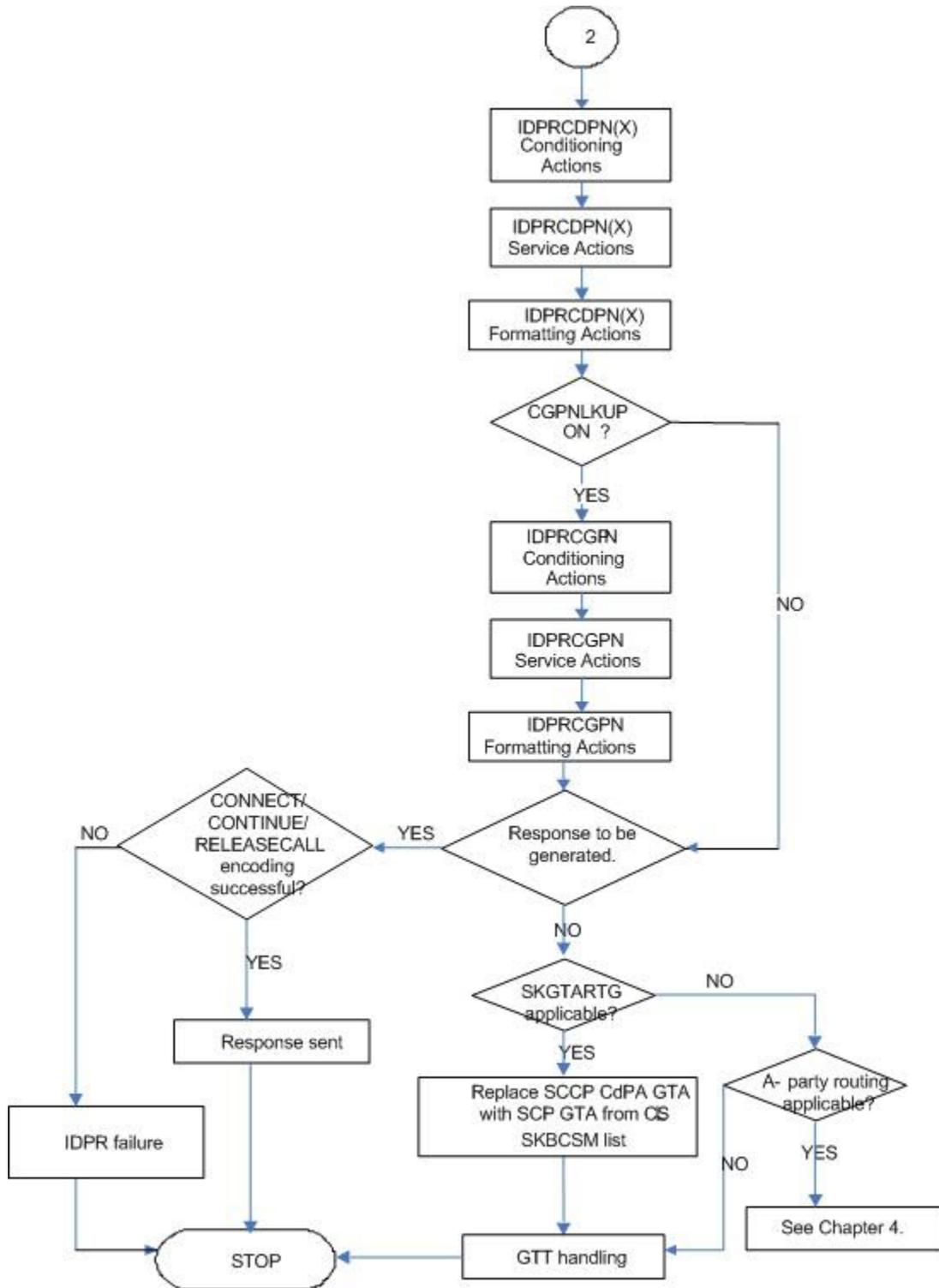


Figure 5-3 Message Flow for IDPR Relay - Sheet 3 of 3



### 5.1.1.1.1 Call Flow

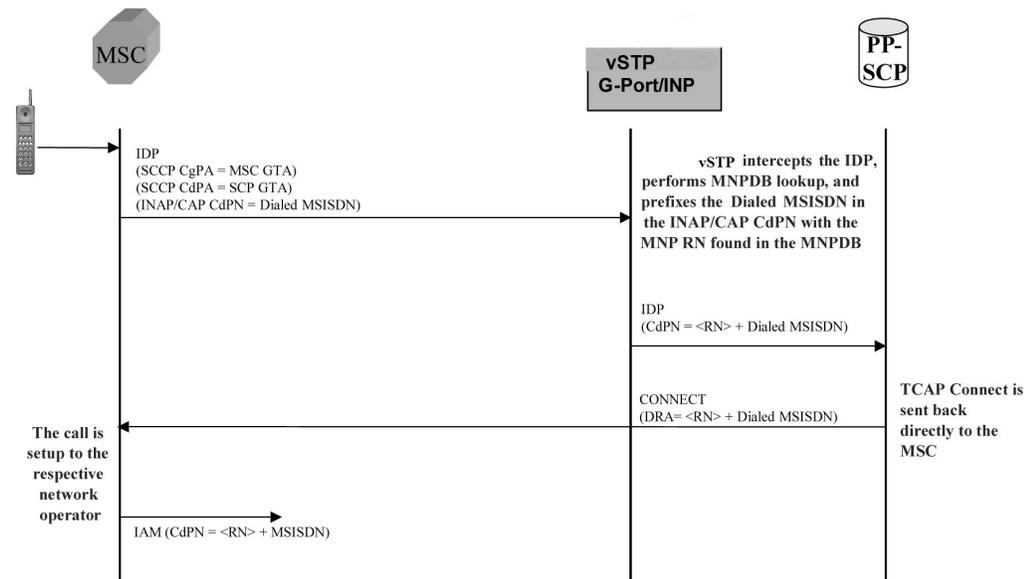
#### Mobile Originated Prepaid Call to a Ported Out Subscriber

This scenario encompasses the following subscriber types:

- **Own Subscriber Ported Out** - Refers to an Own Subscriber who has ported to a Foreign Network.
- **Foreign Subscriber Ported to Foreign Network** - Refers to a Foreign Subscriber who has ported to a different Foreign Network.
- **Foreign Subscriber** (optional, dependent on how the **UDR** is provisioned) - Refers to a subscriber whose number belongs to the number range of a Foreign Network, and who has not ported to another Foreign Network.
- **Foreign Subscriber Not Known to be Ported** (optional, dependent on how the **UDR** is provisioned) - Refers to a Foreign Subscriber whose portability status is unknown by the querying network.

When a prepaid subscriber attempts to originate a call, the **MSC/VLR** must first query a prepaid **SCP** before attempting to complete the call, in order to determine if the subscriber has enough credit to complete the call.

**Figure 5-4 MO Prepaid Call to Ported Out Subscriber**



When a prepaid subscriber originates a call, the MSC/VLR serving that subscriber formulates an **INAP** or **CAP IDP** message and routes it to the Prepaid SCP. This message is routed by **GTT (SCCP CdPA = PPSCP GTA)**, with the vSTP serving as either the Intermediate or Final GTT service provider. In either case, the vSTP is either an Intermediate or Final **GTT** service provider for the message in order for the IDP Relay service to be triggered (the message arriving at the vSTP must have **MTP DPC = vSTP PC**, **SCCP CdPA RI = route-on-GT**, and **SCCP CdPA GTA = PPSCP**).

Upon receipt of the IDP message, the **SCCP CdPA TT**, **SSN**, **NP**, **NAI**, and **GTI** Service Selectors are examined to determine which vSTP SCCP service is required. If

the message parameters match the provisioned Service Selector combination for IDP Relay service in general, the IDP Relay service determines whether this specific IDP message requires processing, based on examination of the SCCP CdPA GTA digits (which should be the GTA of a PPSCP), the **TCAP** Operation Code, and the combination of Service Key and EventTypeBCSM in the INAP/CAP layer. If the SCCP CdPA GTA matches one of the provisioned PPSCP addresses, the Operation Code signifies IDP, and the Service Key and EventTypeBCSM matches one of the provisioned service values for the IDP Relay service, then the message is processed by IDP Relay. Otherwise, the message continues through normal SCCP processing.

If the intercepted IDP message is selected for IDP Relay service, IDP Relay processing extracts the B-party number (CDPN, the number which was dialed by the prepaid subscriber) from the INAP/CAP CalledPartyNumber parameter or from the CAP CalledPartyBCDNumber parameter, and performs a lookup in the UDR (after some number filtering and conditioning).

In this scenario, the vSTP finds a match on the B-party **DN** in the UDR with an association to a Routing Number (**RN**).

 **Note:**

Typically, an DN entered in the database with an association to an RN indicates that the number is either (a) an Own Number ported to another network, or (b) a Foreign Number which has been ported to another foreign network. In some cases (depending upon how the customer chooses to provision the database), this may also indicate a Foreign Number which is not known to be ported.

After finding a match on DN with an associated RN in the UDR, the the INAP/CAP CDPN parameter is modified by prefixing the RN information to the DN. The CDPN NAI parameter will be copied from the incoming value, or changed to 'Unknown', based on the provisioned IDP Relay configuration options. The IDP Relay service may be configured to either send the same NAI as was received in the incoming CDPN, or to send the value 'Unknown' in all cases.

 **Note:**

The term CDPNNAI is used in this document to represent the value in the INAP/CAPCDPN parameter. In INAP, this parameter is known as “NAI”, while in CAP, it is known as “Type of Number”. CDPNNAI is used here to represent both for simplicity.

After the required modifications are performed, the modified IDP message is routed through GTT to the PPSCP indicated by the original GTA in the SCCP CdPA, which was not altered as a result of the IDP Relay operation. The PPSCP receives the modified IDP message, which contains the portability information needed to correctly charge for the call. The SCP then returns the appropriate response to the MSC/VLR, either allowing or denying the call.

In order for the IDP Relay feature to provide accurate portability information for all ported numbers, all ported numbers must be entered into the UDR, including Own numbers ported out as well as Foreign numbers ported to foreign networks. If a foreign number ported to a foreign network is not entered in the database with a routing number (either in the individual or range entry tables), IDP Relay will not find a match, and will not be able to prefix the routing number information to the CDPN in the IDP message with the routing number of the current subscription network. Thus, the original IDP message unmodified is sent to the SCP

with CDPN = dialed DN only. However, even in this case it is possible for the SCP to differentiate calls within the own network from calls to foreign networks very easily.

### Mobile Originated Prepaid Call to Imported or Own Non-Ported Subscriber

This scenario encompasses the following subscriber types:

- **Own Subscriber** - Refers to a subscriber whose number belongs to the number range of the Own Network and who has not ported to another network.
- **Foreign Subscriber Ported In** - Refers to a Foreign Subscriber who has ported into the Own Network.

When a prepaid subscriber attempts to originate a call, the MSC/VLR must first query a Prepaid SCP before attempting to complete the call, in order to determine if the subscriber has enough credit to complete the call.

When a prepaid subscriber originates a call, the MSC/MSC/VLR serving that subscriber formulates an INAP or CAP IDP message and routes it to the Prepaid SCP. This message is routed by GTT (SCCP CdPA = PPSCP GTA), with the vSTP serving as either the Intermediate or Final GTT service provider. In either case, the vSTP is either an Intermediate or Final GTT service provider for the message in order for the IDP Relay service to be triggered (message arriving at the vSTP must have MTP DPC = vSTP PC, SCCP CdPA RI = route-on-GT, and SCCP CdPA GTA = PPSCP).

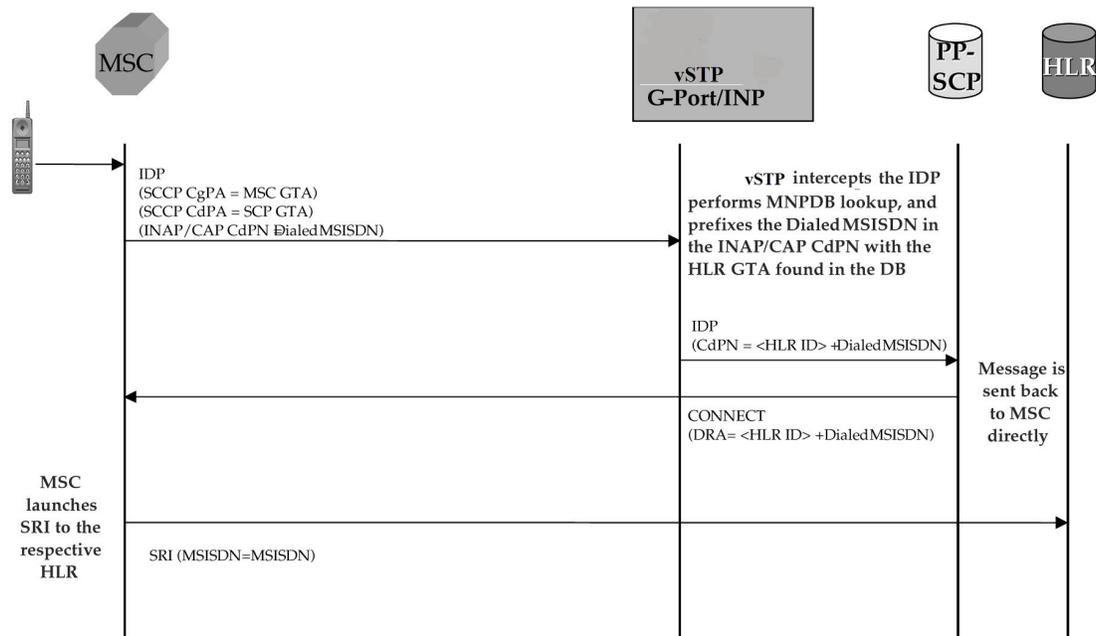
Upon receipt of the IDP message, the the SCCP CdPA **TT**, **SSN**, **NP**, **NAI**, and **GTI** Service Selectors to are examined to determine which SCCP service is required. If the message parameters match the provisioned Service Selector combination for IDP Relay service in general, the SCCP CdPA GTA digits (which should be the GTA of a PPSCP), the **TCAP** Operation Code, and the combination of Service Key and EventTypeBCSM in the INAP/CAP layer are examined to determine whether this specific IDP message requires IDP Relay processing. If the SCCP CdPA GTA matches one of the provisioned PPSCP addresses, the Operation Code signifies IDP, and the Service Key and EventTypeBCSM matches one of the provisioned service values for the IDP Relay service, then the message enters IDP Relay processing. Otherwise, the message continues through normal SCCP processing.

Additionally, for Route on SSN INAP messages with GTI=0, if the OPC/DPC matches a provisioned OPC/DPC, the message is processed by IDP Relay. Otherwise, the message continues through normal SCCP processing.

If the intercepted IDP message is selected for IDP Relay service, IDP Relay processing extracts the B-party number (CDPN - the number which was dialed by the prepaid subscriber) from the INAP/CAP CalledPartyNumber parameter or from the CAP CalledPartyBCDNumber parameter, and performs a lookup in the UDR (after some number filtering and conditioning).

In this scenario, a match is found on the DN in the UDR with an association to an SP entity ID (HLR GTA).

**Figure 5-5 MO Prepaid Call to an Imported or Own-Non-Ported Subscriber**



In this case, the PPSCP always requires an SP ID to be prefixed to the DN in the CDPN - for both Foreign Numbers Ported In as well as Own Numbers never ported. Based on this, IDP Relay requires that all such numbers be entered in the UDR with an association to an SP ID, either as individual numbers (which is likely the case for imported numbers), or in a number range (which is likely the case of own numbers not ported). This distinction is made because in a standard MNP node, it is often standard practice not to enter Own Subscribers never ported. For SP queries, the standard GTT translation normally suffices for these subscribers, and it is not required to enter them into the UDR. If these numbers are not entered, IDP Relay will not find a match, and would simply transfer the IDP message without modification to the PPSCP (containing DN only in CDPN).

This may not be an issue if the PPSCP correctly interprets when the PPSCP receives an IDP without any RN or SP ID, it assumes the DN is an Own Subscriber, and acts accordingly. It is also beneficial to enter all own subscribers with the respective **HLR-ID** to streamline MNP processing in networks with a high prepaid subscriber base.

### Mobile Originated Prepaid Call to Foreign (Non-Ported) Subscriber

In this scenario, an IDP message is received for a number which is a foreign (non-own-network) number and which has not been ported. There are two options in this scenario, both configurable through provisioning. In one case, a number range for the foreign network is entered with a Generic Routing Number for the network. In this case, IDP Relay reacts in the same way as with a ported-out number, prefixing the CDPN with the RN taken from the number range entry. Although the number is technically not ported, the use of a range with RN would still point to the correct network.

Alternatively, if the number is not provisioned in the UDR at all, or is entered without an associated routing number/HLR ID, the IDP message is not modified and the message is simply be relayed to the SCP. In this scenario, the SCP returns the IDP response to the MSC without any prefix.

This method could also be used for Own Subscribers never ported (no entry in the UDR), which would cause IDP Relay to send the unmodified IDP message to the PPSCP.

#### 5.1.1.1.2 CdPN Number Format Identification

The format of the incoming number and the context surrounding the call factor into both the conditioning of the number for the UDR search and the manner in which the message is treated as a result. The following details about the number must be known:

- Is the call terminating to a subscriber in the home country? (Calls terminating to numbers outside the home country are not subject to IDP Relay because number portability does not cross international boundaries).
- Is the calling subscriber roaming or dialing from inside the home country? (Determines if numbers dialed as national numbers are treated as in-country or out-of-country terminated).
- Was the number dialed with Escape Codes? (These must be deleted for UDR lookup, but might be re-inserted for transmission).

The INAP/CAP CDPN parameter includes a CDPN NAI parameter which indicates the Nature of Address for the dialed digits (International, National, Subscriber, or Unknown). This parameter alone cannot always be relied upon to determine the format of the CDPN. For example,

- The CDPN can contain a National number, but the CDPN NAI may be marked "Unknown".
- A National number dialed while a subscriber is roaming must be treated differently than a National number dialed while a subscriber is in his/her home country/network. The condition of whether the calling subscriber is roaming or not cannot be determined from the CDPN NAI in the CDPN.

The following additional checks must be applied to the received IDP in order to determine how the message will be treated.

- **Escape Codes**

Subscribers are normally required to enter an International Escape Code (**IEC**) before dialing the digits of an International number. For example, in some countries, the digits *00* must be dialed before dialing an International number.

Subscribers are also normally required to enter a National Escape Code (**NEC**) to before dialing long distance National numbers. For example, many countries require a single *0* to be dialed before dialing a National number.

Escape codes must be removed before IDP Relay performs the UDR lookup, because the numbers in the **UDR** are always provisioned in International format. When an Escape Code is used, the CDPN NAI will be *unknown*. Therefore, the presence or absence of an **IEC** or **NEC** will indicate whether the number is International or National.

If a message is received with CDPN **NAI** = unknown, IDP Relay first checks the leading digits of the number for a match with a provisioned IEC or NEC, and treats the number accordingly. If CDPN **NAI** = unknown and no match is found on the IEC or NEC, the number is treated as National with no preceding NEC.

- **Calling Subscriber Roaming**

Roaming is another factor in the structure of the incoming IDP message. Whether or not the calling subscriber is roaming when the call is placed determines how the message is treated.

When a subscriber is roaming, all incoming IDP messages generated from calls made by that subscriber are **CAMEL** Application Part (**CAP**) rather than INAP message. When a roaming subscriber dials a National Number (number without a Country Code), the call is treated differently than when a non-roaming subscriber dials a National Number. This is because when a subscriber dials a National number while roaming Internationally, it is assumed that the subscriber is attempting to dial a number in the country where he or she is currently roaming, and not in the home country (if the subscriber wishes to dial a number in the home country, it must be dialed as an International number since the subscriber is roaming).

Because UDR checks are not conducted across International boundaries, calls from a roaming subscriber to a National number are not subject to IDP Relay service. Calls from the same subscriber to a National number when the subscriber is not roaming are subject to IDP Relay service because these numbers are assumed to be terminating in the subscriber's home country, where portability applies. The National number digits could be identical in these two cases, although the actual destination is different.

For these reasons, the IDP Relay function might need to be able to distinguish between an IDP received for a call generated by a roaming subscriber and one generated by a non-roaming subscriber. The IDP Relay service provides the CgPA Check configuration option to select whether IDP messages generated by roaming subscribers should be subjected to IDP Relay processing, or be routed through standard GTT processing.

If the CgPA Check configuration option is ON, the roaming status of the calling subscriber is determined by comparing the Country Code in the **SCCP CGPA** parameter of the IDP message with the provisioned STPOPTS Default Country Code (DEFCC value). (The provisioned DEFCC value corresponds to the *home* network. If a subscriber is roaming, the CC of the visited MSC will not match the provisioned DEFCC value). If National roaming is allowed, the respective scenarios are treated as if the subscriber is not roaming. A roaming scenario is not detected by the CgPA Check and IDP Relay processing is performed. The CgPA Check option is ON by default. If the operator wants the IDP Relay feature to process IDP messages generated from roaming subscribers, the CgPA Check option must be turned OFF.

- **Call Placed to Country Other than Home Country**

The IDP Relay CgPA Check does not apply if a subscriber dials a number in a country other than subscriber's home country. The INAP/CAP CdPN Country Code is checked against the provisioned DEFCC value. If a match is not found, it means the subscriber has dialed a number outside his home country and IDP Relay is not required. The message falls through to GTT processing or to another SCCP service.

### 5.1.1.1.3 Service Selection

When an IDP is sent by an MSC, it is sent to the Prepaid SCP (PPSCP) through the vSTP for GTT processing. As such, the message will contain MTP DPC = vSTP PC and SCCP CdPA = PPSCP GTA with RI = GT. Because the MTP destination of the message is the vSTP, the message is delivered to the vSTP for SCCP processing.

The SCCP CdPA Translation Type (TT), Numbering Plan (NP), Nature of Address (NAI), Global Title Indicator (GTI), and Subsystem Number (SSN) parameters are examined to determine which SCCP service is being requested.

The parameters can match a Service Selector entry that indicates the IDPR service.

This combination of parameters may or may not be enough to determine that the message should receive IDP Relay service. For example, if other IDP messages could be received that do not require IDP Relay, the Service Selectors could be identical for all IDP messages. Therefore, additional service selection criteria are required.

If the parameter combination is consistent with service selectors for the IDP Relay service, the SCCP CdPA GTA digits are compared to the provisioned Common Screening List (CSL) GT list of Prepaid SCP GTs. This list should contain all SCPs that could be the recipient of an IDP message for prepaid query.

If the SCCP CdPA GTA matches one of the provisioned PPSCP GTs, service selection continues to determine if IDP Relay is required.

- The TCAP Operation Code is examined; if it is not *IDP*, the IDP message is passed to standard GTT processing.
- The combination of INAP/CAP Service Key and EventTypeBCSM from the message is compared to provisioned DS of Service Key + Event Type entries from the CSL SKBCSM list. If the message Service Key + EventTypeBCSM matches one of the provisioned SKBCSM combinations pointing to IDP Relay service, then the message is sent for IDP Relay service.

IDP messages not matching these criteria either fall through to standard GTT processing, or are sent to another SCCP service for which the criteria match.

### 5.1.1.2 NPP Processing for IDP Relay

When an IDP message had been identified as requiring IDP Relay processing, NPP processing of the message begins.

#### **NPP Pre-Processing**

The message is decoded and verified.

#### **NPP Processing**

IDP Relay provides the IDPRCDPN, IDPRCDPN2, IDPRCDPN3, and IDPRCDPN4 (collectively referred to as IDPRCDPN(X) services), and IDPRCGPN services to NPP for processing IDP messages. The filters and Action Sets in the NPP Service Rules that are provisioned for IDP Relay services are used to determine what NPP processing is required.

- The IDPRCDPN(X) services are used to process TCAP Called Party Numbers (CdPN). More than one of these services can be provisioned for use at the same time. Each service can be configured separately to handle incoming IDP messages in different ways.
- The IDPRCDPN service is used to process TCAP Called Party Numbers (CdPN).
- The IDPRCGPN service is used to process Calling Party Numbers (CgPN).

An IDPRCDPN(X) NPP service is called first, to begin NPP processing of the CdPN.

- NPP executes the provisioned Conditioning Actions to condition the number to International format for UDR lookup, and to extract information that can be used to format the outgoing message.
- NPP executes the provisioned Service Actions to perform an UDR lookup on the conditioned CdPN, to obtain data and populate Formatting Action values to be used for outgoing message formatting.

- NPP executes the provisioned Formatting Actions, if allowed by the Service Actions, to format the outgoing message.

If CgPN processing is needed, the IDPRCDPN(X) service invokes the IDPRCGPN service.

- NPP executes the provisioned Conditioning Actions to condition the number to International format for UDR lookup, and to extract information that can be used to format the outgoing message.
- NPP executes the provisioned Service Actions to perform an UDR lookup on the conditioned CgPN, to obtain data and populate Formatting Action values to be used for outgoing message formatting.

NPP executes the provisioned Formatting Actions, if allowed by the Service Actions, to format the outgoing message.

### 5.1.1.2.1 UDR Lookup

The called IDP Relay Service Actions search the UDR with the conditioned INAP/CAP CdPN or CgPN digits from the IDP message. The lookup results in one of 4 outcomes:

- **Match on Digits with RN (Routing Number)**

The number belongs to a Foreign Network, and could be an Own Subscriber ported out, or a Foreign Subscriber. The IDP Relay prefixes the RN to the CdPN digits and relays to the PPSCP.

- **Match on Digits with SP (SP Address)**

The number belongs to the Own Network, and could be an Own Subscriber, or a Foreign Subscriber ported in. IDP Relay prefixes the SP address to the CdPN digits and relays to the PPSCP.

- **Match on digits, but no associated RN or SP**

A number was entered in the UDR, but the portability status is unknown. Data might be entered in this format because it is an All Call Query solution based on **SRF**, but regulation does not allow prefixing of non-ported numbers. If IDP Relay finds such a match, the \ IDP Relay function is terminated and the message is routed through standard GTT to the PPSCP. The INAP/CAP portion of the message is not modified; only the MTP and SCCP CdPA are modified if required by standard GTT.

- **No Match on Digits**

The number is not in the UDR. Generally, this indicates that the number has never been ported (in or out), or is an unknown number. The IDP Relay function is terminated, and the message is routed through standard GTT to the PPSCP. The INAP/CAP portion of the message is not modified, and only the MTP and SCCP CdPA are modified if required by standard GTT.

The CgPN is modified only if the entity type matches the CGNPTYPE option value. If the CGNPTTYPE does not match or the CgPN lookup fails, the CgPN is not modified and processing continues for the CdPN.

### 5.1.1.2.2 NPP Conditioning Actions

The IDP Relay services support all Conditioning Actions provided by NPP.

The IDP Relay IDPRCDPN(X) services use the ACCgPN and ACCgPNx Conditioning Actions.

The IDP Relay IDPRCDPN(X) services use the ACLAC **Conditioning Action**.

The IDP A-Party Routing adds the CCCgPN Conditioning Action to the Conditioning Actions used by IDP Relay IDPRCDPN(X) services.

### ACCGPN

The ACCgPN (Area Code from **CgPN**) extracts the Area Code from the Calling Party Number (CgPN) while processing the Called Party Number (**CdPN**) services. The ACCgPN Conditioning Action skips any country code digits (matching DefCC or Multiple **CC**) and removes the number of digits specified in the SCCPOPTS ACLEN configuration option from the beginning of the CgPN. These digits are used as the Area Code (**AC**) to condition the Called Party digits for any subsequent Service Action or Formatting Action.

If the ACCgPN Conditioning Action is invoked, but the Calling Party is not present or has fewer digits than the SCCPOPTS ACLEN option value after any CC digits, then no change to Area Code is made.

The ACCgPN Conditioning Action can be provisioned with the IDPRCDPN(X) NPP Services. The ACCgPN Conditioning Action is mutually exclusive with the ACCgPNx Conditioning Actions and with any other Conditioning Action used to populate the AC (Area Code) Formatting Action value for NPP.

### ACCGPNx

The ACCgPN1 - ACCgPN8 (ACCGPNx) Conditioning Actions to extracts the Area Code from the Calling Party Number (**CgPN**) while processing Called Party Number (**CdPN**) services. The length of the Area Code to be extracted from the CgPN is not specified by SCCPOPTS:ACLEN configuration parameter. Instead, the digit suffix "x" of the Conditioning Action parameter name specifies the length of the Area Code to be extracted. For example, the Conditioning Action ACCgPN4 will extract an Area Code of 4 digits from the CgPN. The ACCgPNx Conditioning Actions skip any Country Code digits (matching DefCC or Multiple **CC**) and remove the specified "x" number of Area Code (**AC**) digits.

If an ACCgPNx Conditioning Action is invoked, but the Calling Party is not present or has fewer digits than the specified "x" number of digits after any CC digits, then no change to Area Code is made.

The ACCgPNx Conditioning Actions can be provisioned with the IDPRCDPN(X) NPP Services. The ACCgPNx Conditioning Actions are mutually exclusive with each other, with the ACCgPN Conditioning Action, and with any other Conditioning Action used to populate the AC (Area Code) Formatting Action value for NPP.

### ACLAC

The ACLAC Conditioning Action obtains the Area Code from the LAI and populates the AC Formatting Action value with the LAI Area Code. These digits will be used as the Area Code (AC) to condition the Called Party digits for any subsequent Service Action or Formatting Action.

### CCCgPN

The number of digits specified in the SCCPOPTS CCLEN option are extracted from the CgPN and used to populate the value of the CC Formatting Action, if it is provisioned. The CC Formatting Action value is used in the formatting the resulting CdPN.

**Table 5-1 IDP Relay Conditioning Actions**

Name	Description
ACCGPN	Area Code from Calling Party The Area Code needs to be extracted from the Calling Party Number.
ACCGPN1	Area Code from Calling Party Number: one-digit Area Code extracted
ACCGPN2	Area Code from Calling Party Number: two-digit Area Code extracted
ACCGPN3	Area Code from Calling Party Number: three-digit Area Code extracted
ACCGPN4	Area Code from Calling Party Number: four-digit Area Code extracted
ACCGPN5	Area Code from Calling Party Number: five-digit Area Code extracted
ACCGPN6	Area Code from Calling Party Number: six-digit Area Code extracted
ACCGPN7	Area Code from Calling Party Number: seven-digit Area Code extracted
ACCGPN8	Area Code from Calling Party Number: eight-digit Area Code extracted
ACLAC	Area Code from Location Area Code (LAC) The Area Code is not included in the incoming DN and needs to be obtained from the Local Area Information (LAI).
CCCGPN	Country Code from Calling Party The Country Code needs to be extracted from the Calling Party Number.

### 5.1.1.2.3 NPP Service Actions

The NPP Service Actions listed in [Table 5-2](#) are used by the IDP Relay feature and related features. Before an NPP Rule can be provisioned with an Action Set containing a Service Action for the IDP Relay feature or a related feature, the feature must be enabled. The precedence indicates the sequence of execution if more than one Service Action is used by a service in a Service Rule.

The following table lists the IDPRCGPN specific Service Actions:

**Table 5-2 IDPRCGPN specific Service Actions used by the IDP Relay Feature**

Service Action	Description	Precedence
INPRTG	Determines: <ul style="list-style-type: none"> <li>If a CONNECT, CONTINUE, or RELEASECALL response will be sent based on UDR lookup on conditioned CgPN</li> <li>If the IDP message should be relayed</li> <li>Whether the CutAndPaste parameter will or will not immediately follow the DRA in a CONNECT message</li> </ul>	95
BLKLSTQRY	For the IDP A-Party Blacklist feature, provides query response mode handling for selected incoming IDP messages.	90
BLKLSTRLY	For the IDP A-Party Blacklist feature, provides relay mode handling for selected incoming IDP messages.	90
CGPNRTG	Determines whether IDP A-Party Routing, IDP Service Key Routing, or both should be attempted in post-NPP processing.	70

**Table 5-2 (Cont.) IDPRCGPN specific Service Actions used by the IDP Relay Feature**

Service Action	Description	Precedence
ASDLKUP	Can be used with the CgPNASDRqd Service Action to obtain ASD from other CgPN lookup for CdPN formatting.	50
CDIAL	Corrective Dialing; can be invoked by any other Service Action to force Formatting Action execution even if the Service Action indicates that Formatting Action execution should not be performed.	10

The following table lists the IDPRCDPN specific Service Actions.

**Note:**

IDPRCDPN(X) refers to any of the IDPRCDPN, IDPRCDPN2, IDPRCDPN3, or IDPRCDPN4 services.

**Table 5-3 IDPRCDPN specific Service Actions used by the IDP Relay Feature**

Service Action	Description	Precedence
CCNCCHK	Used to match conditioned number to a CCNC Common Screening List entry; used only during upgrade. Service: IDPRCDPNIDPRCDPN(X)	100
INPRTG	Determines: <ul style="list-style-type: none"> <li>If a CONNECT, CONTINUE, or RELEASECALL response will be sent based on UDR lookup on conditioned CdPN or CgPN</li> <li>If the IDP message should be relayed</li> <li>Whether the CutAndPaste parameter will or will not immediately follow the DRA in a CONNECT message</li> </ul> Service: IDPRCDPN(X)	95
CDPNNP	Performs UDR lookup on conditioned CdPN; populates provisioned RN and SP Formatting Action values from successful lookup. See, <a href="#">CDPNNP Service Action Handler</a> Service: IDPRCDPN IDPRCDPN(X)	80
CGPNSVCRQD	Used to invoke the IDPRCGPN service for CgPN number conditioning and UDR lookup. Service: IDPRCDPN IDPRCDPN(X)	60
LACCK	Match LAI LAC with populated AC; on match, delete FPFx and PFXA digits. Service: IDPRCDPN IDPRCDPN(X)	60
ASDLKUP	Performs an UDR lookup to obtain CdPN Additional Subscriber Data (ASD) that can be used when formatting the outgoing CdPN. Service: IDPRCDPNIDPRCDPN(X)	50

**Table 5-3 (Cont.) IDPRCDPN specific Service Actions used by the IDP Relay Feature**

Service Action	Description	Precedence
CgPNASDRqd	Used to Invoke the IDPRCGPN service to obtain CgPN Additional Subscriber Data for use when formatting the CdPN. See, <a href="#">CGPNNP Service Action Handler</a> Service: IDPRCDPN IDPRCDPN(X)	50
GRNLKUP	Use of CdPN or CgPN Generic Routing Number when formatting CdPN. Can be used with the CgPNGRNRqd Service Action to obtain GRN from othe CgPN lookup for CdPN formatting. Service: IDPRCDPNIDPRCDPN(X)	50
CgPNGRNRqd	Used to Invoke the IDPRCGPN service to obtain CgPN Generic Routing Number when formatting the CdPN. Service: IDPRCDPN IDPRCDPN(X)	50
SKGTARTG	The SKGTARTG Service Action replaces the SCCP CdPA GTA in the incoming IDP or IDPSMS message with the SCP GTA provisioned in the SCPGTA value for the matching entry of the CSL SKBCSM list. Service: IDPRCDPN(x)	50
CDIAL	Corrective Dialing; can be invoked by any other Service Action to force Formatting Action execution even if the Service Action indicates that Formatting Action execution should not be performed. Service: IDPRCDPNIDPRCDPN(X)	10

#### 5.1.1.2.3.1 CDPNNP Service Action Handler

The CDPNNP Service Action Handler performs an UDR lookup on the conditioned CdPN. A successful lookup is one that returns an entity of the type defined by the NPTYPE configuration option.

The CDPNNP Service Action recognizes own-network IS41 and own-network GSM subscribers.

##### Configuration Options Used

The IDPROPTS NPTYPE option is used to define the success of the UDR lookup.

The IDPROPTS SPFILL option controls the populating of the SP entity type if the DFLTRN option value or GRN data is used for NPP processing.

The IDPROPTS RNSPFILL option controls the populating of the RN and SP entity types to the values of the digits from the UDR lookup when specific conditions are met.

##### Action Performed

Before an UDR lookup is performed, the conditioned TCAP DN is matched to the CSL CCNC list. If a match is not found in the CCNC list, the MSU falls through to GTT handling.

The UDR lookup is performed on the conditioned CdPN. If a match on the NPTYPE value is found, the following actions are performed:

- If the SRFIMSI value is present in an SP or RN entity, the SRFIMSI value is used to populate the SRFIMSI Formatting Action value.
- When the Service Portability feature is ON, CDPNNP populates the RN Formatting Action with the value of the GRN entity from the UDR entry when:
  - UDR lookup results in a successful entity type match with the NPTYPE option value
  - the subscriber is an own-network GSM subscriber

The RN populated with the GRN digits can be used during execution of the Formatting Actions for the outgoing message.

- The IDPROPTS SPFILL option value is used to control the population of UDR RN and SP digits are populated under the control of the IDPROPTS SPFILL option value and the IDPROPTS RNSPFILL option value, as shown in [Table 5-4](#).

If the returned digit string value is less than 5 digits, the IDP Relay feature generates an error message and the message falls through to GTT.

If the returned digit string value is greater than 15 digits, only the first 15 digits are used.

#### Terminating Action?

This is not a terminating action.

**Table 5-4 UDR Lookup Success Criteria and Results**

Case	NPTYPE Value	UDR "Effective" Entity Type	RN	SP
1	RN	RN	Use Network Entity digits.	Not set
2	RNSP, RNSPDN, ANY, ALWAYS	RN	Use Network Entity digits.	If SPFILL option is ON, and RNSPFILL option is ON, use Network Entity digits.
3	SP	SP	If match on Service Portability, use GRN digits. Otherwise, use DFLTRN value if provisioned.	If RN was not found, or SPFILL option is ON, use Network Entity digits.

**Table 5-4 (Cont.) UDR Lookup Success Criteria and Results**

Case	NPTYPE Value	UDR "Effective" Entity Type	RN	SP
4	RNSP, RNSPDN, ANY, ALWAYS	SP	<p>If match on Service Portability, use GRN digits.</p> <p>If no match on Service Portability, use DFLTRN value if provisioned.</p> <p>If DFLTRN value is not provisioned, and RNSPFILL is ON, use Network Entity digits.</p>	<p>If RN was not found, or SPFILL option is ON, use Network Entity digits.</p>

#### 5.1.1.2.3.2 CGPNNP Service Action Handler

The CGPNNP Service Action Handler performs an UDR lookup on the conditioned CgPN. A successful lookup is one that returns an entity of the type defined by the CGNPTYPE configuration option.

#### Configuration Options Used

The IDPROPTS CGNPTYPE option is used to define the success of the UDR lookup.

The IDPROPTS SPFILL option controls the populating of the SP entity type if the DFLTRN option value is used for NPP processing.

The IDPROPTS RNSPFILL option controls the populating of the RN and SP entity types to the values of the digits from the UDR lookup when specific conditions are met.

#### Action Performed

Before an UDR lookup is performed, the conditioned TCAP DN is matched to the CSL CCNC list. If a match is not found in the CCNC list, the MSU falls through to GTT handling.

The UDR lookup performed on the conditioned CgPN. If a match on the CGNPTYPE value is found, the following actions are performed:

- If the SRFIMSI value is present in an SP or RN entity, the SRFIMSI value is used to populate the SRFIMSI Formatting Action value.
- The IDPROPTS SPFILL option value is used to control the population of UDR RN and SP digits are populated under the control of the IDPROPTS SPFILL option value and the IDPROPTS RNSPFILL option value, as shown in [Table 5-4](#).

#### Note:

This table notes that the Service Portability check is performed for CdPN, but not for CgPN.

If the returned digit string value is less than 5 digits, the IDP Relay feature generates an error message and the message falls through to GTT.

If the returned digit string value is greater than 15 digits, only the first 15 digits are used.

#### **Terminating Action?**

This is not a terminating action.

### **5.1.1.2.3.3 INPRTG Service Action Handler**

The INPRTG Service Action Handler performs an UDR lookup on the conditioned TCAP CdPN or CgPN.

The INPRTG Service Action applies to the IDPRCDPN, IDPRCDPN2, IDPRCDPN3, IDPRCDPN4, and IDPRCGPN services.

- If the INPRTG Service Action has been executed in an IDPRCDPN(X) service, then it will not be executed again in the IDPRCGPN service.
- The IDPRCGPN NPP service is invoked only if the incoming CgPN length is equal to or greater than 5 digits for IDP messages and equal to or greater than 1 digit for IDPSMS messages.

#### **Configuration Options Used**

The IDBROPTS options shown in [Table 5-4](#) are used with the result of the INPRTG UDR lookup to determine whether a response is sent or the message is relayed.

IDBROPTS options are used in post-NPP processing to format the DRA and include or exclude the CutAndPaste parameter in CONNECT messages that result from INPRTG processing.

IDBROPTS options also specify the Release Cause to be included in RELEASECALL messages that result from INPRTG processing.

#### **Action Performed**

The UDR lookup is performed on the conditioned TCAP CdPN or CgPN.

- UDR lookup can produce the following results:
  - RN entity associated with DN
  - SP entity associated with DN
  - Neither RN nor SP associated with DN
  - DN not found
- If the conditioned DN is less than 5 or greater than 32 digits, then UDR lookup will not be performed and the result shall be considered as "DN Not Found".
- If the IGM feature is on or the Service Portability feature is enabled, then an entity type / portability type of RN/0 is considered to be SP.

The lookup result and IDBROPTS options are used in post-NPP processing to determine whether a CONNECT, CONTINUE, or RELEASECALL response is sent, or the message is relayed (here, relay means continue with the rest of the Service Action execution),

 **Note:**

If the Calling Party is blacklisted as determined by the BLKLSTQRY or BLKLSTRLY Service Action, then a CONNECT message is sent according to the BLKLSTQRY or BLKLSTRLY Service Action processing. See [Table 5-5](#)

**Table 5-5 IDBROPTS Parameters and Response Type Association for the INPRTG Service Action**

Parameter	UDR Result	Default Response Type
CDRNRSP CGRNRSP	Individual or Range database entry for CdPN or CgPN is found; RN entity is found.	CONNECT
CDSRSP CGSRSP	Individual or Range database entry for CdPN or CgPN is found; SP entity is found.	RELAY
CDNOENTITYRSP CGNOENTITYRSP	Individual or Range database entry for CdPN or CgPN is found; no entity is found.	CONTINUE
CDDNOTFNRSP CGDNOTFNRSP	No Individual or Range database entry for CdPN or CgPN is found.	RELEASE

#### 5.1.1.2.3.4 SKGTARTG Service Action Handler

For Service Key-based GTA Routing (SK GTA Routing), the SKGTARTG Service Action Handler replaces the SCCP CdPA GTA in the IDP or IDPSMS message with a provisioned SCP GTA in the SKBCSM CSL list.

The SKGTARTG Service Action applies to the IDPRCDPN, IDPRCDPN2, IDPRCDPN3, and IDPRCDPN4 services.

 **Note:**

If Service Key-based GTA Routing and IDP A-Party Routing are both provisioned, Service Key-based GTA Routing takes precedence.

#### Configuration Options Used

The `scpgta` parameter and the `:list=skbcsmlist` parameter of the `ent/chg-csl` commands are used to provision SCP GTA values for the CSL SKBCSM list.

#### Action Performed

The SKGTARTG Service Action Handler replaces the SCCP CdPA GTA in the IDP or IDPSMS message with an SCP GTA from the SCPGTA entry for the matching SK+BCSM entry of the SKBCSM CSL list.

The IDP or IDPSMS message is GTT routed to the provisioned SCP GTA.

### 5.1.1.2.4 Interactions of Multiple Service Actions and Results

The following sections describe the interactions among various Service Actions executed for the IDPRCDPN(X) and IDPRCGPN services, and the outcome of the NPP processing.

#### ASD and GRN Service Actions

Service Actions that involve the processing of ASD and GRN data have the following relationships:

- The IDP ASD feature, or IDP GRN feature, or both must be enabled before the related Service Actions can be provisioned in Service Rule Sets. The features must be turned on to allow Service Action processing to occur.
- The ASDLKUP and GRNLKUP Service Actions can exist in the same Service Action set with any other existing IDP Relay CdPN Service Action. or any other CgPN Service Action.
- The CGPNASDRQD and CGPNGRNRQD Service Actions can exist in the same Service Action set with any other existing IDP Relay CdPN Service Action.
- The ASDLKUP, CGPNASDRQD, GRNLKUP, and CGPNGRNRQD Service Actions should have lower precedence than the IDP Relay NP Service Actions (CDPNNP, CGPNNP) .

#### BLKLSTQRY, BLKLSTRLY, INPRTG, SKGTARTG, and CGPNRTG Service Actions

[Table 5-6](#) describes the interaction of the BLKLSTQRY, BLKLSTRLY, INPRTG, SKGTARTG, and CGPNRTG Service Actions.

**Table 5-6 Interactions and Outcome of NPP Processing for IDP Relay Service Actions**

BLKLSTQRY or BLKLSTRLY (CgPN)	INPRTG (CdPN or CgPN)	SKGTARTG (CdPN)	CDPNRTG (CgPN)	Expected Result
CONNECT	N/A	N/A	N/A	CONNECT (as determined by IDP A-Party Blacklist feature)
RELEASE_SMS	N/A	N/A	N/A	RELEASE_SMS (as determined by IDP A-Party Blacklist feature)
CONTINUE	CONNECT	N/A	N/A	CONNECT (as determined by INPRTG (CdPN or CgPN)
	CONTINUE			CONTINUE (as determined by INPRTG (CdPN or CgPN)
	RELEASECALL			RELEASECALL (as determined by INPRTG (CdPN or CgPN)
	RELAY, or SA not provisioned			CONTINUE (as determined by IDP A-Party Blacklist feature)
RELAY, or SA not provisioned	CONNECT	N/A	N/A	CONNECT (as determined by INPRTG (CdPN or CgPN)

**Table 5-6 (Cont.) Interactions and Outcome of NPP Processing for IDP Relay Service Actions**

BLKLSTQRY or BLKLSTRLY (CgPN)	INPRTG (CdPN or CgPN)	SKGTARTG (CdPN)	CDPNRTG (CgPN)	Expected Result
	CONTINUE	N/A	N/A	CONTINUE (as determined by INPRTG (CdPN or CgPN))
	RELEASECALL	N/A	N/A	RELEASECALL (as determined by INPRTG (CdPN or CgPN))
	RELAY, or SA not provisioned	SUCCESS GTA, or SA not provisioned	N/A SUCCESS	SK GTA Routing CgPN Routing
		GTA, or SA not provisioned	FAILURE (some provisioning error) or SA not provisioned	GTT

### 5.1.1.2.5 Examples of NPP Processing for IDP Relay

The examples in this section describe how a message flows through NPP based on a specific Service Action set configuration. Each example presents alternative paths based on the status of the subscriber represented by the conditioned number:

- Ported Out - The subscriber is known to be ported out of the network.
- Not Ported - The subscriber is known to be served by the network.
- Not Known - The subscriber is not known to the network.

In NPP processing, Conditioning Action execution is followed by Service Action execution. Formatting Action execution follows Service Action execution if Formatting Action is to occur based on the processing results.

The following digit strings are used in NPP processing:

- Original Digit String - The DN provided to NPP by the service from the incoming message when NPP is invoked by the service.
- Conditioned Digit String - The number created by Conditioning Action execution to contain one or more of the Country Code (CC), the Area Code (AC), the Subscriber Number (SN), the Dialed or Directory Number (DN), and the internationally formatted number that is CC + AC +DN (ZN)
- Outgoing Digit String - The number that results from Formatting Action execution.

#### NPP Processing Example Using the CDPNNP and ASDLKUP Service Actions

Processing for Ported Out and Not Ported subscribers is similar. The resulting Outgoing Digit String differs between the two based on whether the RN or the SP Formatting Action has a value.

The resulting Outgoing Digit String is empty for the Not Known subscriber because Formatting Action execution was not performed. The service will not modify the CdPN parameter in the outgoing message.

**Table 5-7 NPP Processing of the CDPNNP and ASDLKUP Service Actions**

NPP Phase		Ported Out	Not Ported	Not Known
Conditioning Action execution	(any Conditioning Actions)	The Original Digit String is broken into pieces from which the Conditioned Digit String is created.		
Service Action execution	CDPNNP	UDR lookup result contains an RN.	UDR lookup result contains an SP.	UDR lookup returns no record.
	ASDLKUP	UDR lookup finds ASD.		UDR lookup returns no record (no ASD).
Formatting Action execution	(any Formatting Actions)	The Outgoing Digit String is constructed using the provisioned Formatting Action values.		Formatting Action execution is not performed.

**NPP Processing Example Using the CDPNNP, ASDLKUP, and CDIAL Service Actions**

The CDIAL Service Action can be used to cause Formatting Action execution to occur even when Service Action execution indicates that it should not be performed, as when there was not information about the subscriber in the UDR. In the resulting Outgoing Digit String, the RN, SP, and ASD Formatting Action values will not contain UDR information, though Formatting Action execution could still generate a useful Digit String for substitution purposes.

**Table 5-8 NPP Processing of the CDPNNP, ASDLKUP, and CDIAL Service Actions**

NPP Phase		Ported Out	Not Ported	Not Known
Conditioning Action execution	(any Conditioning Actions)	The Original Digit String is broken into pieces from which the Conditioned Digit String is created.		
Service Action execution	CDPNNP	UDR lookup result contains an RN.	UDR lookup result contains an SP.	UDR lookup returns no record.
	ASDLKUP	UDR lookup finds ASD.		UDR lookup returns no record (no ASD).
	CDIAL	NPP performs Formatting Action execution even for Not Known subscribers.		
Formatting Action execution	(any Formatting Actions)	The Outgoing Digit String is constructed using the provisioned Formatting Action values.		

**NPP Processing of the INPRTG and CDPNNP Service Actions**

The example shown in [Table 5-9](#) assumes that the following IDPROPTS configuration option values are provisioned:

- CDRNRSP = CONNECT
- CDSRSP = RELAY

- CDNOENTITYRSP = CONTINUE
- CDDNNOTFNDRSP = RELEASECALL

**Table 5-9 NPP Processing of the INPRTG and CDPNNP Service Actions**

NPP Phase					
Conditioning Action execution	(any Conditioning Actions)	The Original Digit String is broken into pieces from which the Conditioned Digit String is created.			
Service Action execution	INPRTG	UDR lookup result contains an RN entity. Sets the response type to CONNECT. The RN is used when the CONNECT is sent for a DN associated with an RN entity. Formatting Action execution will not be performed.	UDR lookup contains an SP entity. Sets the response type to RELAY.	UDR lookup returns no record. Sets the response type to RELEASECALL. Formatting Action execution will be not performed.	UDR lookup results in DN found with no entity. Sets the response type to CONTINUE. Formatting Action execution will not be performed.
	CDPNNP	This Service Action is executed only if the INPRTG Service Action resulted in setting the response type to RELAY.			
Formatting Action execution	(any Formatting Actions)	Formatting Action execution is performed only when the response type is RELAY.			

### 5.1.1.2.6 NPP Formatting Actions

IDP Relay supports all Formatting Actions provided by NPP. IDP Relay does not provide any additional Formatting Actions.

### 5.1.1.3 Post-NPP Processing

IDP Relay determines the type of message that will be sent, based on features and functions used, configuration options, and NPP Service Action execution results.

IDP Relay performs and verifies the encoding of the outgoing message.

- IDPROPTS options are used to format the DRA and include or exclude the CutAndPaste parameter in CONNECT messages that result from NPP INPRTG Service Action execution. .
- The incoming SCCP CdPA and CgPA parameters are used in CONNECT, CONITNUE and RELEASECALL responses; the incoming CgPA becomes the response CdPA and the incoming CdPA becomes the response CgPA.
- The IDPROPTS CDRELCAUSE and CGRELCAUSE options specify the Release Cause in RELEASECALL response messages that result from INPRTG Service Action execution.

- Any Formatting Action values populated during Service Action and Formatting Action execution are used in the outgoing message encoding.

IDP Relay sends the message as indicated by the features and configuration options.

IDP Relay sends the message as indicated by the features and configuration options.

- IDP Relay sends a CONNECT, CONTINUE, or RELEASECALL response without forwarding the message to GTT.
- IDP Relay passes the IDP or IDPSMS message to GTT handling.
- IDP Relay relays the IDP or IDPSMS message.
- IDP A-Party Blacklist generates either a Connect or a Continue message to the originator, and can relay the IDP query to the SCP.
- IDP A-Party Routing and IDP Service Key Routing route the message to a Prepaid server.

## 5.1.2 IDP Relay Additional Subscriber Data Feature

The IDP Relay Additional Subscriber Data (IDPR ASD) feature allows for the insertion of Additional Subscriber Data (ASD) from the incoming CgPN and **CdPN** digit strings into the CdPN of an outgoing IDP query message.

Typical uses for IDP Relay use of ASD are for CNL information and for triggerless equal access information.

IDPR ASD uses the ASDLKUP and CgPNASDRqd Service Actions for the IDPRCDPN serviceIDPRCDPN, IDPRCDPN2, IDPRCDPN3, and IDPRCDPN4 services in NPP processing.

- The ASDLKUP Service Action Handler uses the ASDLKUP Service Action to perform an individual or range UDR lookup on the conditioned CdPN, to find an entry containing an ASD digit string.
- The CgPNASDRqd Service Action Handler performs an UDR lookup for the DN in the CgPN indicated by the ASDLKUP Service Action, and populates the value for the ASD Formatting Action with the found ASD.

The ASDLKUP Service Action or CgPNASDRqd Service Action can coexist in the same Service Action group with any other Service Actions used by IDP Relay. The ASDLKUP Service Action and the CgPNASDRqd Service Action are mutually exclusive in the same Action Set.

Depending on the Formatting Action configuration for the selected NPP rule, the NPP Formatting Action execution can use the ASD in formatting the CdPN digit string in the outgoing message.

## 5.1.3 IDP Relay Generic Routing Number Feature

The IDP Relay Generic Routing Number (IDPR GRN) feature allows for the insertion of Generic Routing Number data (GRN) from the incoming CgPN and **CdPN** digit strings into the CdPN of an outgoing IDP query message.

IDPR GRN uses the GRNLKUP and CgPNGRNRqd Service Actions for the IDPRCDPN serviceIDPRCDPN, IDPRCDPN2, IDPRCDPN3, and IDPRCDPN4 services in NPP processing.

- The GRNLKUP Service Action Handler uses the GRNLKUP Service Action to perform an individual or range UDR lookup on the conditioned CdPN, to find an entry containing a GRN digit string.
- The CgPNGRNRqd Service Action Handler performs an UDR lookup for the DN in the CgPN indicated by the GRNLKUP Service Action, and populates the value for the GRN Formatting Action with the found GRN.

The GRNLKUP Service Action or CgPNGRNRqd Service Action can coexist in the same Service Action group with any other Service Actions used by IDP Relay. The GRNLKUP Service Action and the CgPNGRNRqd Service Action are mutually exclusive in the same Action Set.

Depending on the Formatting Action configuration for the selected NPP rule, the NPP Formatting Action execution can use the GRN in formatting the CdPN digit string in the outgoing message.

## 5.1.4 IDP A-Party Blacklist Feature

The IDP A-Party Blacklist feature enhances the Prepaid IDP Query Relay feature to provide a generic framework to support subscriber blacklisting capability with a query-based or relay-based method. The feature supports the blacklist check on Calling Party (A-Party or CgPN) number in the IDP CAMEL or INAP message.

### 5.1.4.1 Feature Description

The IDP A-Party Blacklist feature provides subscriber blacklisting capability on the Calling Party (A-Party or CgPN) number in the IDP CAMEL message. (The feature is not supported for IDPSMS messages.) The blacklisting function is achieved using either a query-based mode, or a relay-based mode in conjunction with IDP Relay feature processing.

vSTP receives an IDP query message destined to the vSTP PC, or a prepaid IDP message sent to the vSTP PC for translation to a prepaid SCP. MSCs are configured with a trigger point to send an IDP message for just post-paid, or prepaid, or all subscribers in the network, depending on the use case for a particular operator.

The necessary discrimination and pre-processing are performed by the prepaid IDP Relay functions (SCCP CdPA check, CgPA check and SKBCSM Common Screening List). The Calling Party Number (from the CgPN parameter in the message) is decoded. If the subscriber number is blacklisted, the number in the UDR has a blacklist flag and any Routing Number information that is needed to re-route the call. If a blacklist match is found, a Connect message is returned with Routing Number (if provisioned). This Routing Number could be a service center number that receives the re-routed call and provides the necessary assistance. If the subscriber is not blacklisted, the IDP message continues normal processing for IDP A-Party Blacklist Relay, or a CONTINUE response is generated for IDP A-Party Blacklist Query.

The blacklisting function is achieved using either a query-based mode or a relay-based mode. The two modes are provided by two Numbering Plan Processor (NPP) Service Actions that are executed by the Prepaid IDP Query Relay (IDP Relay) IDPRCGPN NPP service:

- IDP A-Party Blacklist Query mode is provided by the BLKLSTQRY NPP Service Action, which is used when a query/response mode is desired for both blacklist-match and blacklist-no-match cases.
- IDP A-Party Blacklist Relay mode is provided by BLKLSTRLY NPP Service Action, which is used when a query/response mode is desired only for the blacklist-match case. In the

blacklist-no-match case, the message is subject to other new or existing provisioned features, their status, and the results of any other Service Action Handler execution.

## 5.1.5 IDP A-Party Routing and IDP Service Key Routing Features

The IDP A-Party Routing and IDP Service Key Routing components of the IDP A-Party Routing feature enhance the Prepaid IDP Query Relay feature to provide a routing alternative to the existing default SCCP GTA routing. An IDP or IDPSMS message can be routed to an available Prepaid Server.

- IDP A-Party Routing uses the A-Party (CgPN) parameter of an IDP or IDPSMS message
- IDP Service Key Routing uses the ServiceKey and EventTypeBCSM parameters in the incoming IDP or IDPSMS message.

### 5.1.5.1 Feature Description

The IDP A-Party Routing feature has two components:

- IDP A-Party Routing - Part Number 893033301
- IDP Service Key Routing - Part Number 893033601

IDP A-Party Routing and IDP Service Key Routing are functions of the NPP IDPRCGPN service for IDP Relay that can be used independently and together. When used together, the IDP A-Party Routing function will be attempted first. If sufficient information is not available for routing, then execution of the IDP Service Key Routing function can be attempted as a fall-through option. The IDP Service Key Routing function is attempted as a fall-through option only if that desired behavior is configured. This allows both features to be enabled and turned on, yet only IDP A-Party Routing, only IDP SK Routing, or both can be selected.

Common Screening Lists and SCCP configuration options control the operation of the two features. NPP processing for the features uses the IDP Relay feature IDPRCDPNIDPRCDPN, IDPRCDPN2, IDPRCDPN3, IDPRCDPN4, and IDPRCGPN services and specific Conditioning Actions and Service Actions.

#### **IDP A-Party Routing**

IDP A-Party Routing in the vSTP is an extension of the Prepaid IDP Query Relay (IDP Relay) feature that uses the A-Party (CgPN) parameter of an IDP or IDPSMS message to provide a routing alternative to the default SCCP GTA routing.

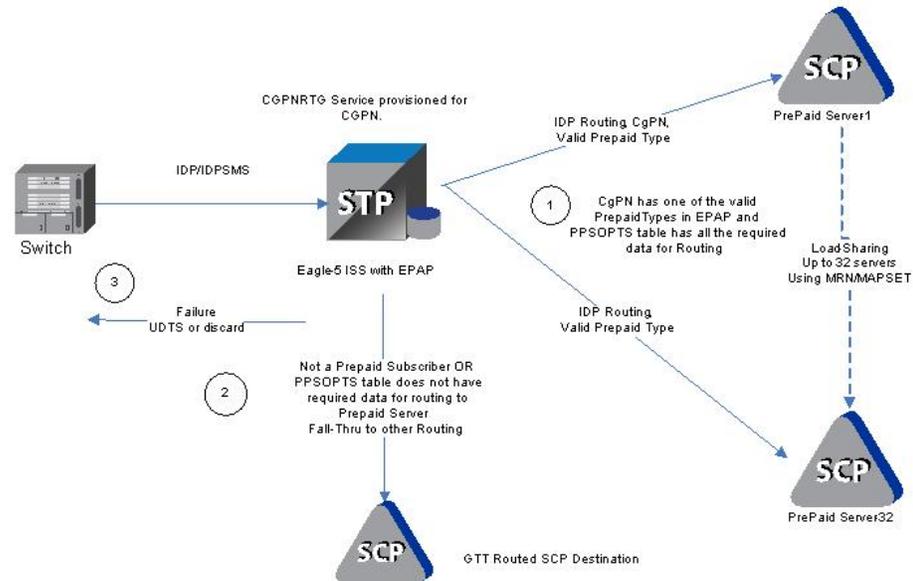
The IDP A-Party Routing function is provided by an NPP Service Action, and by routing algorithms used during post-NPP processing. The routing algorithms use Prepaid Short Message (PPSOPTS) table data and MRNSET or MAPSET table data.

If all of the required data for A-Party routing is provisioned, then IDP A-Party Routing is attempted. In the case of successful routing, an IDP or IDPSMS message can be routed to one of the available Prepaid Servers from a list of provisioned servers in the MRNSET or MAPSET loadshare table. In the case of a routing failure, either a UDTs is sent back to the originator, or the message is discarded. If all of the required data for A-Party routing is not provisioned, then routing will fall through to either IDP Service Key Routing or GTT routing.

[Figure 5-6](#) illustrates the following IDP A-Party Routing use cases:

1. Successful A-Party Routing to a prepaid server
2. Fall-through to IDP Service Key Routing or GTT routing when the A-Party is not a prepaid subscriber or A-Party Routing does not have the complete data required for routing to the prepaid server
3. Failed A-Party Routing; either a UDTS is sent back to the originator or the message is discarded

**Figure 5-6 IDP A-Party Routing Message Flow**



### IDP Service Key Routing

IDP Service Key Routing in the vSTP is an extension of the Prepaid IDP Query Relay (IDP Relay) feature that provides a routing alternative to the default SCCP GTA routing during post-NPP processing, either independently or as a fall-through option for IDP A-Party Routing.

IDP Service Key Routing uses the Service Key and EventType BCSM parameters in the incoming IDP or IDPSMS message, the provisioned prepaid type data in the SKBCSM Common Screening List, and data in the Prepaid Short Message (PPSOPTS), MRNSET, and MAPSET tables.

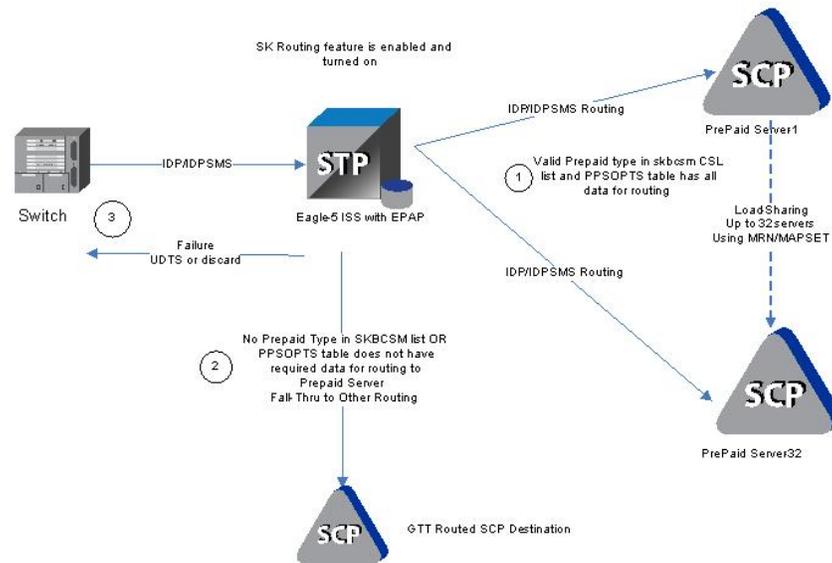
If all of the required data for Service Key routing is provisioned, then IDP Service Key Routing is attempted. In the case of successful routing, the IDP or IDPSMS message can be routed to one of the available Prepaid Servers from a list of provisioned servers in the MRNSET or MAPSET load share table. In the case of routing failure, either a UDTS is sent back to the originator, or the message is discarded. If all of the required data for Service Key routing is not provisioned, then routing will fall through to GTT routing.

Figure 5-7 illustrates the following IDP Service Key Routing use cases:

1. Successful Service Key Routing to a prepaid server
2. Fall-through to GTT routing; either the SKBCSM list or the PPSOPTS table does not have the complete data required for routing to the prepaid server

- Failed Service Key routing; either a UDTS is sent back to the originator or the message is discarded

**Figure 5-7 IDP Service Key Routing Message Flow**



### 5.1.5.1.1 IDP A-Party Routing and Service Key Routing Interaction

The two features link together when both features are turned on and the A-Party Routing CGPNRTG NPP Service Action is provisioned.

The processing always attempts A-Party Routing first. If A-Party Routing is not attempted, Service Key Routing will be attempted depending on the CGPNSKRTG configuration option value in the IDPROPTS table. Service Key Routing is considered only if both features are enabled and turned on.

- If the CGPNSKRTG option is ON, Service Key Routing will be considered if A-Party Routing is not attempted. A-Party Routing will not be attempted if sufficient data required for A-Party Routing is not provisioned.
- If the CGPNSKRTG option value is OFF, Service Key Routing will be skipped and the message falls through to GTT routing if A-Party Routing is not attempted.

Whether A-Party Routing or Service Key (SK) Routing is attempted, after a message attempts to route, no other routing method (including the regular SCCP GTA/GTT routing) is attempted. If routing fails, this is treated as an IDP Relay routing failure; a UDTS is sent and the message is discarded.

**Table 5-10 IDP A-Party Routing and IDP Service Key Routing Feature Interaction**

A-Party Routing Turned On	CGPNRTG Service Action Provisioned	SK Routing Turned On	IDPROPTS CGPNSKRTG	Routing Decision	
No	N/A	No	N/A	Fall through to GTT	
		Yes	N/A	SK Routing (Fail = UDTS, discard) (Insufficient Data=Fall through to GTT)	
Yes	No	No	N/A	Fall through to GTT	
		Yes	N/A	SK Routing (Fail = UDTS, discard) (Insufficient Data = Fall through to GTT)	
Yes	Yes	Insufficient Data	No	N/A	Fall through to GTT
			Yes	Off	Fall through to GTT
		Sufficient Data	N/A	On	Fall through to SK Routing (Fail = UDTS, discard) (Insufficient Data = Fall through to GTT)
			N/A	N/A	A-Party Routing (Fail = UDTS, discard)

### 5.1.5.1.2 IDP A-Party Routing Service Action Handlers

IDP A-Party Routing provides Service Action Handlers for the NPP Service Actions that are specific to IDP A-Party Routing. IDP A-Party Routing and NPP perform the following functions:

- UDR lookup
- Interpretation of results from UDR lookups
- NPP processing of Service Actions that are used for IDP A-Party Routing

The following table provides a summary of the Service Actions used for IDP A-Party Routing.

**Table 5-11 Summary of IDP A-Party Routing Service Actions**

Service Action	Description	Function	Precedence
CGPNRTG	CgPN A-Party or Service Key Routing	Determines whether CgPN routing and/or SK routing should be attempted during post-NPP processing.	80
CGPNSVCRQD	Calling Number lookup	Sets a flag to cause the IDPRCGPN service to be invoked for the message.	60

#### 5.1.5.1.2.1 CGPNRTG Service Action Handler

The CGPNRTG Service Action Handler performs an UDR lookup on the conditioned CgPN to find the Portability Type, and determines whether CgPN routing, or Service Key routing, or both should be attempted during post-NPP processing.

##### **Configuration Options Used**

If the IDP A-Party Routing feature and the IDP Service Key Routing feature are on, the IDPROPTS CGPNSKRTG option is used to determine if Service Key Routing should be used as a fall-back option for A-Party Routing.

##### **Action Performed**

The Portability Type from the UDR lookup is examined to identify a prepaid subscriber.

If the IDP Service Key Routing feature is on and the IDP Service Key Routing feature is not enabled, Service Key Routing will not be attempted in post-NPP processing.

If both features are on, the CGPNSKRTG configuration option is used to determine whether only A-Party Routing will be attempted, or Service Key Routing is available if A-Party Routing fails, in post-NPP processing.

##### **Terminating Action?**

This is not a terminating action.

#### 5.1.5.1.2.2 CGPNSVCRQD Service Action Handler

The CGPNSVCRQD Service Action Handler sets a flag to cause the IDPRCgPN service to be invoked for the message.

##### **Configuration Options Used**

None.

##### **Action Performed**

A flag is set to cause the IDPRCgPN service to be invoked for the message.

##### **Terminating Action?**

This is not a terminating action.

### 5.1.6 IDP Screening for Prepaid Feature

The **IDP** Screening for Prepaid feature provides a mechanism to decide, prior to routing the calls to the prepaid engine, whether checking the credit status of prepaid subscribers is required.

#### 5.1.6.1 Feature Description

For a voice or text (short message) calls originated by prepaid subscribers, the serving MSC formulates an INAP IDP message, destined for a prepaid engine, to check subscriber credit status.

The IDP Screening for Prepaid feature provides a mechanism to intercept the IDP message and decide whether checking the credit status of prepaid subscribers is required before routing the calls to the prepaid engine.

In-network voice and text (short message) calls from prepaid subscribers, with specified "unlimited" call and texting plans, are not subjected to credit checks (routing to a prepaid engine) and are delivered by the MSC to the intended destination.

#### **Voice Calls - Unlimited Call and Text**

The vSTP intercepts IDP messages and determines whether checking credit status is required prior to routing the calls to the prepaid engine.

Voice calls originated by prepaid subscribers with specified "unlimited" call and text plans are identified by a predefined Service Key value that differs from the one used for other originating voice calls (either originated by prepaid subscriber with specified "unlimited" text plans, or prepaid subscribers not subscribing to "unlimited" plans). The value assigned to the Service Key is set by the originating MSC when the call hits an Intelligent Network (IN) trigger.

For voice calls originated by prepaid subscribers with a specified "unlimited" call and text plan, the vSTP examines whether the calls are in-network. In-network calls are calls from a subscriber to another subscriber, and are described by a list of prefixes. For in-network voice calls, the vSTP returns an INAP Continue message to instruct the MSC to continue the calls (bypass the prepaid status check). For any other type of calls, the vSTP relays the IDP message to the prepaid engine using Global Title Translation (GTT).

For voice calls that do not originate from prepaid subscribers with a specified "unlimited" call and text plan, the vSTP relays the IDP message to its intended destination.

#### **Text Calls - Unlimited Call and Text**

Text calls (short messages) originated by prepaid subscribers with a specified "unlimited" call and text plan use the same Service Key as voice calls.

For text calls that do not originate from a "24/7 Call and Text Unlimited" or a "24/7 Text Unlimited" prepaid subscriber, the vSTP relays the IDP message to its intended destination.

#### **Text Calls - Unlimited and Text**

Text calls originated by prepaid subscribers with a specified "unlimited" text plan will be identified by a predefined Service Key value that differs from the one used for calls originated by prepaid subscribers with a specified "unlimited" call and text plan or prepaid subscribers not subscribed to the specified "unlimited" calling plans.

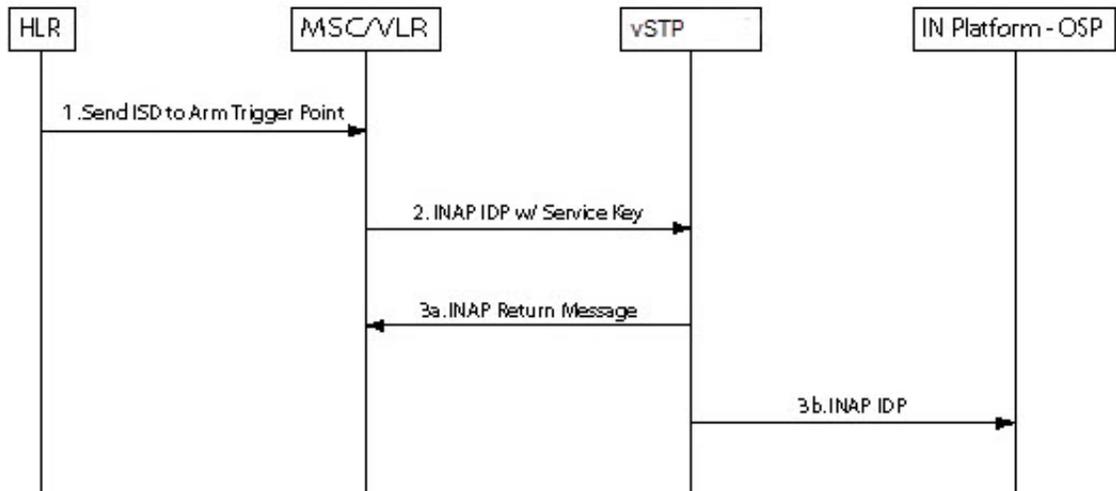
When text calls originate from prepaid subscribers with a specified "unlimited" text or "unlimited" call and text plan, the vSTP examines whether the call is an in-network call. If it is an in-network text call, the vSTP returns an INAP Continue message to instruct the MSC to continue the call.

For any other types of calls, the vSTP relays the IDP message to the prepaid engine.

### 5.1.6.2 Call Flow

The following figure illustrates an IDP message that is subject to IDP screening for prepaid.

**Figure 5-8 IDP Message Subject to IDP Screening for Prepaid**



1. HLR sends the MAP Insert\_Subscriber\_Data message to MSC to arm trigger points.
2. MSC formulates an INAP IDP message and sends it to vSTP with a Service Key encoded as follows:

- ServiceKey = xx for voice and text calls originated from prepaid subscribers with "unlimited" call and text plan
- ServiceKey = yy for text calls originated from prepaid subscribers with "unlimited" call and text plan
- ServiceKey = zz for all other types of prepaid calls

vSTP intercepts the INAP IDP message and determines the disposition of the call by examining the following values of the parameters encoded in the INAP IDP message:

- ServiceKey
- TeleService
- CallingPartyNumber
- CalledPartyBCDNumber

3. Based on the Service Key parameter values, the vSTP performs one of the following:
  - a. The vSTP returns an INAP Continue Message to the MSC if any one of all the following 3 scenarios is identified:
    - Prepaid voice calls originated from prepaid subscribers with "unlimited" call and text that include:
      - ServiceKey = xx
      - TeleService = Telephony (value = 17)
      - Both Calling Party Number and CalledPartyBCDNumber are found in the In-Network Subscriber List

- Prepaid text calls originated from prepaid subscribers with "unlimited" call and text that include:
    - ServiceKey = xx
    - TeleService = Short MessageMO-PP (value = 34)
    - Both Calling Party Number and CalledPartyBCDNumber are found in the In-Network Subscriber List
  - Prepaid text calls originated from prepaid subscribers with "unlimited" text that include:
    - ServiceKey = yy
    - TeleService = Short MessageMO-PP
    - Both Calling Party Number and CalledPartyBCDNumber are found in the In-Network Subscriber List
- b. For all other scenarios, the vSTP relays the INAP IDP message to its intended destination.

## 5.2 MOSMS Overview

The Mobile Originated Short Message Service (MO SMS) features address the number portability requirements of wireless network operators for delivery of Mobile Originated SMS messages. The vSTP 5 ISS MO SMS features apply number portability database lookup to SMS messages for GSM networks, validates subscriber use of the correct Short Message Service Center, and delivers messages to Prepaid Servers if either the Calling Party Number or Called Party Number is associated with a prepaid subscriber.

These features include:

- Mobile Originated Based GSM SMS Number Portability (MO-Based GSM SMS NP)
- Portability Check for Mobile Originated SMS (MNP SMS)
- Prepaid Short Message Service Intercept (PPSMS)
- Mobile Originated SMS Additional Subscriber Data (MO SMS ASD)
- Mobile Originated SMS Generic Routing Number (MO SMS GRN)

The MO SMS features are based on the vSTP platform with UDR. Numbering Plan Processor (NPP) is used by the MO SMS features for number conditioning and service logic execution.

### Mobile Originated Based GSM SMS Number Portability

The Mobile Originated Based GSM SMS Number Portability (MO-Based GSM SMS NP) feature provides network information to the Short Message Service Center (SMSC) for subscribers in the GSM network. This ported information allows the SMSC to distribute the messages to the correct operating network for the Called Party Number.

### Portability Check for Mobile Originated SMS

When the Portability Check for Mobile Originated SMS (MNP SMS) feature is enabled and turned on, the vSTP 5 ISS filters incoming messages based on the MAP Operation Code. If the message is an MO Forward Short Message (MO FSM), the **MSISDN** number of the originating subscriber is used to search the G-Port Mobile Number Portability database. If a match is found indicating the subscriber has been ported-out, the vSTP 5 ISS uses the destination SMSC address obtained from the **SCCP CdPA** to search a list of home network

SMSC addresses. If a match is found, indicating the ported-out subscriber is fraudulently attempting to send SMS using the SMSC of the old network, the message is discarded and an error message is generated and returned to the originating MSC.

### **Prepaid Short Message Service Intercept**

The Prepaid Short Message Service Intercept (**PPSMS**) feature applies to only mobile originated SMS, which are messages sent from a mobile handset through an Mobile Switching Center (MSC) to the Short Message Service Center (SMSC). PPSMS screens incoming messages from the MSC based on the MAP operation code. Message Discrimination determines whether the MSISDN of the sender is retrieved and a database lookup performed. Database lookup determines if the MSISDN belongs to a contract subscriber or a prepaid subscriber. If the MSISDN belongs to a contract subscriber, the message is routed to the SMSC. If the MSISDN belongs to a prepaid subscriber, the message is diverted to a Prepaid SMS Server for a credit check before allowing the message to be delivered to the SMSC.

### **MO SMS Additional Subscriber Data**

The MO SMS Additional Subscriber Data (MO SMS ASD) feature allows for the insertion of Additional Subscriber Data (ASD) values into the outgoing message. The MO SMS ASD feature supports the ASDLKUP or CGPNASDRQD NPP Service Actions for GSM MO SMS NPP Services. The ASDLKUP and CGPNASDRQD NPP Service Actions are mutually exclusive within the same NPP Rule.

The ASDLKUP Service Action populates the ASD digits retrieved from an UDR lookup of the individual or range DN table. The ASD digits are used with the Formatting Action. ASDLKUP supports both Calling Party and Called Party NPP Services for GSM : MOSMSGCDPN, MOSMSGCGPN, MOSMSICDPN, MOSMSICGPN. However, ASD digits retrieved by Calling Party or Called Party NPP Services are not used for modifying CgPN. ASD digits retrieved by Calling Party NPP Service are used with the Formatting Action for the Called Party Number if CGPNASDRQD Service Action is executed from Called Party NPP Service. If no ASD digits are found, no action is taken.

The CGPNASDRQD Service Action retrieves the ASD digits from the UDR lookup of the Calling Party Number. The ASD digits are used with the Formatting Action for the Called Party Number. CGPNASDRQD supports Called Party NPP Services for GSM: MOSMSGCDPN, MOSMSICDPN.

### **MO SMS Generic Routing Number**

The MO SMS Generic Routing Number (MO SMS GRN) feature allows for the insertion of a Generic Routing Number (GRN) digit string into the outgoing message. The MO SMS GRN feature supports the GRNLKUP or CGPNGRNRQD NPP Service Actions in GSM MO SMS NPP Services. The GRNLKUP and CGPNGRNRQD NPP Service Actions are mutually exclusive within the same NPP Rule.

The GRNLKUP Service Action populates the GRN digits retrieved from an UDR lookup of the individual or range DN table. The GRN digits are used with the Formatting Action. GRNLKUP supports both Calling Party and Called Party NPP Services for GSM : MOSMSGCDPN, MOSMSGCGPN, MOSMSICDPN, MOSMSICGPN. However GRN digits retrieved by Calling Party or Called Party NPP Services are not used for modifying CgPN. GRN digits retrieved by Calling Party NPP Service are used with the Formatting Action for the Called Party Number if CGPNGRNRQD Service Action is executed from Called Party NPP Service. If no GRN digits are found, no action is taken.

The CGPNGRNRQD Service Action retrieves the GRN digits from the UDR lookup of the Calling Party Number. The GRN digits are used with the Formatting Action for the Called Party Number. CGPNGRNRQD supports Called Party NPP Services for GSM : MOSMSGCDPN, MOSMSICDPN.

### TCAP Segmented SMS Support Phase 1

The TCAP Segmented SMS Support Phase 1 enhancement allows the Portability Check for Mobile Originated SMS and Mobile-Originated Based GSM SMS NP features to correctly process TCAP Segmented SMS messages. If a segmented message is subjected to the service associated with either of these features, then the vSTP 5 ISS routes the initial TC\_Begin message using standard GTT processing. The subsequent TC\_Continue message is subjected to the specified service. The GTT feature and either the Portability Check for Mobile Originated SMS or the Mobile-Originated Based GSM SMS NP feature must be turned on before the TCAP Segmented SMS Support Phase 1 enhancement can be provisioned. The MOSMSTCAPSEG parameter of the MNPOptions table is used to provision TCAP Segmented SMS Support Phase 1.

## 5.2.1 System Options for MO SMS Features in GSM Networks

The system level options stored in the GSMSMSOPTS table are used to perform number conditioning, response generation, and other feature-specific options. [System Options - MO SMS Features in GSM Networks](#) shows the MO SMS options in the GSMSMSOPTS table, possible values, and the actions taken for each value.

The MO-Based GSM SMS NP, MO SMS ASD, MO SMS GRN, Portability Check for MO SMS, or Prepaid SMS Intercept feature must be enabled before these options can be specified in the GSMSMSOPTS table.

**Table 5-12 System Options - MO SMS Features in GSM Networks**

GSMSMSOPTS Option	Value	Action in the vSTP
MOSMSDEFRN	1-15 digits, NONE (default)	The value is the default routing number used for <b>own-network</b> subscribers.
MOSMSACLEN	0-8 (default =0)	The value is the number of digits from the MO SMS CgPA used as the Area Code in the MO SMS CdPA.
MOSMSDIGMAT	BESTFIT	When the HomeSMSC Match with Digits option is set to <i>BESTFIT</i> , an exact match is attempted on the incoming SCCP CdPA digits in the Home SMSC table. If an exact match is not found, a best fit match of the leading digits of the incoming SCCP CdPA digits is attempted to the Home SMSC table entries.
	EXACT (default)	When the HomeSMSC Match with Digits option is set to <i>EXACT</i> , an exact match must be made of the incoming SCCP CdPA digits in the Home SMSC table.
MOSMSFWD	NO (default)	No MO-SMS forward will be performed.
	YES	If the MO-SMS TCAP Called Party Number is modified, then the MO-SMS message will be redirected by modifying the SCCP CdPA, to the GTA value identified in the MOSMSGTA field.  This option cannot be set to YES unless the MOSMSGTA option has a valid value specified.

**Table 5-12 (Cont.) System Options - MO SMS Features in GSM Networks**

GSMMSOPTS Option	Value	Action in the vSTP
MOSMSGTA	5-21 digits, NONE (default)	This option is used to replace the SCCP CdPA in the MO-SMS message. If the MO-SMS TCAP Called Party Number is modified, then the MO-SMS message will be redirected by modifying the SCCP.  This option cannot be specified unless a GTA with the same value has been provisioned in the GTT translation table. For more information about the GTT translation table, refer to the <i>Database Administration - GTT User's Guide</i> .
MOSMSNAI	INTL (default)	When SNAI=INTL, no number conditioning is required before lookup in the Number Portability database.
	NAI	The NAI from the MO_SMS message is used for conditioning before lookup in database. <ul style="list-style-type: none"> <li>If the NAI is INTL, then Number Portability lookup is performed immediately.</li> <li>If the NAI is any other value, then the number is considered to be in national format. The CC is added before Number Portability lookup is performed.</li> </ul>
	NAT	The CdPN is treated as National number for lookup in the Number Portability database. When SNAI=NAT, the CC will be added to the DN before lookup in the Number Portability database.
	UNKNOWN	When this value is set, the NAI will be treated as Unknown for the purposes of Number Conditioning.
MOSMSSA	NO (default)	No subaddress is searched for in the B party number from the TCAP part.
	YES	The subaddress is searched in the B party number. If the subaddress (identified by "#" present in the B party number) is found, the subaddress is removed before Number Portability database lookup is performed.
MOSMSTCAPSE G	OFF (default)	Mobile Originated Segmented TCAP messages are not supported.
	ON	Mobile Originated Segmented TCAP messages are supported.
MOSMSTYPE	ALL	When the lookup in the Number Portability database has entitytype=SP or RN or no_entity, then the lookup is considered successful.
	RN	When the lookup in the Number Portability database has entitytype=RN, then the lookup is considered successful.
	SP	When the lookup in the Number Portability database has entitytype=SP, then the lookup is considered successful.
	SPRN (default)	When the lookup in the Number Portability database has entitytype=SP or RN, then the lookup is considered successful.
MOSMSSPFILL	OFF (default)	The Numbering Plan Processor (NPP) does not populate both RN and SP entities for own-network subscribers at the same time.
	ON	The Numbering Plan Processor (NPP) populates both RN and SP entities for own-network subscribers at the same time.

## 5.2.2 MO-Based GSM SMS NP

The **MO**-Based GSM SMS NP feature provides network information to the Short Message Service Center (**SMSC**) for subscribers using the GSM network. This information allows the SMSC to select a protocol to deliver **SMS** messages to the called party.

The MO-Based GSM SMS NP feature:

- Intercepts SMS messages after they have undergone Prepaid Short Message Service Intercept (**PPSMS**) and Portability Check for Mobile Originated SMS (**MNP SMS**) processing and before they reach the SMSC

 **Note:**

The MO-Based GSM SMS NP feature does not require the PPSMS or MNP SMS features to be enabled.

- Decodes the TCAP/MAP message destination address and performs lookup in the number portability (**NP**) database
- Modifies the destination address in the TCAP message with directory number (**DN**) porting information
- Relays the message to the SMSC

The SMSC uses the DN porting information to determine whether to forward the message to other operators or to process the message for an in-network subscriber.

The MO-Based GSM SMS NP feature applies to ForwardSM SMS MSUs with ITU TCAP/MAP for either ITU or ANSI MTP messages.

### 5.2.2.1 Options

The MO-Based GSM SMS NP feature provides the following configurable options for controlling the processing of GSM **SMS** messages:

- Modifying SMS destination address information for processing
- Outbound digit format
- When an **NP** DB lookup is considered to be successful
- Handling of sub address field in destination address

### 5.2.2.2 MO-Based GSM SMS NP Protocol Handling

After the MO-Based GSM SMS NP feature has been enabled and turned on, it provides the following protocol handling:

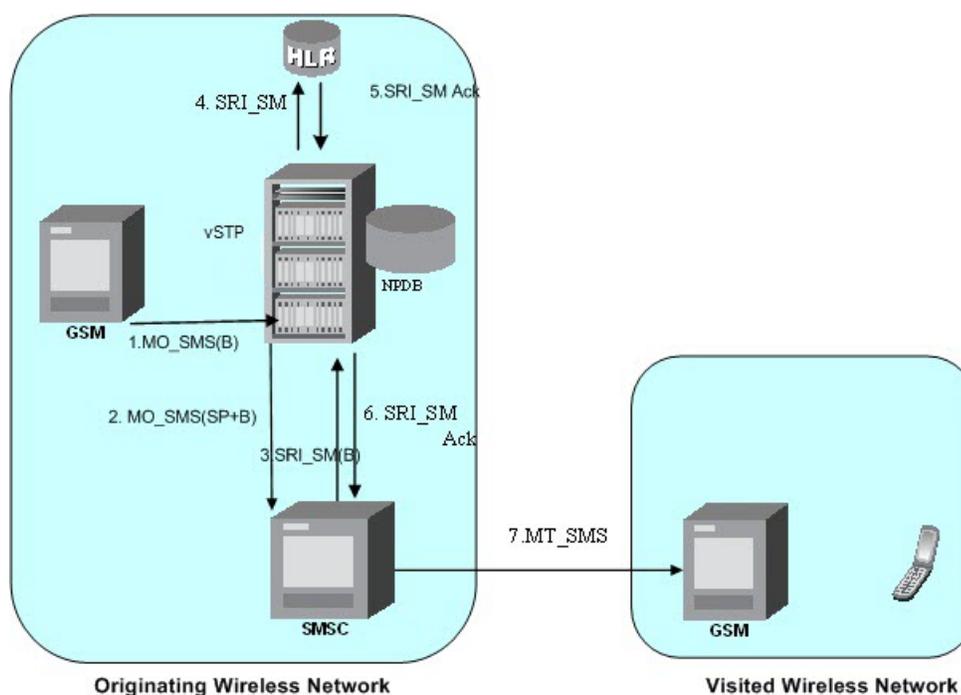
- The MO-Based GSM SMS NP feature traps the MO\_SMS message and performs NPDB lookup based on the B number from the TCAP SM-RP-UI parameter. If the entity type is the same as the value of the MOSMSTYPE option in the GSMSMSOPTS table, then this feature modifies the outgoing MO\_SMS based on the value of the MOSMSDNFMT option.
- When the outgoing MO-SMS is modified, the NAI is based on the value of the MOSMSDNNAI parameter in the GSMSMSOPTS table.

- The MO-Based GSM SMS NP feature performs SCCP **CdPA** GTA lookup against the **SMSC** list maintained by the **STP**. If the lookup is not successful, the **MSU** falls through to **GTT** handling.
- When both the MO-Based GSM SMS NP feature and the Portability Check for MO-SMS feature are configured:
  - Both features must have the same service-selector service.
  - The MO-Based GSM SMS NP feature processes an MSU only when the MSU has passed the processing by the Portability Check for MO\_SMS feature and no **NACK** has been sent.
- The MO-Based GSM SMS NP feature is required only for MO\_SMS messages with SMS-Submit and SMS-Command.
- The number conditioning is based on the Conditioning Actions provisioned in the NPP Rule Set.
- For messages handled within this feature, the SCCP CdPA is always used to route the message.
- If the MOSMSTYPE=ALL, MOSMSDNFMT=RN, and the UDR lookup has no entity assigned to the DN, then the MO\_SMS message is not modified.
- The MAP Called Party Number is modified by the formatted digits computed by the Formatting Actions in the NPP Rule Set.
- If the MOSMSSA=YES, then the subaddress is searched and removed from **MAP** called Party number for **NPDB** lookup. The subaddress is not removed from the final MO\_SMS message.
- If the number of called party digits in the modified MO\_SMS message is greater than 20, then the digits are not modified and the original message is routed to the **SMSC** based on SCCP CdPA.
- The MO-Based GSM SMS NP feature considers a successful UDR lookup with entitytype=RN and portabilitytype=0 to be entitytype=SP.
- If the MOSMSFWD=Yes and the MO-SMS **TCAP** called-party number is modified after successful UDR lookup, then the MO-SMS message is redirected to the **GTA** identified in the MOSMSGTA field by modifying the SCCP CdPA.

### 5.2.2.3 MO-Based GSM SMS NP Call Flows

This section illustrates the sequence of messages that occur when a mobile operator delivers SMS messages in a number portability environment to:

- A called subscriber that is in the same network as the calling subscriber
- A called subscriber that is in a different network from the calling subscriber

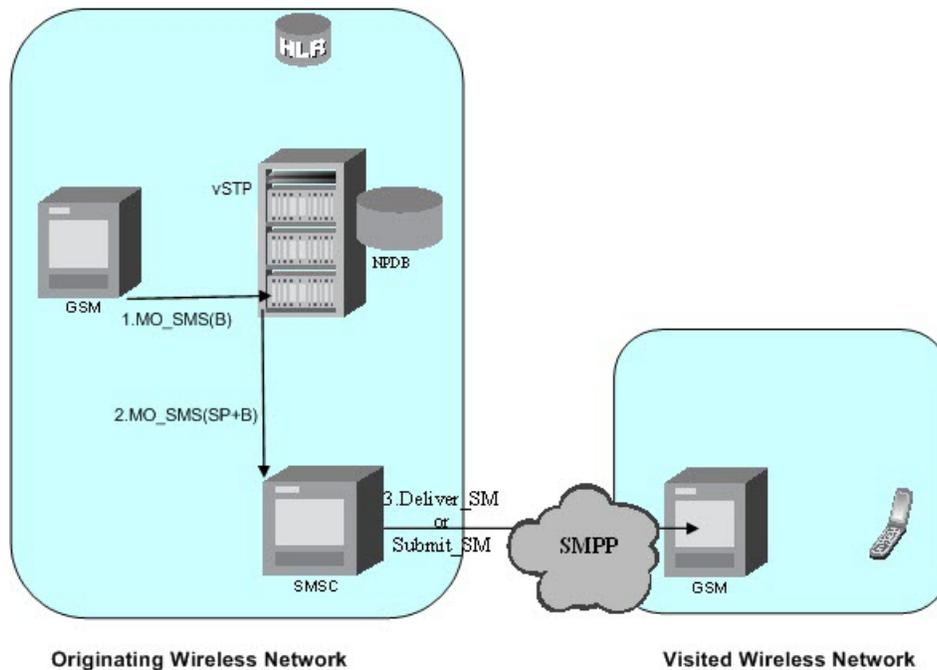
**Figure 5-9 MO-Based GSM SMS NP Call Flow for In-Network Subscriber****Call considerations:**

- The TCAP calling party is a wireless GSM subscriber.
- The TCAP called party is a non-ported or ported-in wireless subscriber that belongs to the same carrier as the TCAP calling party.
- The call type is SMS.
- The SMSC (Short Message Service Center) has to remove the prefix that indicates that the DN (dialed number) is ported in.
- If the called subscriber is ported-in, it must be provisioned individually.

**Message Flow:**

1. MO\_SMS(B) - vSTP intercepts SMS messages after they have undergone Prepaid Short Message Service Intercept (PPSMS) and Portability Check for Mobile Originated SMS (MNP SMS) processing and decodes the TCAP/MAP message destination address.
2. MO\_SMS(SP+B) - If successful, modify B-party Number and relay to SMSC.
3. SRI\_SM(B) - Send message to HLR to find B-party.
4. SRI\_SM - Send message to HLR to locate B-party.
5. SRI\_SM Ack - HLR sends message to vSTP.
6. SRI\_SM Ack - vSTP routes message to SMSC.
7. MT\_SMS - Deliver message to in-network subscriber.

Figure 5-10 MO-Based GSM SMS NP Call Flow for Other-Network Subscriber



Call considerations:

- The TCAP called party is a non-ported or ported-in wireless subscriber that belongs to a different carrier from the TCAP calling party.
- The call type is SMS.
- The SMSC (Short Message Service Center) has to remove the prefix that indicates that the DN (dialed number) is ported in. If the called subscriber is ported-out, it must be provisioned individually.
- If the called subscriber is TDMA, the vSTP Migration feature ensures that the message gets delivered in the TDMA network.

Message Flow:

1. MO\_SMS(B) - vSTP intercepts SMS messages after they have undergone Prepaid Short Message Service Intercept (PPSMS) and Portability Check for Mobile Originated SMS (MNP SMS) processing and decodes the TCAP/MAP message destination address.
2. MO\_SMS(SP+B) - If successful, modify B-party Number and relay to SMSC.
3. Deliver\_SM - Forward message or submit message other network.

### 5.2.3 Portability Check for Mobile Originated SMS

The Portability Check for Mobile Originated SMS (**MNP SMS**) feature is designed to prevent subscriber use of an incorrect Short Message Service Center by filtering incoming messages based on **MAP** Operation Code. If the message is a MO Forward Short Message (**MOFSM**), the Mobile Subscriber Integrated Services Digital Network (**MSISDN**) number of the originating subscriber, or subscriber phone number, is used to search the MOSMS Mobile Number Portability database.

When a mobile subscriber sends a Mobile Originated Short Message Service message (**MOSMS**) using a GSM handset, the message is first deposited in a Short Message Service Center (**SMSC**). The SMSC determines where the intended recipient, who is also a mobile subscriber, is located by querying the Home Location Register (**HLR**) of the recipient to determine the current Mobile Switching Center (**MSC**) of the recipient.

The SMSC address to which a message is routed is programmed into the GSM mobile handset. After a subscriber ports to another network, the handset is reprogrammed with the SMSC address for the new network; however, the subscriber could change the SMSC address to the address of the former network, causing Short Message Service (**SMS**) messages to be sent incorrectly to the former network SMSC of the subscriber. Because the former network would not have billing records for the ported-out subscriber, the subscriber would receive free SMS service.

If a match is found in the MOSMS Mobile Number Portability database to indicate that the subscriber has been ported-out, the vSTP 5 ISS uses the destination SMSC address obtained from the SCCP CdPA to search a list of home network SMSC addresses. If a match is found to indicate that the ported-out subscriber is attempting to send a short message using the SMSC of the subscriber's former network, the message is discarded. An error message is generated and returned to the originating MSC.

### Portability Check for Mobile Originated SMS Call Flow

The MAP\_FORWARD\_SHORT\_MESSAGE (FSM), in the following Call Flow example is used to carry a text message (short message) being transmitted from the mobile handset of one subscriber to the mobile handset of another subscriber. In practice, the short message is delivered first to the Short Message Service Center (SMSC) of the sending subscriber, and then the SMSC is responsible for sending the short message to the intended recipient.

Refer to the following steps in the flow for this call.

The vSTP will perform the following with respect to MNP SMS Feature functionality.

1. The vSTP receives an **UDT** message.
2. vSTP checks whether the service selector value is `mosms`. If the service selector matches `mosms`, continue to the next step. If the service selector is not `mosms`, the message falls through to GTT (#12).
3. The MAP OpCode is examined. If the OpCode is `MO_FSM`, PPSMS processing continues with the next step. If the OpCode is not `MO_FSM`, the message falls through to GTT (#12).
4. If the PPSMS feature is on, the message falls through to PPSMS processing (#8). If the PPSMS feature is not on, processing continues with the next step.
5. If the MNP SMS feature is on, the Mobile Subscriber Integrated Services Digital Network (MSISDN) number is used to search the MOSMS Mobile Number Portability subscriber database. If the MNP SMS feature is not on, the message falls through to GTT (#12).
6. If the MSISDN Number is found in the PDB/DN table, then the portability type of the subscriber is checked for *Not Known to be Ported (0)* / *Ported-out (1)* / *FNPTFN (2)* / *Not identified to be ported (36)* and processing continues. If the MSISDN Number is not found in the PDB/DN table, the message falls through to GTT (#12). If the portability type is in the range of *Prepaid1 (3)* to *Prepaid32 (35)*, the message falls through to GTT (#12).
7. The SCCP CdPA Address is used to search the list of home network SMSC addresses. If a match is found, the ported-out subscriber is fraudulently attempting to send SMS using the SMSC of the old network. The message is discarded; UIM #1129 is issued; an error

message is generated and returned to the originating MSC, and the message falls through to #15. If the message is not on the list, the message falls through to GTT (#12).

8. If the message is from one of the IN Platforms (PPSMS Servers), The message exits from MNP SMS feature functionality and falls through to PPSMS processing (#14). If the message is not from one of the PPSMS Servers, processing continues to the next step.
9. The MSISDN number (phone number) of the originating subscriber is used to search the MOSMS Mobile Number Portability subscriber database. If the MSISDN Number is found in the PDB/DN table, then continue to the next step. Otherwise, exit from MNP SMS feature functionality and continue with Normal GTT processing (#12).
10. Check the portability type of the subscriber. If the portability type matches the range of *Prepaid1 (3)* to *Prepaid32 (35)*, go to #14; otherwise, continue with the next step.
11. If the subscriber portability type is *Not Known to be Ported (0)* / *Ported-out (1)* / *FNPTFN (2)* / *Not identified to be ported (36)* and MNP SMS feature is also ON, then go to #7. Otherwise, exit from MNP SMS feature functionality and continue with Normal GTT processing.
12. Exit from MNP SMS feature functionality and continue with existing processing for other services or GTT.
13. Exit from MNP SMS feature functionality and continue with existing processing for MOSMS.
14. Exit from MNP SMS feature functionality and continue with existing processing for PPSMS.
15. Exit from MNP SMS feature functionality.

## 5.2.4 Prepaid Short Message Service Intercept

Prepaid Short Message Service Intercept (PPSMS) is applicable to the A-Party (MSISDN) and B-Party (TP-DA of SM-RP-UI) sides of the GSM Forward Short Message.

PPSMS performs the following main functions:

### Message Discrimination

PPSMS uses the G-Port message selection methods to determine whether the message should receive PPSMS/G-Port service versus GTT.

If the incoming selectors match a SRVSEL entry and the entry has SERV=PPSMS, PPSMS is performed. If no match is found in SRVSEL table then GTT is performed. If the SSN is for HLR, G-Port is performed. If the SSN is for MSC, PPSMS is performed, and if the SSN is for neither, GTT is performed. Next, the MAP Operation Code received in the message is examined. Only Mobile originated forward short message calls receive PPSMS service. Other messages fall through to GTT. After MAP operation code discrimination, PPSMS provides discrimination based on SCCP CgPA GTA digits. This allows the operator to decide whether messages from certain CgPAs will receive PPSMS service or fall through to GTT, even if the messages meet all of the previous service selection criteria.

## Number Conditioning

The **UDR** stores international MSISDNs only. The received **MSISDN** number or SCCP CdPA digits may need to be converted to an international number to do a database lookup.

When **PPSMS** is required to be performed on a message and the number is not international (that is, the NAI of MSISDN number is “National (Significant) Number” or “Subscriber Number”), the National/Local to International number conditioning is triggered.

For a National (Significant) Number, the received MSISDN digits are prepended with the default country code and for a Subscriber number, the MSISDN digits are prepended with the default country code and the default network code. If the NAI is neither International or Subscriber, the message is treated as National.

## Prepaid Screening

Once the number is conditioned, the PPSMS feature performs a database search to determine if the MSISDN belongs to a prepaid subscriber. This is determined by the portability type field associated with the database entry for the MSISDN. PPSMS performs the database lookup using the international MSISDN. The individual number database is searched first, and if the number is not found, then the number range database is searched. If a match is not found in individual nor range-based database, then GTT is performed on the message. In case of MSISDN numbers in the PPSMS database being odd and the last digit of the decoded MSISDN from the FSM being 'zero', PPSMS first performs a database lookup once using the even number. If no match is found, then PPSMS performs the database lookup again, now using the odd number (without last digit).

## Message Relay to IN Platform

If the database search determines that the subscriber is prepaid, the message is redirected to one of the two IN platforms using the translation data in the PPSOPTS table. If the routing indicator in the IN platform translation data is route-on-SSN, the mated application table is accessed to determine the point code/subsystem status for the IN platform, and if it has a mate. The SCCP CdPA GTA should not be changed as a result of this operation. If the RI in the translation data indicates route-on-GT, and if the Intermediate GTTLoad Sharing feature is turned on, the Mated Relay Node (MRN) table is accessed to determine the point code status and if the IN platform has a mate. Subsystem status is not maintained in the mated relay node.

## Prepaid Short Message Service Intercept Message Handling

Prepaid Short Message Service Intercept (PPSMS) performs message handling in the following steps.

1. The message arrives at the vSTP route-on-gt. The vSTP decodes the SCCP portion and uses the data to perform the G-Port selection based on the CdPA NP, NAI, TT, SSN, and GTI. The result of the selection provides a service indicator. The service indicator is PPSMS if PPSMS is required. If a PPSMS selector does not match the incoming GT fields, the message is passed on for GTT selection.
2. If #1 indicates PPSMS is required, and the message is not a UDTs generated by vSTP, the vSTP performs PPSMS service.
3. If the message is a UDTs generated by the vSTP, then regular GTT is performed on the message.
4. If the vSTP receives a UDTs message from another node, it is treated in the same manner as any other message. If GTT is indicated, then the UDTs translation is based

on the CdPAGTA, and the message is routed to the translated address. If GTT is not indicated, the UDTS is through switched via MTP routing. The one exception is that if translation fails on the UDTS, the vSTP will not generate another UDTS to send to the originator of the UDTS that failed.

5. The TCAP/MAP portion of the message is decoded by PPSMS. If the message is not a TC\_BEGIN, the message falls through to GTT.
6. If the message is a TC\_BEGIN, PPSMS decodes the Operation Code of the MAP message to distinguish MO\_FSMs from the rest. If the OpCode is not FSM (MAP version 1 or 2) or MO\_FSM (MAP version 3), the message falls through to GTT.
7. If the OpCode is FSM (MAP version 1 or 2) or MO\_FSM (MAP version 3), the MAP portion of the message is decoded and searched for a MSISDN tag. If a MSISDN tag is not found, the message falls through to GTT. For version 3 MO\_FSMs, the SMRPOA parameter would contain the MSISDN tag. For version 1 or 2 FSMs, a MSISDN tag is found if the message is mobile originated. If it is mobile terminated, a MSISDN tag is not found and the message falls through to GTT.
8. If the MSISDN is found in #7, the SCCP CgPA GTA is compared to the IN platform GTAs provisioned in the PPSOPTS table. If the decoded GTA matches one of the IN platform Gas, the message falls through to GTT.
9. If the SCCP CgPA GTA in #8 does not match any of the IN platform GTAs, the MSISDN from the MAP portion is decoded and conditioned to an international number before performing the lookup. The number conditioning is based on NAI of MSISDN parameter. The number is converted to an international number, if necessary.
10. The database lookup is performed in two parts:
  - The exception or individual number database is searched for a match. If the match is found, the data associated with this entry is considered.
  - If the conditioned number is absent in the exception database, the number range database is searched. If the match is found, the data associated with this range entry is considered. If the search is unsuccessful, the result is no match.
11. If a number match is found as a result of the search, the portability type field associated with the entry is examined.
  - If the portability type is in the range of *Prepaid1* to *Prepaid32*, the IN platform translation information (PC and RI) associated with that type is retrieved from the GSM options. If the RI is SSN, the information is used to access the mated application (MAP) table for point code status and to see if the selected IN platform is in a load sharing relationship with another. If the RI is GT, and if the IGTTLoad Sharing feature is on, the mated relay node table is used for this purpose. If the point code is available, the message is routed the IN platform. If the point code is in a load sharing relationship with other point codes, messages are equally divided between them.
  - If the portability type is not in the range of *Prepaid1* to *Prepaid32*, the message falls through to GTT.
12. If a number match is not found as a result of the search in #10, the message falls through to GTT.

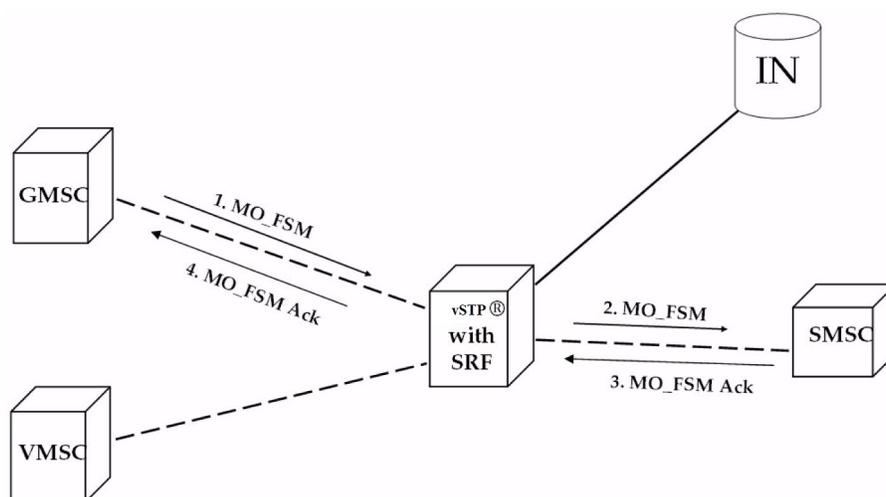
### 5.2.4.1 Prepaid Short Message Service Intercept Call Flows

The MAP\_FORWARD\_SHORT\_MESSAGE (**FSM**), in the following Call Flow examples is used to carry a text message (short message) being transmitted from the mobile handset of one subscriber to the mobile handset of another subscriber. In practice, the short message is delivered first to the Short Message Service Center (SMSC) of the sending subscriber, and then the SMSC is responsible for sending the short message to the intended recipient.

#### Successful Delivery of Mobile Originated FSM from Contract/Postpaid Subscriber

The following figure describes the steps in the flow for this call:

**Figure 5-11 Successful Delivery of MO\_FSM from Contract Subscriber**



1. The Gateway Mobile Switching Center (**GMSC**) sends the Mobile Originated Forward Short Message (MO\_FSM) to the vSTP with PPSMS (TCBEGIN). Based on **MTPDPC** = vSTP point code and **SCCP CdPA TT, NP, NAI, SSN**, and **GTI**, the message is pre-selected for PPSMS service. If service is not PPSMS, the message falls through to GTT.)

Next, the MAP OpCode and SCCP **CgPA GTA** are examined. The OpCode is **MO\_FSM** and the **CgPAGTA** is not from one of the **IN** platforms, therefore, PPSMS processing continues. (If the OpCode is not **MO\_FSM**, or if CgPA GTA is for one of the IN platforms, the message falls through to **GTT**.)

The vSTP queries the **DB** using the sender's MSISDN from the OA field in the MAP portion of message.

MSISDN is present in the database, but the portability type is not in the range of *prepaid1* to *prepaid32*, meaning the sender is not a prepaid subscriber.

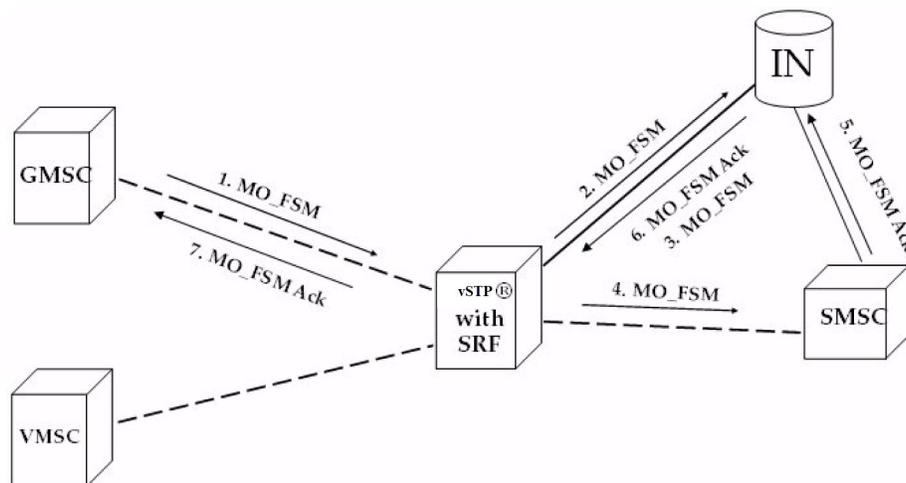
2. The vSTP therefore GTT-routes the MO\_FSM to the **SMSC** (TCBEGIN).
3. The **SMSC** returns the **MO\_FSM\_ack** (TCEND).
4. One of two possibilities:
  - a. The SMSC sends the MO\_FSM\_ack route-on-**SSN** to the GMSC, then the SRF will simply MTP route the MO\_FSM\_ack to the GMSC. G-Port is not involved.

- b. The SMSC sends the MO\_FSM\_ack route-on-GT, and the service selectors indicate G-Port/PPSMS. CdPA SSN = GMSC, which is same as SMSC, so PPSMS is selected. As PPSMS decodes message, it discovers it is a TCEND. Therefore, the message falls through to normal GTT and is routed to the GMSC.

### Successful Delivery of Mobile Originated FSM from Prepaid Subscriber

The following figure describes the steps in the flow for this call:

**Figure 5-12 Successful Delivery of Mobile Originated FSM from Prepaid Subscriber**



1. The Gateway Mobile Switching Center (GMSC) sends the Mobile Originated Forward Short Message (MO\_FSM) to the vSTP with PPSMS (TCBEGIN). Based on MTPDPC = vSTP point code and SCCP CdPA TT, NP, NAI, SSN, and GTI, the message is pre-selected for PPSMS service. If service is not PPSMS, the message falls through to GTT.

Next, the MAP OpCode and SCCP CgPA GTA are examined. The OpCode is MO\_FSM and the CgPAGTA is not from one of the IN platforms, therefore, PPSMS processing continues. If OpCode is not MO\_FSM, or if CgPA GTA is for one of the IN platforms, the message falls through to GTT.

The vSTP queries the DB using sender's MSISDN from SM RP OA field in MAP portion of message.

MSISDN is present in the database, and the portability type is *prepaid1*, meaning the sender is a prepaid subscriber.

2. The vSTP forwards the MO\_FSM to the IN Platform (TCBEGIN) associated with *prepaid1*, after checking mated application or mated relay node table. The portability types *prepaid1* through *prepaid32* are used to select which of the IN platforms the message should be sent.
3. The IN Platform checks the account, finds there is enough credit to send the message, opens a new TCAP dialogue, and returns the MO\_FSM to the SRF (TCBEGIN-2).
4. The message arrives at vSTP and is again selected for PPSMS service based on CdPATT, NP, NAI, GTI, and CdPA SSN = SMSC. The OpCode is MO\_FSM but the

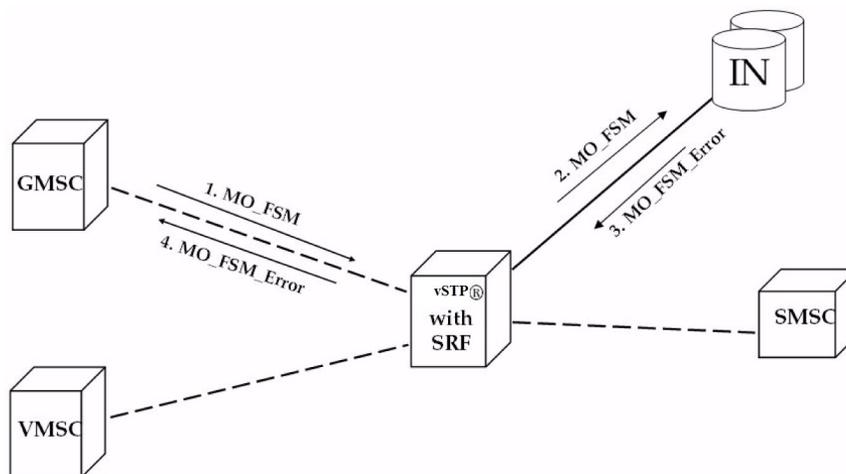
SCCP CgPA GTA is IN platform, therefore, PPSMS service is not indicated and the message falls through to GTT and is routed to the SMSC.

5. The SMSC returns the MO\_FSM\_ack to the IN platform (TCEND-2). There are two possibilities:
  - a. The SMSC sends the MO\_FSM\_ack route-on-SSN to the IN platform, then the SRF will simply MTP route the MO\_FSM\_ack to the IN platform. G-Port is not involved.
  - b. The SMSC sends the MO\_FSM\_ack route-on-GT, and the service selectors indicate G-Port/PPSMS. CdPA SSN = GMSC, which is same as SMSC, so PPSMS is selected. As PPSMS decodes the message, it discovers it is a TCEND. Therefore, the message falls through to normal GTT and is routed to the GMSC.
6. The IN Platform transfers the MO\_FSM\_ack to the first transaction and returns the MO\_FSM\_ack to the SRF (TCEND).
7. One of two possibilities:
  - a. The IN platform sends the MO\_FSM\_ack route-on-SSN to the GMSC, then the SRF will simply MTP route the MO\_FSM\_ack to the GMSC. G-Port is not involved.
  - b. The IN platform sends the MO\_FSM\_ack route-on-GT, and the service selectors indicate G-Port/PPSMS. CdPA SSN = GMSC, which is same as SMSC, so PPSMS is selected. PPSMS decodes message, discovers it is a TCEND, and the message falls through to normal GTT and is routed to the GMSC.

#### Unsuccessful Delivery of Mobile Originated FSM from Prepaid Subscriber - Credit Check Failure

The following figure describes the steps in the flow for this call:

**Figure 5-13 Unsuccessful Delivery of Mobile Originated FSM from Prepaid Subscriber at SCP**



1. The Gateway Mobile Switching Center (GMSC) sends the Mobile Originated Forward Short Message (MO\_FSM) to the vSTP with PPSMS (TCBEGIN). Based on MTPDPC = vSTP point code and SCCP CdPA TT, NP, NAI, and GTI, the message is pre-selected for PPSMS service. If service is not PPSMS, the message falls through to GTT.

Next, the MAP OpCode and SCCP CgPA GTA are examined. The OpCode is MO\_FSM and the CgPAGTA is not from one of the IN platforms, therefore, PPSMS processing continues. If the OpCode is not MO\_FSM, or if CgPA GTA is for one of the IN platforms, the message falls through to GTT.

The vSTP queries the DB using sender's MSISDN from the SM RP OA field in the MAP portion of message.

MSISDN is present in the database, and the portability type is *prepaid1*, meaning the sender is a prepaid subscriber.

2. The vSTP forwards the MO\_FSM to the IN Platform (TCBEGIN) associated with *prepaid1*.  
The portability types *prepaid1* through *prepaid32* are used to select to which of the IN platforms the message should be sent.
3. The IN Platform checks the account, finds there is not enough credit to send the message, and rejects the message by returning a **MO\_FSM\_Neg\_Response** to the SRF (TCEND).
4. One of two possibilities:
  - a. The IN platform sends the MO\_FSM\_Neg\_Response route-on-SSN, then the SRF will simply MTP route the MO\_FSM\_Neg\_Response to the GMSC. G-Port is not involved.
  - b. The IN platform sends the MO\_FSM\_Neg\_Response route-on-GT, and the service selectors indicate G-Port/PPSMS. CdPA SSN = GMSC, which is same as SMSC, so PPSMS service is selected. PPSMS decodes message, discovers it is a TCEND, and the message falls through to normal GTT and is routed to the GMSC.

## 5.2.5 Numbering Plan Processor for MO SMS Features

Numbering Plan Processor for MO SMS features (MO SMS NPP) provides comprehensive NPP number conditioning and service logic execution for MO SMS features that support the GSM protocol. The MO SMS features can be selected and sequenced as required without repetitive number conditioning functions. NPP resolves complex number conditioning using a flexible provisioning logic. For detailed information about NPP, refer to *Numbering Plan Processor (NPP) Overview*.

Numbering Plan Processor for MO SMS features (MO SMS NPP) supports the following features:

- MO-Based GSM SMS NP
- Portability Check for MO SMS (MNP SMS)
- Prepaid SMS Intercept (PPSMS)
- MO SMS Additional Subscriber Data (MO SMS ASD)
- MO SMS Generic Routing Number (MO SMS GRN)

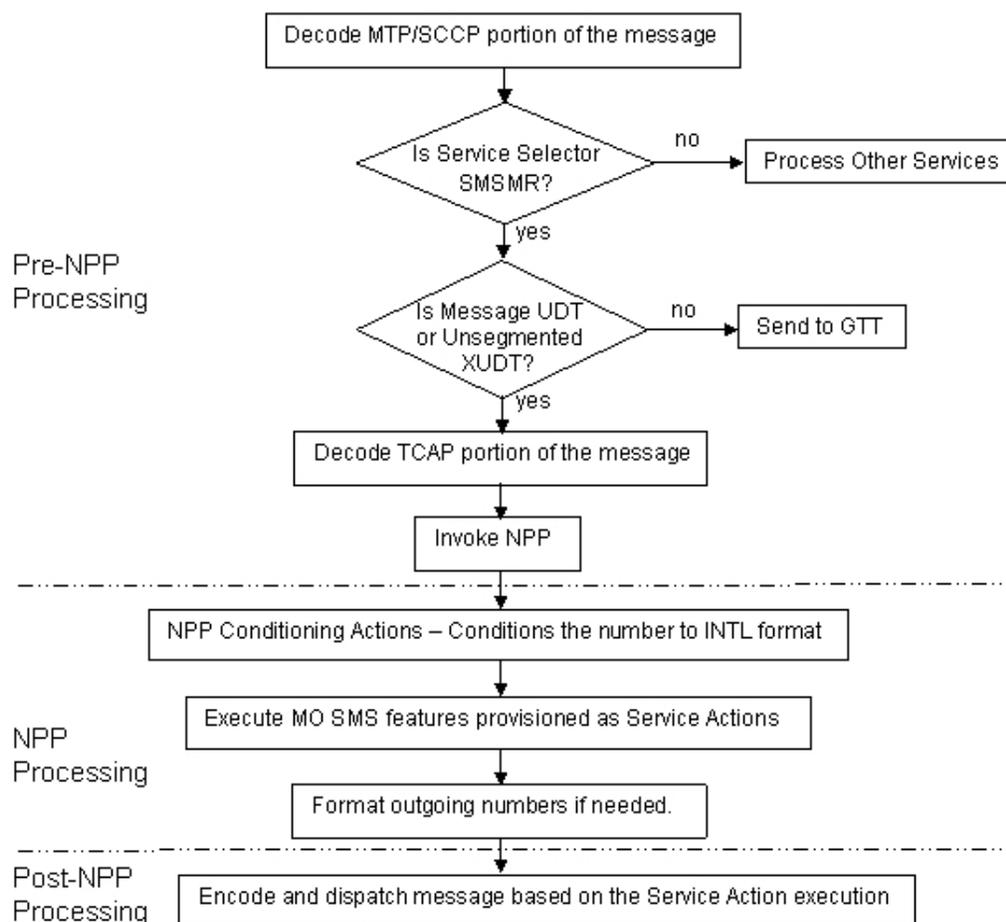
### MO SMS NPP Message Processing

After decoding the MTP and SCCP portion of the MSU, the system verifies whether the SCCP parameters of the message match any of the provisioned Service Selectors. If the Service Selector = `smsmr`, MO SMS processing begins. The TCAP portion of the message is decoded.

NPP-related functions are performed next. The incoming Called Party Number or Calling Party Number is conditioned to international format using Conditioning Actions. All Service Actions provisioned for the NPP Services are performed after verifying whether the feature is enabled and turned on.

After the NPP service functions are completed, the message is directed to post-NPP processing. The message is encoded and dispatched. If the message is redirected to Global Title Translation (GTT), translation can be performed based on the SCCP Called Party Address digits or the TCAP Called Party Number.

**Figure 5-14 MO SMS NPP Message Processing**



### NPP Processing

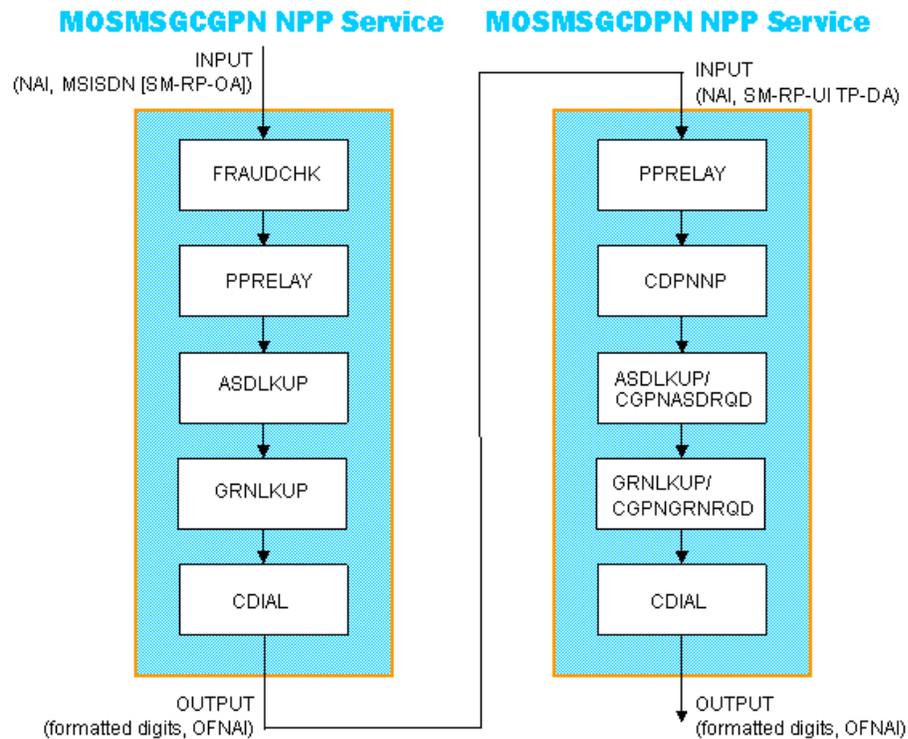
NPP processing supports both GSM Forward Short Message Mobile Originated (MO) messages. GSM protocol supports MO-Based GSM SMS NP, Portability Check for MO SMS, and Prepaid SMS Intercept.

#### NPP processing for GSM

NPP processing performed for GSM protocol and possible Service Actions that can be provisioned are shown in [Figure 5-15](#). GSM protocol supports two NPP Services: MOSMSGCDPN for processing Called Party Numbers and MOSMSGCGPN for processing Calling Party Numbers. The Calling Party Number is processed first. The Calling Party

Number is the MSISDN digits of the SM-RP-OA parameter of the Forward Short Message. The Called Party Number is processed second. The Called Party Number is the TP-DA digits of the SM-RP-UI parameter of the message being processed.

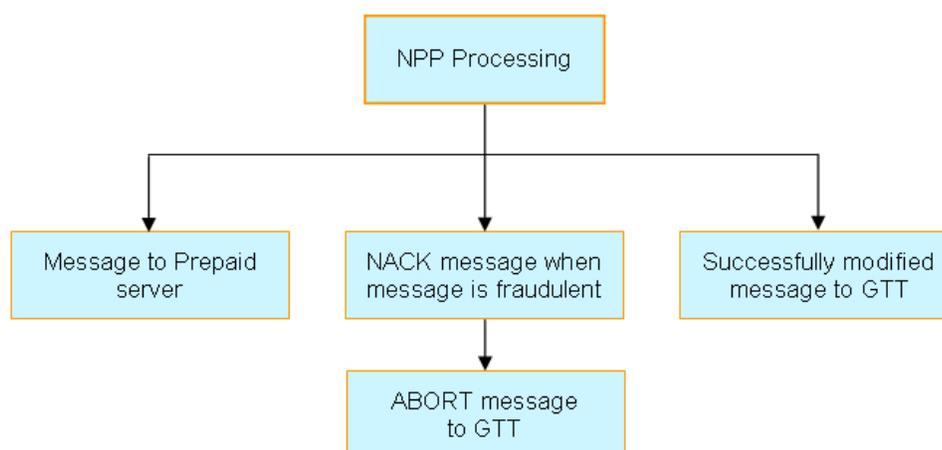
**Figure 5-15 MO SMS NPP - GSM NPP Processing**



### Post-NPP Processing

After conditioning the number, performing Service Actions, and formatting the number passed to NPP, the decoded message is encoded and sent to the correct module or destination for further processing. For GSM protocol, several dispositions are possible:

- The message can be sent to a Prepaid Server after PPRELAY Service Action processing.
- The message can be NACK if the FRAUDCHK Service Action determines that the message is fraudulent.
- The message can fall through to GTT after CDPNNP Service Action processing.

**Figure 5-16 Post-NPP Processing****UDR Lookup for NPP Services**

An entry for a conditioned number can be found in either an Individual DN UDR Table or a range DN UDR Table. If an entry is found in the Individual DN UDR Table, the range DN table is not searched. An Individual DN Table entry has precedence over a range DN Table entry. Most NPP Service Actions require an UDR Lookup result. For a given NPP Service, UDR Lookup is performed only once. This UDR Lookup is performed by the first Service Action that needs an UDR Lookup result.

**5.2.5.1 NPP Provisioning**

Numbering Plan Processing (NPP) provides number conditioning and service logic execution for the following MO SMS-related features:

- Mobile Originated Based GSM SMS Number Portability (MO-Based GSM SMS NP)
- Portability Check for Mobile Originated SMS (MNP SMS)
- Prepaid Short Message Service Intercept (PPSMS)
- Mobile Originated Additional Subscriber Data (MO SMS ASD)
- Mobile Originated Generic Routing Number (MO SMS GRN)

**NPP Services**

The NPP Service in the first column of [Required NPP Services](#) must be provisioned before turning on the MO SMS-related feature in the second column for the feature to be functional.

**Table 5-13 Required NPP Services**

Feature	NPP Service
MO-Based GSM SMS NP	MOSMSGCDPN
MNP SMS	MOSMSGCGPN
PPSMS	MOSMSGCDPN and MOSMSGCGPN
MO SMS ASD	MOSMSGCDPN, MOSMSGCGPN, MOSMSICDPN, and MOSMSICGPN

**Table 5-13 (Cont.) Required NPP Services**

Feature	NPP Service
MO SMS GRN	MOSMSGCDPN, MOSMSGCGPN, MOSMSICDPN, and MOSMSICGPN

The NPP Services to process Called Party and Calling Party Numbers in GSM protocol are described below:

- MOSMSGCDPN - NPP Service to process the Called Party Number of the SM-RP-UI TP-DA parameter of SMS-SUBMIT or SMS-COMMAND GSM Forward Short Message.
- MOSMSGCGPN - NPP Service to process the Calling Party Number MSISDN SM-RP-OA parameter of SMS-SUBMIT or SMS-COMMAND GSM Forward Short Message.

### Service Actions

The NPP Service Actions supported by MO SMS NPP are shown in [Supported Service Actions](#). The precedence and applicability of the service actions are specified for each NPP Service.

**Table 5-14 Supported Service Actions**

Service Action	MOSMSGCDPN	MOSMSGCGPN	MOSMSICGPN
ASDLKUP	50	50	50
CDIAL	10	10	10
CDPNNP	60	n/a	n/a
CGPNASDRQD	50	n/a	n/a
CGPNGRNRQD	50	n/a	n/a
FRAUDCHK	n/a	90	n/a
GRNLKUP	50	50	50
MIGRATE	n/a	n/a	n/a
PPRELAY	80	80	n/a

**Table 5-15 Service Action Value Definitions by NPP Service**

Service Action Value	MOSMSGCDPN	MOSMSGCGPN	MOSMSICDPN	MOSMSICGPN
ASDLKUP	Populates ASD FA with ASD data received from DN UDR Lookup	Populates ASD FA with ASD data received from DN UDR Lookup	Populates ASD FA with ASD data received from DN UDR Lookup	Populates ASD FA with ASD data received from DN UDR Lookup
CDIAL	Performs corrective dialing	Performs corrective dialing	Performs corrective dialing	Performs corrective dialing
CDPNNP	Performs CdPN UDR Lookup and determines whether ported	-	Performs CdPN UDR Lookup and determines whether ported	-

Table 5-15 (Cont.) Service Action Value Definitions by NPP Service

Service Action Value	MOSMSGCDPN	MOSMSGCGPN	MOSMSICDPN	MOSMSICGPN
CGPNASDR QD	Populates ASD FA with CgPN ASD data if available from CgPN UDR Lookup by MOSMSGCGPN	-	Populates ASD FA with CgPN ASD data if available from CgPN UDR Lookup by MOSMSICGPN	-
CGPNGRNR QD	Populates GRN FA with CgPN GRN data if available from CgPN UDR Lookup by MOSMSGCGPN	-	Populates GRN FA with CgPN GRN data if available from CgPN UDR Lookup by MOSMSICGPN	-
FRAUDCHK	-	Performs CgPN UDR Lookup and discards message if the subscriber is fraudulent	-	-
GRNLKUP	Populates GRN FA with GRN data received from DN UDR Lookup	Populates GRN FA with GRN data received from DN UDR Lookup	Populates GRN FA with GRN data received from DN UDR Lookup	Populates GRN FA with GRN data received from DN UDR Lookup
MIGRATE	-	-	Performs CdPN UDR Lookup and determines whether migrated	-
PPRELAY	Performs CdPN UDR Lookup and redirects message to prepaid subscriber if CdPN is prepaid	Performs CdPN UDR Lookup and redirects message to prepaid subscriber if CdPN is prepaid	-	-

## Conditioning Actions

### ACCGPN Conditioning Action

In addition to the general Conditioning Actions available in the **NPP** feature, the ACCgPN Conditioning Action is supported by the MOSMSGCDPN and MOSMSICDPN NPP Services.

ACCGPN (Area Code from **CgPN**) extracts the Called Party Number (**CdPN**) area code information from the Calling Party Number (CgPN). The ACCgPN Conditioning Action skips DEFCC length from the international number and removes the number of digits specified in the SCCPOPTS ACLEN configuration option from the beginning of the CgPN. These digits are used as the Area Code (**AC**) to condition the Called Party digits for any subsequent Service Action or Formatting Action.

If the ACCgPN Conditioning Action is invoked, but the Calling Party is not present or has fewer digits than the SCCPOPTS ACLEN option value after any CC digits, then no change to Area Code is made.

The ACCgPN Conditioning Action can be provisioned with the MOSMSGCDPN and MOSMSICDPN NPP Services. The ACCgPN Conditioning Action is mutually exclusive with

the ACCgPNx Conditioning Actions and with any other Conditioning Action used to populate the AC (Area Code) Formatting Action value for NPP.

**Table 5-16 ACCgPN Conditioning Action**

Conditioning Action	Description
ACCgPN	Area Code extracted from Calling Party Number (CgPN)

### ACCgPN1 through ACCgPN8 Conditioning Actions

The ACCgPN1 - ACCgPN8 (ACCgPNx) Conditioning Actions to extracts the Area Code from the Calling Party Number (**CgPN**) while processing Called Party Number (**CdPN**) services. The length of the Area Code to be extracted from the CgPN is not specified by SCCOPTS:ACLEN configuration parameter. Instead, the digit suffix "x" of the Conditioning Action parameter name specifies the length of the Area Code to be extracted. For example, the Conditioning Action ACCgPN4 will extract an Area Code of 4 digits from the CgPN. The ACCgPNx Conditioning Actions skip any Country Code digits (matching DefCC or Multiple **CC**) and remove the specified "x" number of Area Code (AC) digits.

If an ACCgPNx Conditioning Action is invoked, but the Calling Party is not present or has fewer digits than the specified "x" number of digits after any CC digits, then no change to Area Code is made.

The ACCgPNx Conditioning Actions can be provisioned with the MOSMSGCDPN and MOSMSICDPN NPP Services. The ACCgPNx Conditioning Actions are mutually exclusive with each other, with the ACCgPN Conditioning Action, and with any other Conditioning Action used to populate the AC (Area Code) Formatting Action value for NPP.

**Table 5-17 ACCgPNx Conditioning Actions**

Conditioning Action	Description
ACCgPN1	Area Code from Calling Party Number: one-digit Area Code extracted
ACCgPN2	Area Code from Calling Party Number: two-digit Area Code extracted
ACCgPN3	Area Code from Calling Party Number: three-digit Area Code extracted
ACCgPN4	Area Code from Calling Party Number: four-digit Area Code extracted
ACCgPN5	Area Code from Calling Party Number: five-digit Area Code extracted
ACCgPN6	Area Code from Calling Party Number: six-digit Area Code extracted
ACCgPN7	Area Code from Calling Party Number: seven-digit Area Code extracted
ACCgPN8	Area Code from Calling Party Number: eight-digit Area Code extracted

### Formatting Actions

In addition to the general Formatting Actions available in the NPP feature, the following Formatting Actions support MO SMS NPP.

- RNOSPODN - RN or SP value, if RN or SP was found in UDR Lookup; Otherwise, the Conditioning Action DNx is used for this Formatting Action value.
- RNOSPOZN - RN or SP value, if RN or SP was found in UDR Lookup; Otherwise, the Conditioning Action SNx is used for this Formatting Action value.
- RNOSPOSN - RN or SP value, if RN or SP was found in UDR Lookup; Otherwise, the Conditioning Action ZNx is used for this Formatting Action value.



**Note:**

CgPN is not modified by any MOSMS NPP feature.

## 5.3 IDPR and MOSMS Configurations

This section provides procedures to configure the connection required for IDPR and MOSMS.

IDPR and MOSMS are configured using the vSTP managed objects. The MMI API contains details about the URI, an example, and the parameters available for each managed object.

### 5.3.1 MMI Managed Objects for IDPR and MOSMS

MMI information associated with MNP is accessed from a DSR NOAM or SOAM from **Main Menu**, and then **MMI API Guide**.

Once the *MMI API Guide* displays, use the application navigation to locate specific vSTP managed object information.

[Table 5-18](#) lists the managed objects and operations supported for vSTP MNP G-Port feature.

**Table 5-18 vSTP MNP Managed Objects and Supported Operations**

Managed Object Name	Supported Operations
CSL (Common Screening List)	Insert, Update, Delete
IDPROptions	Update
NppActionSet	Insert, Update, Delete
NppServiceRuleSet	Insert, Update, Delete
NppService	Insert, Update, Delete
PPSRelays	Insert, Update, Delete

#### CSL - Insert, Update, Delete

Execute this command on an active SOAM to insert CSL:

```
/vstp/commonscreeninglists -v POST -r /<Absolute Path>/<filename>
```

Example output:

```
{
  "data":
  {
    "ds": "Abc123",
    "feature": "Feature1",
    "list": "Ccnc",
    "p1": "prepaidno",
    "p2": "idprcdpn",
    "scpgta": "1234"
  },
  "messages":
  [
  ],
  "links":
  {
  },
  "status":
  true
}
```

### IDPROptions - Update

Execute this command on an active SOAM to update IDPROptions:

```
/vstp/idproptions -v PUT -r /<Absolute Path>/<filename>
```

Example output:

```
{
  "cdcnp": "Off",
  "cddnotfndrsp": "Release",
  "cddra": "Rndn",
  "cddranai": "Nat1",
  "cddranp": "E164",
  "cdnoentityrsp": "Continue",
  "cdrelcause": 31,
  "cdrnrsp": "Connect",
  "cdsprsp": "Relay",
  "cgcnp": "Off",
  "cgdnotfndrsp": "Release",
  "cgdra": "Rndn",
  "cgdranai": "Nat1",
  "cgdranp": "E164",
  "cgnoentityrsp": "Continue",
  "cgnptype": "Rnsp",
  "cgpaccck": "Nonintl",
  "cgpnskrtg": "No",
  "cgrelcause": 31,
  "cgrnrsp": "Connect",
  "cgsnai": "Incoming",
  "cgsprsp": "Relay",
}
```

```
"dfltrn": "None",
"dlma": "None",
"dlmb": "None",
"dlmc": "None",
"drafrmt": "Grn",
"dranai": 3,
"map": "Nai2ton",
"nai": 2,
"nptype": "Rnsp",
"rnspfll": "Off",
"snai": "Incoming",
"ton": 3
}
```

### NPPActionSets - Insert, Update, Delete

Execute this command on an active SOAM to insert NPPActionSets:

```
/vstp/nppactionsets -v POST -r /<Absolute Path>/<filename>
```

Example output:

```
{
  "data":
  {
    "actSetName": "ASN1",
    "caList": [
      "Cc1",
      "Dn3"
    ],
    "faList": [
      "Cc"
    ],
    "ofnai": "Inc",
    "saList": [
      "Blklstrly",
      "Cncchk",
      "Nprelay"
    ]
  },
  "messages":
  [
  ],
  "links":
  {
  },
  "status":
  true
}
```

**NPPService - Insert, Update, Delete**

Execute this command on an active SOAM to insert NPPService:

```
/vstp/nppservice -v POST -r /<Absolute Path>/<filename>
```

Example output:

```
{
  "data":
  {
    "h0Code": "1-5",
    "h1Code": "*",
    "networkIndicatorCode": "0-2",
    "nextScrRuleGroupName": "scr1",
    "nsfi": "Dpc",
    "priority": "2",
    "ruleName": "rule1",
    "scrRuleGroupType": "Sio",
    "scrRuleGroupName": "scr2",
    "serviceIndicator": "0",
    "actionSccp": true
  },
  "messages":
  [
  ],
  "links":
  {
  },
  "status":
  true
}
```

**NPPServiceRuleSets - Insert, Update, Delete**

Execute this command on an active SOAM to insert NPPServiceRuleSets:

```
/vstp/nppservicerulesets -v POST -r /<Absolute Path>/<filename>
```

Example output:

```
{
  "data":
  {
    "asn": "asn1",
    "fdl": "29",
    "fnai": "Intl",
    "fpfx": "A1",
    "invkserv": "Nppt",
    "srvn": "Nppt"
  },
  "messages":
```

```
    [
  ],
  "links":
  {
  },
  "status":
  true
}
```

### PPSRelay - Insert, Update, Delete

Execute this command on an active SOAM to insert PPSRelay:

```
/vstp/ppsrelay -v POST -r /<Absolute Path>/<filename>
```

Example output:

```
{
  "data":
  "6961034c-6439-43da-b935-5238d6616f84",
  "messages":
  [
  ],
  "links":
  {
  },
  "status":
  true
}
```

## 5.3.2 Configuration for UDR

Configuring IDPR and MOSMS for UDR involves adding vSTP MP(s) to UDR and then configuring UDR on the ComAgent server.

### Assumptions:

- The user is aware of UDR and ComAgent functionality, and
- UDR is already installed and UDR topology is already configured

Perform the following steps to configure IDPR and MOSMS for UDR:

1. Add details about the vSTP MP on the ComAgent Remote Servers screen as a client by navigating to **Communication Agent**, and then **Configuration**, and then **Remote Servers** and clicking **Insert** on an active OCUDR NOAMP.
2. Select the OCUDR server group from the *Available Local Server Groups* that needs to communicate with vSTP MP.
3. From the active OCUDR GUI, navigate to **Communication Agent**, and then **Maintenance**, and then **Connection Status** and verify connection are *InService*.
4. From the active OCUDR GUI, navigate to **Communication Agent**, and then **Maintenance**, and then **Routed Services Status** and verify the *STPDbSvc* status is *Normal*.

5. From an active DSR NOAM, navigate to **Communication Agent**, and then **Configuration**, and then **Remote Servers** and click **Insert**.
6. Add the UDR NO IP in the ComAgent Remote Server screen as a Server.
7. Select the STP MP server group from the *Local SG* that needs to communicate with UDR.
8. Also add the Standby and DR NOs to the Local SG.
9. Navigate to **Communication Agent**, and then **Configuration**, and then **Connection Groups**, select *STPSvcGroup* and click **Edit**.
10. Add all available UDR NO servers.
11. Navigate to **Communication Agent**, and then **Maintenance**, and then **Connection Status**, select the server name, and check the connection status.

#### UDR Configuration: SOAP Provisioning Request for MSISDN Steps to Enable MNP Feature on UDR:

Enable MNP feature on UDR by running the **enablevMNPsec** loader on the Active NOAM Server console. Follow the below steps:

1. Go to the path: `/usr/TKLC/udr/prod/maint/loaders/upgrade`
2. On the path, execute the **enablevMNPsec** script.

The following snippet provides an example of provisioning MNP data with the Type as SPRN and GRN in an individual MSISDN:

#### Adding GRNID:

Insert:

```
<req name="insert" resonly="y" inputType="mnpGrnId">
  <ent name="Subscriber"/>
  <set>
    <expr><attr name="GRNID"/><value val="10000"/></expr>
    <expr><attr name="MnpDataGRN"/><op value="="/>
      <cdata>&lt;![CDATA[<?xml version="1.0" encoding="UTF-8"?>
        <MnpGRN>
          <EDigit>10000</EDigit>
          <RI>1</RI>
          <PC>111-222-333</PC>
          <PCDom>ansi</PCDom>
          <SSN>3</SSN>
          <SRFIMSI>22222222</SRFIMSI>
          <DigAct>INSERTENTITYID</DigAct>
        </MnpGRN>]]&gt;
      </cdata>
    </expr>
  </set>
</req>
```

#### Adding SPRNID :

```
<req name="insert" resonly="y" inputType="mnpSprnId">
  <ent name="Subscriber"/>
  <set>
```

```

    <expr><attr name="SPRNID"/><value val="68547777"/></expr>
<expr>
<attr name="MnpDataSPRN"/><op value="/">
    <CDATA[<![CDATA[<?xml version="1.0" encoding="UTF-8"?>
        <MnpSPRN>
            <Type>RN</Type>
            <EDigit>68547777</EDigit>
            <RI>0</RI>
            <PC>111-222-444</PC>
            <PCDom>ansi</PCDom>
            <SSN>3</SSN>
            <SRFIMSI>111111111</SRFIMSI>

```

### Adding MNP Subscriber with SPRNID & GRNID:

```

<req name="insert" resonly="y" inputType="mnpSubscriber">
  <ent name="Subscriber"/>
  <set>
    <expr><attr name="MSISDN"/><value val="22222222333"/></expr>
    <expr><attr name="CLDBL"/><value val="1"/></expr>
    <expr><attr name="CLNBL"/><value val="1"/></expr>
    <expr><attr name="PType"/><value val="1"/></expr>
    <expr><attr name="ASD"/><value val="abcd"/></expr>
    <expr><attr name="SPRNID"/><value val="68547777"/></expr>
    <expr><attr name="GRNID"/><value val="10000"/></expr>
  </set>
</req>

```

### Enabling Split feature and Self Heal feature for MNP on UDR:

Enable Split feature and self heal on UDR by running the `enableSplitFeature` and `enableMNPwithSplit` loaders on the Active NOAM Server console with the following steps:

1. Navigate to the `/usr/TKLC/udr/prod/maint/loaders/upgrade` path on the Active NOAM Server console.
2. Execute the `enableSplitFeature` and `enableMNPwithSplit` scripts.

#### Note:

There is no need to restart any of the servers after running the loader.

The following snippet shows an example of provisioning MNP data with the Type as SPRN and GRN in an individual MSISDN:

```

<req name="insert" resonly="y" inputType="mnpSubscriber" type="range">
<ent name="Subscriber"/>
<set>
<expr><attr name="MSISDN"/><value val="22222222000"/></expr>
<expr><attr name="MSISDN"/><value val="222222223000"/></expr>
<expr><attr name="CLDBL"/><value val="1"/></expr>
<expr><attr name="CLNBL"/><value val="1"/></expr>
<expr><attr name="PType"/><value val="1"/></expr>

```

```

<expr><attr name="ASD"/><value val="abcd"/></expr>
<expr><attr name="SPRNID"/><value val="68547777"/></expr>
<expr><attr name="GRNID"/><value val="10000"/></expr>
<expr><attr name="Split"/><value val="1"/></expr>

</set>
</req>

```

### The enableSplitFeature Feature Flag Behavior

The **enableSplitFeature** Feature flag behavior for different scenarios is described as follows:

- When the Feature flag is enabled:
  - When no value is set: By default Split field with value **1** is added to subscriber profile.
  - Split field value is **0**: Subscriber profile with Split field value **0** (non splitable range) is inserted.
  - Split field value is **1**: Subscriber profile with Split field value **1** is inserted.
- When the Feature flag is disabled:
  - When no value is set: Subscriber profile will not have split field.
  - Split Field with value is **1**: Create or Update requests are rejected with **invalid XML** error message.
  - Split Field with value is **0**: Create or Update requests are rejected with **invalid XML** error message.

## 5.3.3 IDPR and MOSMS Alarms and Measurements

### Alarms and Events

The following table lists the Alarms and Events specific to the IDPR and MOSMS support for vSTP:

Alarm/ Event ID	Name
70310	VstpTooManyDigitDRA
70311	VstpIdprCgpnEcdError
70312	VstpIdprCdpnEcdError
70313	VstpIdprCdpnNppServiceOff
70314	VstpIdprCgpnNppServiceOff
70315	VstpDestAddrDcdFail
70316	VstpTcapEncFail
70317	VstpOutBoundDigit
70318	VstpSMSMandParamMiss
70319	VstpAddrDcdFail
70320	VstpMnpCdpaMatchHomeSmsc

For more details related to Alarms and Events, refer to Alarms and KPIs Reference document.

**Measurements**

The following table lists the measurements specific to the IDPR and MOSMS support for vSTP:

Measurement ID	Measurement Name
21739	VstpSccpIdprCdpn
21740	VstpSccpIdprCdpn2
21741	VstpSccpIdprCdpn3
21742	VstpSccpIdprCdpn4
21743	VstpSccpIdprMsrcv
21744	VstpSccpIdprMsErr
21745	VstpSccpIdpSkgtart
21746	VstpSccpIdpSkgtart2
21747	VstpSccpIdpSkgtart3
21748	VstpSccpIdpSkgtart4
21749	VstpSccpIdpInpConn
21750	VstpSccpIdpInpConn2
21751	VstpSccpIdpInpConn3
21752	VstpSccpIdpInpConn4
21753	VstpSccpIdpInpCont
21754	VstpSccpIdpInpCont2
21755	VstpSccpIdpInpCont3
21756	VstpSccpIdpInpCont4
21757	VstpSccpIdpAPtyRtd
21758	VstpSccpIdpAPtyGtt
21759	VstpSccpIdpSkrtcd
21760	VstpSccpIdpAPtySkr
21761	VstpSccpIdpInpRlc
21762	VstpSccpIdpInpRlc2
21763	VstpSccpIdpInpRlc3
21764	VstpSccpIdpInpRlc4
21765	VstpSccpIdpInpRtg
21766	VstpSccpIdpInpRtg2
21767	VstpSccpIdpInpRtg3
21768	VstpSccpIdpInpRtg4
21769	VstpSccpMsGwsAGt
21770	VstpSccpIdprMsSucc
21771	VstpSccpIdprMsFail
21772	VstpSmsMogRecv
21773	VstpSmsMogErr
21774	VstpSccpMoSmsSegOk
21775	VstpSccpMoSmsSegErr
21788	VstpSccpIdpBlkConn
21789	VstpSccpIdpBlkCont
21659	vstpGportNonCallRelay
21660	vstpGportNonCallGtt

For more details related to measurements, refer to Measurement Reference document.

# 6

## vSTP G-Flex Feature

The GSM Flexible Numbering (G-Flex) feature enables efficient Home Location Register (HLR) management in ITU networks, **ANSI** networks, Global System for Mobile communications (GSM) networks, and IS-41 networks. G-Flex optimizes the use of subscriber numbers and number ranges by providing a logical link between any MSISDN number or IMSI and an HLR. This arrangement allows subscribers to be moved easily from one HLR to another.

The GSM Flexible Numbering (G-Flex) feature enhances the vSTP capabilities, by allowing operators to flexibly assign individual subscribers to HLRs and route signaling messages, based on MSISDN or IMSI number.

Upon receiving a message, G-Flex performs a G-Flex selector search in the database using the SCCP `cdpa` parameters available in the message. Existence of the selectors in the G-Flex database triggers G-Flex processing. Number conditioning is supported for the incoming messages that are destined for G-Flex processing.

The G-Flex functionality can be considered as an enhancement to Global Title Transpotation (GTT) functionality in vSTP. The following are the G-Flex enhancements over GTT:

- **Increased Number of Translations:** The translation limit for GTT is 1 million. This limit is enhanced when G-Flex feature is used. However, the G-Flex translations are supported only from international MSISDNs and IMSIs to HLRs.
- **Number Conditioning:** Since the G-Flex DataBase (GDB) stores MSISDNs and IMSIs as international numbers, and does not store Mobile Global Titles (MGTs), G-Flex provides the capability to condition incoming numbers to be international MSISDNs or IMSIs for the database look up.
- **Discrimination of Messages:** Since G-Flex is used only for HLR translations, it provides a method to identify, which messages should receive G-Flex Relay or GTT. This is provided via a G-Flex service selector table, which defaults back to the GTT selector table if a match is not found.
- **Variable Number of Digits:** There is no fixed number of digits for MSISDNs or IMSIs. For example, a 12-digit MSISDN can coexist with a 15-digit one. However, the number of digits of the stored numbers must be 8-15.

### 6.1 Feature Overview

In today's mobile networks, subscribers are assigned to Home Location Registers (HLRs) and AuCs (Authentication Centers) in blocks or ranges of subscriber numbers. These ranges are used by MSCs (Mobile Switching Centers) to route many types of signalling messages to HLRs/AuCs. In this document, the term HLR is used to include AuC, as applicable.

G-Flex allows an operator to flexibly assign individual subscribers to HLRs and route signaling messages accordingly, based on subscriber numbering.

The G-Flex C7 Relay node is located in the operator's C7/SS7 network between the MSCs and HLRs. It can also serve as the direct interface to other networks.

There are several types of numbers that identify subscribers, which are assigned by MSCs to HLR/AuCs using this range mechanism:

- **MSISDN** (Mobile Station International Integrated Services Digital Network) numbers, which use numbering plan E.164.
- **IMSI** (International Mobile Subscriber Identity) numbers, which use numbering plan E.212.
- **MIN** (Mobile Identification Number), which uses the E.164 numbering plan.
- **MDN (Mobile Directory Number)**, which uses the E.164 numbering plan.

G-Flex optimizes the use of subscriber numbers and number ranges by providing a logical link between any MSISDN number or IMSI, and an HLR.

- Subscribers can be easily moved from one HLR to another.
- Each HLR can be filled to 100% of its capacity by allowing subscriber number ranges to be split over different HLRs and individual subscriber numbers to be assigned to any HLR.
- Subscriber number routing data is not required to be maintained in all MSCs in the network.
- 

G-Flex is designed to alleviate problems in areas such as network load balancing and efficient use of HLR capacity. Today's rigid scheme for assigning subscribers to HLRs leads to several inefficiencies for network operators, as described in the following examples:

- When IMSI numbers, which identify the **SIM** (Subscriber Identity Module), get lost or are otherwise out of service, “holes” sometimes open in the IMSI ranges. These holes result in HLR capacity that cannot be used because switches will not be routing messages using those lost numbers anymore.
- In many cases, subscribers are “split” across multiple HLRs, as their IMSI range can point to a different HLR than their MSISDN range. Operators must take special steps to ensure that calls are not mishandled.
- With the advent of **MNP** (Mobile Number Portability), the MSISDN no longer indicates the subscription network. This leads to holes in the MSISDN ranges that address HLRs. As in the case with IMSIs, these MSISDN holes result in HLR capacity that cannot be used by existing MSC routing schemes.
- With the advent of MNP, operators need to handle message routing based on MSISDNs that are imported to the network from another operator and do not fit into the existing range mechanism.
- Prepaid service may result in the allocation of a large block of IMSIs to an HLR, many of which may not be put in service immediately.
- Corporate clients may reserve a large block of numbers that must be assigned to an HLR. Many of these may not be used immediately, or ever.

## 6.1.1 Number Conditioning

Incoming SCCP CdPAs (Called Party Numbers) destined for G-Flex processing are conditioned as follows to fit the GDM (G-Flex Database) lookup requirements where possible:

- If the G-Flex GTT selectors available in the incoming message match an entry in the Selector table, then the service Numbering Plan from the Selector table entry uses the CdPA Numbering Plan. Further conditioning is applied based on the CdPA Numbering Plan.
- If the G-Flex GTT selectors available in the incoming message match an entry in the Selector table, then the service Nature of Address from the Selector table entry uses the CdPA Nature of Address. Further conditioning is applied based on the CdPA Nature of Address.
- If the Nature of Address is National (Significant), the default CC (country code for E.164 or E.214) or default **MCC** (mobile country code for E.212) is prepended to the number for GDM look up. The default country code to be used by vSTP, must be previously provisioned. If not, a measurement is issued, and the message falls through to GTT.
- If the Nature of Address is Subscriber, the default CC + default **NC** (network code for E.164 or E.214) or default MCC + default **MNC** (for E.212) are prepended to the number. The default codes to be used by vSTP must be previously provisioned. If not, a measurement is issued, and the message falls through to GTT.
- If the Numbering Plan is E.214, the CC + **NC** part of the number is replaced with its corresponding MCC + MNC from the provisioned conversion data. If no matching CC + NC has been provisioned, a measurement is issued, and the message falls through to GTT.

Numbers with fewer than 5 digits after the conditioning are not processed by G-Flex. A measurement is issued, and the message falls through to GTT.

Numbers with more than 15 digits after the conditioning are not processed by G-Flex. A measurement is issued, and the message falls through to GTT.

## 6.1.2 G-Flex Call Flows

Several types of subscriber numbers can be used as a basis for routing messages to HLRs: IMSI, MSISDN, MIN, and MDN.

G-Flex handles two types of IMSI routing :

- IMSI routing that uses the actual IMSI (an E.212 number)
- IMSI routing that uses the Mobile Global Title (MGT), which is an E.214 number derived from the IMSI

G-Flex also handles the MSISDN/MIN/MDN cases, which use the E.164 numbering plan. The call flows in this section address these three cases.

The call flows in this section show only one possible scenario for how messages are routed in the network and where various stages of GTT are performed. G-Flex C7 Relay may perform intermediate or final GTT and/or replace the SCCP (Signaling Connection Control Part) CdPA (Called Party Address) with the HLR entity address, depending on the message received and provisioned data. All call flows here assume that G-Flex C7 Relay is integrated with the vSTP.

 **Note:**

In GSM networks, each network entity (for example, MSC, HLR, VLR [Visitor Location Register]) is identified by an E.164 entity address. GSM networks also route messages based on E.164 entity addresses when those addresses are known by the sender. While the routing of these messages must also be handled by G-Flex C7 Relay, this function is not considered to be a core part of G-Flex. Because these numbers are not expected to be populated in the G-Flex data, messages routed using these addresses should fall through to normal or enhance) GTT (Global Title Translation). Therefore, call flows for this type of routing are not described here.

**MGT (E.214) Routing**

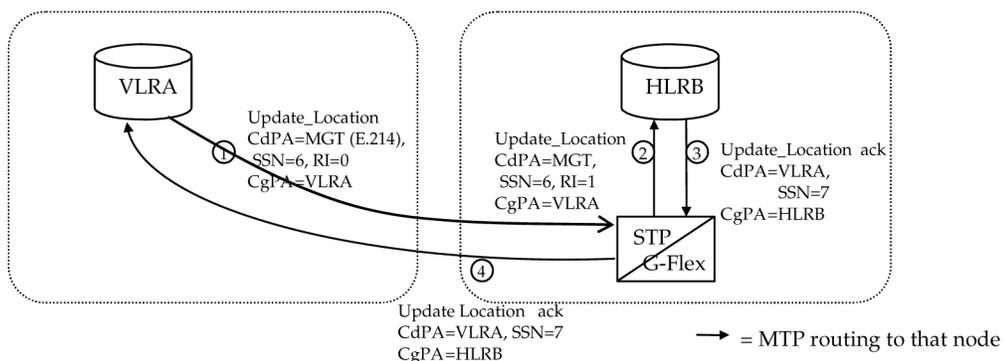
The partial Update Location procedure shown in [Figure 6-1](#) is an example of E.214 mobile global title routing. MGT is employed in situations where the E.164 address of the receiving node (labeled HLRB) is not yet known by the sending node (labeled VLRA).

In order to update information about the subscriber's location, VLRA sends a **MAP** (Mobile Application Part) Update\_Location message to the G-Flex Relay (possibly through a Gateway Mobile Switching Center).

The steps in [Figure 6-1](#) are cross-referenced in the following procedure.

1. The message is received at the G-Flex Relay. Global title information triggers G-Flex processing. Because the SCCP CdPA contains an E.214 number, G-Flex first converts the E.214 number to an international E.212 number before searching the vSTP Real Time Database (UDR) with the E.212 number (Step 1). G-Flex also handles the case where an E.212 number is received in the SCCP CdPA. In this case, the database is searched directly using the E.212 number.
2. G-Flex finds a match with HLR GT information and routes the message to the designated DPC (HLRB) (Step 2).
3. HLRB responds to VLRA with an Update\_Location ack. This message has the E.164 address of VLRA in the SCCP CdPA and is routed by normal or enhanced GTT, not G-Flex (Step 3).
4. The message is relayed to VLRA (Step 4).

**Figure 6-1 E.214 (E.212) Routing Example - Location Updating**



There are other MAP messages from VLR to HLR that also fall into this category of requiring E.214 global title routing. All of these messages are handled the same way by G-Flex, using the process described above.

### IMSI (E.212) Routing

G-Flex processing for a message routed with an E.212 number in the SCCP CdPA GTA (Global Title Address) is essentially the same as the processing for a message routed with an E.214 number. The only difference is that the number does not have to be converted to E.212 (since it is already E.212) before doing the database lookup. Therefore, those call flows are not shown here.

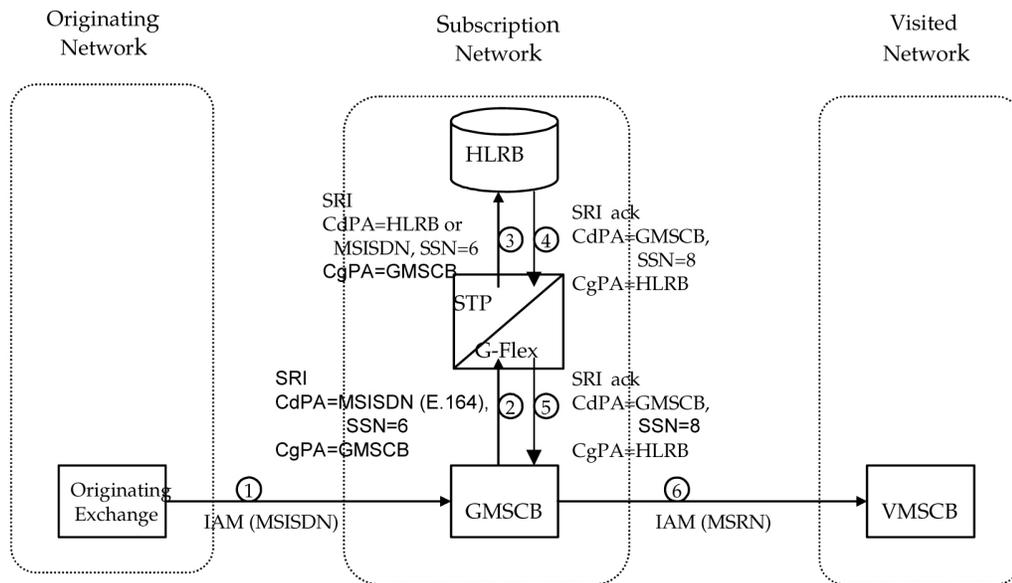
### MSISDN/MIN/MDN (E.164) Routing

A mobile terminated call results in the GMSC (Gateway Mobile Switching Center) querying the HLR through the use of the called number as a GTA. G-Flex is used to locate the appropriate HLR. The partial mobile terminated call procedure shown in [Figure 6-2](#) is an example of MSISDN global title SCCP addressing. This applies to MIN and MDN routing numbers as well.

The steps in [Figure 6-2](#) are cross-referenced in the following procedure.

1. A call is originated and an IAM (Initial Address Message) is sent from the originating network to the subscription network (Step 1).
2. Digit analysis at GMSCB detects a mobile terminated call to a mobile station and generates a MAP Send\_Routing\_Info (SRI) message to the G-Flex Relay (Step 2).
3. The vSTP receives the message. Global title information triggers G-Flex processing. Since the SCCP CdPA contains an E.164 number, G-Flex searches the UDR with the E.164 number, which must be converted to an international number if it is not one already. The G-Flex finds a match with HLR GT information and routes the message to the designated DPC (HLRB) (Step 3).
4. HLRB responds to GMSCB with an SRI `ack`. This message has the E.164 address of GMSCB in the SCCP CdPA, and is routed by normal or enhanced GTT, not G-Flex (Step 4).
5. The message is relayed to GMSCB (Step 5).
6. GMSCB sends an IAM containing the MSRN (Mobile Station Roaming Number) to the visited network (Step 6).

**Figure 6-2 Mobile Terminated Call**



Other MAP messages that are routed using MSISDN/MIN/MDN global title routing to an HLR are handled the same way by G-Flex. This includes mobile terminated short messages.

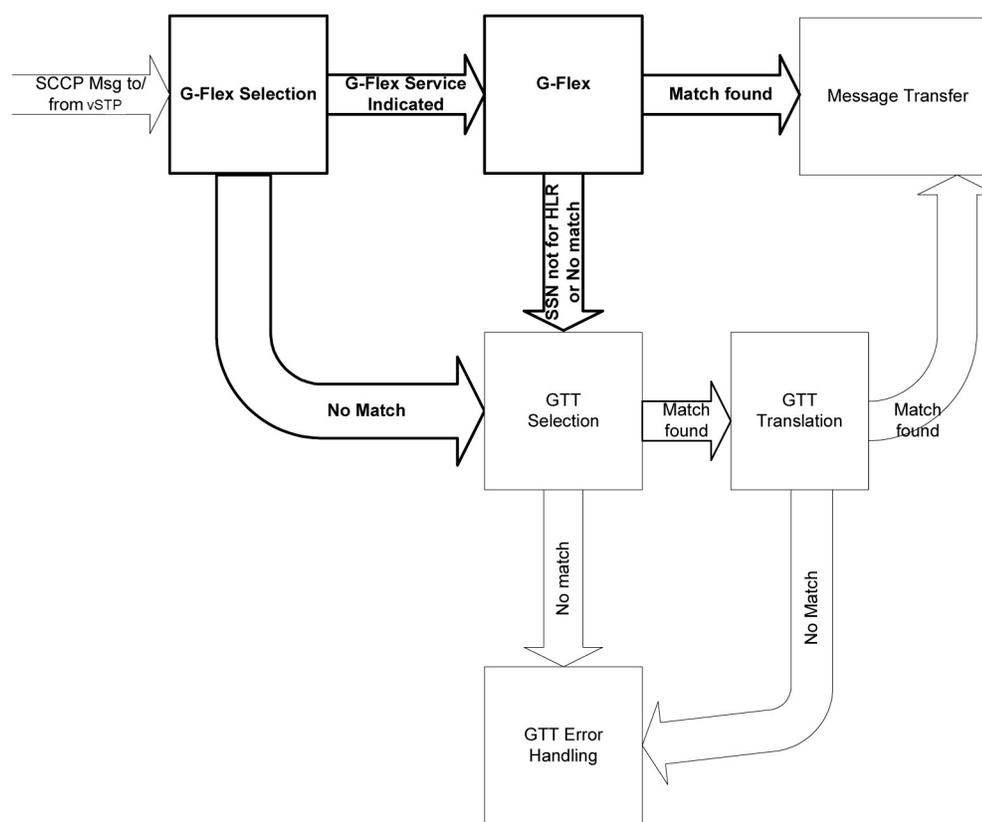
## 6.2 G-Flex Relay Function Description

The G-Flex Relay Function (G-Flex Relay) provides the following enhancements to vSTP GTT:

- **Increased number of translations** – The GTT limit is 270,000 total translations. With G-Flex Relay, the number is millions. However, G-Flex Relay translations are only from international MSISDNs and IMSIs to HLRs.
- **Number conditioning** – Because the GDB stores MSISDNs and IMSIs as international numbers and does not store MGTs, G-Flex provides the capability to condition incoming numbers to be international MSISDNs or IMSIs for the database look up.
- **Provides discrimination of messages that need its functionality** – Because G-Flex is used only for translating to HLRs, it provides a method to identify which messages are processed by G-Flex Relay and which by GTT. This is provided using a G-Flex Service Selector table that defaults back to the GTT Selector table if a match is not found, and by providing SSN-based discrimination.
- **Variable number of digits** – There is no fixed number of digits for MSISDNs or IMSIs. For example, a 12-digit MSISDN can coexist with a 15-digit one. However, the number of digits of the stored numbers must be between 5 and 15.
- **Replacement of GT with entity address** – The ability to set the outgoing CdPA GT (NP, NAI, ES, GTAI) to the HLR international entity number is provided.

The following figure shows the basic functioning of SCCP, with the parts for G-Flex in bold:

Figure 6-3 G-Flex in SCCP



In order to keep the diagram simple, the only error conditions shown are the no-match cases for G-Flex and GTT selectors and translations. G-Flex has its own error handling for some cases that issues measurements and peg measurements appropriately before letting the MSU fall through to GTT translation. Also, there are error conditions in GTT selection, GTT translation, and message transfer that are handled by GTT error handling.

G-Flex Relay is performed in the following stages.

1. The message arrives at vSTP Route-on-GT. The vSTP decodes the SCCP portion and uses the data to perform G-Flex selection based on the CdPA GT fields other than the ES and GTAI. The result of this selection provides two pieces of data, identification of the NP and NAI for G-Flex and a G-Flex Service Indicator. The Service Indicator is G-Flex if G-Flex Relay is required. If a G-Flex selector does not match the incoming GT fields, then GTT selection is attempted. It is possible that G-Flex and GTT selectors will not match the incoming GT fields. In this case, GTT error handling is used.
2. If stage 1 indicates that G-Flex Relay is required and if the message is not a UDTS-generated by the vSTP, the vSTP performs SSN-based discrimination. If the G-Flex service state is ONLINE, then step 3 is performed. Otherwise, G-Flex SCCP Service Re-Route is performed.
3. The conditioned number is looked up in the GDB.
4. If the number is found, the translation data for the number is used to alter and route the message.
5. If G-Flex Relay is not required, or the number is not found in the GDB, the set of GTT translations is used for translation.

Table 6-1 lists possible combinations for G-Flex selector and G-Flex data provisioning, and the resulting action of G-Flex Relay.

**Table 6-1 G-Flex Relay Data Combinations**

G-Flex Selector Matches Incoming GT	Number in GDB	vSTP Action
No	N/A	GTT used
Yes	No	Fall-through to GTT
Yes	Yes	G-Flex translation

G-Flex Relay is divided into the following subtasks:

- Conversion of national/local numbers to international numbers
- Conversion of E.214 MGT to E.212 international IMSI
- GDB lookup
- Message forwarding
- Error handling

## 6.2.1 Conversion of National/Local Numbers to International Numbers

G-Flex stores international DNs and IMSIs in the GDB. SCCP CdPA numbers may need to be converted to international numbers in order to do an GDB lookup. When a message needs G-Flex Relay and has either a national (significant) number or Subscriber Number as the Service NAI, then the national/local to international number conversion is triggered. G-Flex uses the SCCP CdPA GTAI number and its SNAI to convert to an international number based on the numbering plan as shown in the following table:

**Table 6-2 National/Local Numbers to International Numbers Conversion Logic**

Service Numbering Plan	Service Nature of Address	Action
E.164	National (Significant) number	Prepend GTAI digits with the default E.164 Country Code (CC).
E.164	Subscriber number	Prepend <b>GTAI</b> digits with the default E.164 country code (CC) and network code ( <b>NC</b> ).
E.212	National (Significant) number	Prepend GTAI digits with the default mobile country code (MCC).
E.212	Subscriber number	Prepend GTAI digits with the default Mobile Country Code ( <b>MCC</b> ) and Mobile Network Code ( <b>MNC</b> ).
E.214	National (Significant) number	Prepend GTAI digits with the default E.164 Country Code (CC).
E.214	Subscriber number	Prepend GTAI digits with the default E.164 Country Code (CC) and Network Code (NC).

**Table 6-2 (Cont.) National/Local Numbers to International Numbers Conversion Logic**

Service Numbering Plan	Service Nature of Address	Action
Other	N/A	Assume the default to be E.164 International number

**Notes:**

- If any of the default CC, NC, MCC, or MNC are required for conversion and are not provisioned in the database, G-Flex Relay issues a measurement and falls through to GTT.
- If the converted number is fewer than five digits, G-Flex Relay falls through and performs GTT on the message. G-Flex Relay issues a measurement when a converted number is fewer than five digits.
- If the converted number is more than 15 digits, then G-Flex Relay issues a measurement when the number exceeds 15 digits and falls through to GTT.
- G-Flex Relay uses the conditioned number for database lookup purposes only and does not modify the CdPA GTAI in the message unless `rcgta=yes` or `ccgt=yes`.
- For the G-Flex selector-specified service numbering plan (IMSI, DN, or **MGT**), the numbering plan in the incoming message is replaced with the G-Flex Selector service numbering plan (E.164, E.212, or E.214, respectively). This is for GDB lookup purposes only.

## 6.2.2 Conversion of E.214 MGT to E.212 IMSI

Because the GDB does not store MGTs, the messages with E.214 MGT in the CdPA **GTAI** are converted to an E.212 International IMSI in order to perform the GDB lookup. G-Flex maintains a logical MGT2IMSI conversion table to perform this conversion. The MGT2IMSI conversion table contains up to ten entries of E.164 part (CC + NC digits) and its corresponding E.212 part (MCC + MNC). If a G-Flex message has E.214 as the CdPA numbering plan, G-Flex Relay performs the following steps to derive the E.212 International IMSI:

1. G-Flex Relay uses MGT as the key and does a lookup in the MGT2IMSI conversion table to find a match on E.164 part (CC + NC digits).
2. If a match is found, G-Flex Relay replaces the matched digits of the MGT with the corresponding E.212 part (MCC + MNC digits). If a match is not found, a measurement is issued and the G-Flex Relay falls through to GTT.
3. G-Flex Relay uses this complete E.212 International IMSI number to do the GDB lookup.

 **Note:**

If the IMSI for a particular country/network is the complete 15 digits and the E.164 CC + NC for that country is more than five digits, the MGT generated could contain a truncated MSIN. This is possible because the converted MGT is more than 15 digits and the maximum number of digits allowed in the MGT is 15 digits. (Refer to E.214 for more details on conversion.) Under these circumstances, the MGT is truncated at 15 digits. Therefore, the MGT-to-IMSI reconversion would not regenerate a complete IMSI and would lead to incorrect results and errors.

## 6.2.3 GDB Lookup

G-Flex Relay performs the GDB lookup using either the complete international DN or IMSI. If the DN or IMSI number is found in the GDB and it has an HLR translation, then G-Flex Relay extracts the HLR translation data and generates a forwarding message. G-Flex Relay falls through and performs GTT for the following error cases:

- The DN number is not present in the database.
- The IMSI number is not present in the database.

The preceding error cases do not generate any measurement, but fall through to GTT processing.

If the GDB lookup is for GTI=2 and is an even number of digits ending in 0, then G-Flex performs a less than or equal to lookup for the odd number of digits (digit length minus 1). If a match is found, G-Flex saves the record and record index.

G-Flex then tries to continue to find an exact match on the even number of digits. If the exact match is found in the GDB, then the HLR translation data corresponding to the even number of digits record is used. Otherwise the HLR translation data corresponding to the found odd number of digits record is used. If the even and odd translation is not found, then the G-Flex Relay falls through and performs GTT.

The important issue is that the less than or equal to search re-enters the search where the comparison left off. This minimizes any impact on performance for this special case.

## 6.2.4 Message Forwarding

### GFRF Forwarding Message: MTP Portion

G-Flex modifies the MTP routing label to include the HLR PC as the DPC and the vSTP true PC as the OPC. G-Flex modifies the MTP Level 2 length based on the size of the forwarding message. The following tables lists the fields modified by G-Flex Relay:

**Table 6-3 G-Flex Relay Forwarding Message: MTP Portion**

Fields	Values
MTP Level 2 length	Number of octets in response MSU starting from <b>MTP3</b> SIO field. If number of octets is greater than 63, Level 2 length is set to 63

**Table 6-3 (Cont.) G-Flex Relay Forwarding Message: MTP Portion**

Fields	Values
MTP Level 3 DPC	Point code obtained from the HLR GT information in GDB
MTP Level 3 OPC	vSTP true PC

**G-Flex Relay Forwarding Message: SCCP Portion**

The following functions are performed for the SCCP portion of the message:

**Replacing the CdPA GTAI digits with the HLR entity number**

When an MSISDN or IMSI number is found in the GDB and the Replace GT flag is set for this entry, G-Flex Relay replaces the CdPA GTAI digits with the provisioned HLR entity number. G-Flex also modifies the numbering plan (E.164), nature of address (international), and encoding scheme to match the HLR entity number.

G-Flex Relay does not replace the Global Title Indicator format (GTI) element of the GT.

**Replacing of SSN in the CdPA**

When the HLR translation data includes a SSN, G-Flex Relay replaces the SSN in the called party address of the message with the new SSN. If the SSN is not present in the incoming message, then G-Flex Relay updates the **Subsystem Number** Indicator and includes the new SSN in the Called Party Address of the message before it forwards the message to the next node.

**Inclusion of OPC in the CgPA**

When the routing indicator of the calling party address is set to Route-on-SSN, and no SPC is present in it, the OPC from the received message is taken and inserted into the CgPA before the message is forwarded to the next node.

**Deleting the CdPA GT Digits**

When G-Flex performs Final-GTT, the Routing Indicator of the Called Party Address is set to Route-on-SSN. G-Flex provides an option to delete the Global Title present in the Called Party Address. If the Delete GT option is set, G-Flex modifies the GTI to zero and deletes the GT information from the SCCP CdPA before the message is forwarded to the end node. The following table summarizes the possible changes by G-Flex Relay to the SCCP fields:

**Table 6-4 G-Flex Relay Forwarding Message: SCCP Portion**

Field	Value
SCCP CdPA Length	New CdPA length after the possible modifications
SCCP CdPA Routing indicator	Routing Indicator obtained from the GDB. (GT or DPCSSN)
SCCP CdPA Global Title Indicator	Same as incoming message or zero
SCCP CdPA Subsystem Number Indicator	Same as incoming message or replaced/inserted with the subsystem number indicator based on the existence of the SSN provisioned in the HLR translation
SCCP CdPA SSN	Same as incoming message or replaced/inserted with the SSN provisioned in the HLR translation

**Table 6-4 (Cont.) G-Flex Relay Forwarding Message: SCCP Portion**

Field	Value
SCCP CdPA GT	Same as incoming message or replaced or deleted with HLR entity address provisioned in the GDB
SCCP CgPA Length	New CgPA length after the possible modifications
SCCP CgPA Point Code Indicator	Same as incoming message or if CgPA RI is Route-on-SSN and PCI is not 1, then set PCI to 1
SCCP CgPA SPC	If the CgPA RI is Route-on-SSN and no point code is present in the CgPA SPC, then the OPC is included as the SPC (Secondary Point Code)
SCCP CdPA Subsystem Number Indicator	Same as incoming message or replaced/inserted with the Subsystem Number indicator based on the existence of the SSN provisioned in the HLR translation

### Error Handling

The purpose of the Error Handling is to discard or return messages that encounter routing and database failures and cannot be delivered to the HLR. When G-Flex Relay is unable to transfer a message and Return on Error is set, then G-Flex Relay follows the same error handling procedures used by GTT. The DATA field of the UDT message and the reason cause for return are included in UDTS message.

G-Flex Relay follows the same error handling procedures as GTT for the following error cases:

- Routing failures
- Network congestion

Forwarding message after replace GT and/or Insertion of OPC or SSN is greater than the CCS7 message limit (272 bytes).

An exception to GTT error handling is when the G-Flex Relay GDB entry cannot be found. In this case, it is not considered an error and the G-Flex Relay capability will forward the message to GTT processing.

## 6.3 G-Flex MAP Layer Routing (G-Flex MLR) Feature

This chapter describes the G-Flex MAP Layer Routing (G-Flex MLR ) feature. G-Flex MLR allows subscriber digits to be obtained from either the SCCP layer or the MAP layer of a message during GDB lookup.

### 6.3.1 G-Flex MAP Layer Routing

The vSTP G-Flex feature can perform GDB subscriber number lookup based either on a subscriber's E.164 MSISDN number, or the subscriber's E.212 IMSI number. In some GSM networks, MSCs use an E.214 MGT (Mobile Global Title) number for routing between networks. G-Flex cannot perform database lookup directly with an E.214 MGT number, but it can convert the E.214 MGT into a E.212 IMSI number, and thus correctly process the message. In an ITU network, when a visited network entity (VLR, GGSN, SGSN, or GMLC) needs to contact a home network entity ( AuC or HLR) given only the IMSI of a subscriber, it will convert the E.212 IMSI into an E.214

MGT. This process applies only to the first message of a dialogue. Subsequent messages of that same dialogue will be routed using E.164 numbers.

When the **SCCP** CdPA is truncated by the MSC in a message that is received for G-Flex service, G-Flex needs to use the subscriber number from the MAP layer for routing.

The G-Flex MLR feature supports G-Flex routing for messages based on the MAP-layer IMSI and MSISDN parameters that does not involve checking the format of the CdPA, though the messages contain SCCP Called Party Address (CdPA) parameters in ITU E.214 format. The **CdPA** should contain an E.214 number, but its format and content have no bearing on the G-Flex MLR function.

G-Flex MLR processes messages with the MAP operations shown in the following table:

**Table 6-5 MAP Operations Processed by G-Flex MLR**

MAP Operation Name	Processing
updateLocation updateGprsLocation sendParameters sendAuthenticationInfo registerSS activateSS deactivateSS interrogateSS authenticationFailureReport restoreData readyForSM purgeMS processUnstructuredSS-Request sendRoutingInfoForLCS	G-Flex MLR processes messages with MAP operations that commonly encode the SCCP CdPA GTA in the E.214 format (MGT) where trailing IMSI digits may be truncated from the MGT, and that always include IMSI in the MAP layer.
AnyTimeInterrogation	G-Flex MLR processes messages with the AnyTimeInterrogation (ATI) operation, using the MSISDN from the MAP layer of the ATI message for conditioning and GDB look up. The MSISDN is converted to International format for GDB searching based on the Nature of Address Indicator in the MAP MSISDN parameter. No HomeRN deletion is required.

The Application Context Name and version supported by G-Flex MLR are shown in the following table:

**Table 6-6 MAP Protocol Versions Supported by G-Flex MLR**

MAP Operation	MAP Operation Name	Application Context Name and Version Supported	IMSI from Component or Dialogue Portion of TCAP	Lookup for MSISDN if IMSI is Missing	MSISDN from Component or Dialogue Portion of TCAP
Location Update (2)	updateLocation	networkLocUpContext-v3 application-context-name value of 0.4.0.0.1.0.1.3  networkLocUpContext-v2 application-context-name value of 0.4.0.0.1.0.1.2.  networkLocUpContext-v1	Component	No	NA
Send Parameters (9)	sendParameters	infoRetrievalContext-v1	Component	No	NA
Update GPRS Location (23)	updateGprsLocation	gprsLocationUpdateContext-v3 application-context-name value of 0.4.0.0.1.0.32.	Component	No	NA
Send Authentication Information (56)	sendAuthenticationInfo	infoRetrievalContext-v3 application-context-name value of 0.4.0.0.1.0.14.3.  infoRetrievalContext-v2 application-context-name value of 0.4.0.0.1.0.14.2.	Component	No	NA
AnyTime Interrogation (71)	AnyTimeInterrogation	anyTimeInfoEnquiryContext-v3 application-context-name value of 0.4.0.0.1.0.29.3.	NA	Yes (MSISDN is only looked up)	Component
Register Supplementary Service (10)	registerSS	networkFunctionalSsContext-v2	Dialogue	No	NA
Activate Supplementary Service (12)	activateSS	networkFunctionalSsContext-v2	Dialogue	No	NA
Deactivate Supplementary Service (13)	deactivateSS	networkFunctionalSsContext-v2	Dialogue	No	NA
Interrogate Supplementary Service (14)	interrogateSS	networkFunctionalSsContext-v2	Dialogue	No	NA
Authentication Failure Report (15)	authenticationFailureReport	authenticationFailureReportContext-v3	Component	No	NA
Restore Data (57)	restoreData	networkLocUpContext-v3 networkLocUpContext-v2	Component	No	NA
Process Unstructured SS Request (59)	processUnstructuredSS-Request	networkUnstructuredSsContext-v2	Dialogue	Yes	Dialogue
Ready For Short Message (66)	readyForSM	mwdMngtContext-v3 mwdMngtContext-v2	Component	No	NA
Purge Mobile Subscriber (67)	purgeMS	msPurgingContext-v3 msPurgingContext-v2	Component	No	NA

**Table 6-6 (Cont.) MAP Protocol Versions Supported by G-Flex MLR**

MAP Operation	MAP Operation Name	Application Context Name and Version Supported	IMSI from Component or Dialogue Portion of TCAP	Lookup for MSISDN if IMSI is Missing	MSISDN from Component or Dialogue Portion of TCAP
Send Routing Information for Location Service (85)	sendRoutingInfoForLCS	locationSvcGatewayContext-v3	Component	Yes	Component

G-Flex MLR processes messages with the following MAP operations commonly encode the SCCP CdPA GTA in the E.214 format (MGT) where trailing IMSI digits may be truncated from the MGT, and these messages always include IMSI in the MAP layer.

- MAP Update\_Location
- Update\_GPRS\_Location
- Send\_Parameters
- MAP Send\_Authentication\_Information

G-Flex MLR also processes messages with the AnyTimeInterrogation (ATI) operation, using the MSISDN from the MAP layer of the ATI message for conditioning and GDB look up. The MSISDN is converted to International format for GDB searching based on the Nature of Address Indicator in the MAP MSISDN parameter. No HomeRN deletion is required.

For the following MAP Operations, G-Flex MLR uses the GSMOPTS GFLEXMAPPLAYERRTG configuration option value to determine whether to use the IMSI or MSISDN to obtain subscriber digits from the MAP layer when performing GDB lookup:

- updateLocation
- updateGprsLocation
- sendParameters
- sendAuthenticationInfo
- AnyTimeInterrogation

The GFLEXMAPPLAYERRTG option can have the following values:

- NONE - The G-Flex MLR function is not performed for a message that contains an updateLocation, sendParameters, sendAuthenticationInfo, updateGprsLocation, or AnyTimeInterrogation operation code. Normal G-Flex processing is applied to the message. The IMSI or MSISDN is taken from the SCCP CdPA parameter for TC-BEGIN messages.
- IMSI - The G-Flex MLR function uses the IMSI for the GDB lookup, for the updateLocation, sendParameters, sendAuthenticationInfo, and updateGprsLocation operations.
- MSISDN - The G-Flex MLR function uses the MSISDN for the GDB lookup, for the AnyTimeInterrogation operation.
- All - The G-Flex MLR function uses the IMSI or the MSISDN for the GDB lookup, based on the operation code of the message. If the message contains an updateLocation,

sendParameters, sendAuthenticationInfo, or updateGprsLocation operation code, the G-Flex MLR function uses the IMSI parameter. If the message contains an AnyTimeInterrogation operation code, the G-Flex MLR function uses the MSISDN parameter.

For the operations shown in [Table 6-7](#), G-Flex MLR uses the GSMOPTS MAPLYRRTGON configuration option to turn on processing of each specified operation or all operations, and the MAPLYRRTGOFF configuration option to turn off processing of each specified operation or all operations. The values are specified in a comma-separated list for the option in the `chg-gsmopts` command. One or both options can be specified in one command, but the same value cannot be specified in both options in the same command. When ALL is specified for one option, the other option cannot be specified in the same command.

**Table 6-7 GSMOPTS Configuration Options MAPLYRRTGON and MAPLYRRTGOFF**

Operation Name	Configuration Option Value
registerSS	regss
activateSS	actss
deactivateSS	dactss
interrogateSS	intross
authenticationFailureReport	authfailrpt
restoreData	rstdata
processUnstructuredSS-Request	procunstrqt
readyForSM	rdyforSM
purgeMS	purgmobss
sendRoutingInfoForLCS	sriloc
All 10 operations listed in this table	all

"Normal" G-Flex processing is performed using the SCCP CdPA when:

- The G-Flex MLR feature is not turned on.
- The received message does not include an operation of interest.
- The operation does not contain an IMSI parameter.
- The operation does not contain an MSISDN parameter. No measurement is generated.
- The G-Flex MLR feature encounters a supported operation code that contains an invalid ACN.

The G-Flex MLR feature applies only when:

- The G-Flex MLR feature is enabled and turned on.
- An incoming MSU contains and SCCP UDT message type code or XUDT non-segmented message type code.
- The message contains a TCAP Message Type of Begin (in the MAP layer information of only the first TCAP component of the message).
- The TCAP component is Invoke.
- The GSMOPTS GFLEXMAPLAYERRTG configuration option is not NONE.

- For the message processing controlled by the GSMOPTS GFLEXMAPLAYERRTG configuration option, the option is not NONE.
- For the message processing controlled by the MAPLYRRTGON option, the option must be set for the operation code in the incoming message, and
  - SCCP CdPA NP=E.214 if CdPA GTI=4 and NP is present.
  - The length of the MCC+MNC (Mobile Country Code + Mobile Network Code) in the resulting E.212 IMSI number must be greater than the length of the CC+NDC (Country Code+Network Destination Code) in the E214 MGT number that is converted to the E212 IMSI number. The maximum length of the SCCP CdPA is 15 digits.

If the MCC+MNC length is greater than the CC+NDC length and CdPA is 15 digits, then after E.214 MGT to E.212 IMSI conversion, the resulting number of digits is greater than 15. The last digits may be truncated; in this case IMSI digits can be taken from the MAP layer.

- SCCP CdPA GTI=2
  - \* The SCCP CdPA GTA length is not checked because the SCCP CdPA Encoding Scheme (ODD or EVEN) is not known in this case, and there might be filler digits ('0') that make the length determination uncertain.

or

The CdPA GTI=4 and the SCCP CdPA length is 15 digits.

- \* If the length of the SCCP CdPA GTA is 16 digits and the last digit is a stop digit ('0xF'), the stop digit is treated as a filler digit and the CdPA GTA length is considered to be 15 digits.
- \* If the CdPA GTI=4, the SCCP CdPA GTA is 8 bytes, and the Encoding Scheme is not BCD ODD (1) or BCD EVEN (2), the Encoding Scheme is assumed to be BCD EVEN (2).

The G-Flex MLR measurements are generated to indicate the following errors in the IMSI and MSISDN parameter in a message. Normal G-Flex processing is applied to the message.

- Missing IMSI (a measurement is not generated for a missing MSISDN)
- Decoding errors such as an IMSI parameter value that does not have at least 5 digits and no more than 15 digits, or an MSISDN parameter value that does not have at least 1 digit and no more than 15 digits
- MSISDN digits with the NAI set to Subscriber or National and the STPOPTS Default Country Code (DEFCC) or Default Network Destination Code (DEFNDC) configuration option is not set appropriately
- Invalid TCAP component

G-Flex MLR affects only the selection of digits for GDB lookup. All other processing is the same as G-Flex. No changes are made to the MAP layer of the outgoing message; the SCCP layer may be changed per the provisioned Network Entity parameters in the EPAP (such as Digit Action).

## 6.4 G-Flex Configurations

This section provides procedures to configure the connection required for G-Flex configurations.

G-Flex is configured using the vSTP managed objects. The MMI API contains details about the URI, an example, and the parameters available for each managed object.

## 6.4.1 MMI Managed Objects for IDPR and MOSMS

MMI information associated with MNP is accessed from a DSR NOAM or SOAM from **Main Menu**, and then **MMI API Guide**.

Once the *MMI API Guide* displays, use the application navigation to locate specific vSTP managed object information.

[Table 5-18](#) lists the managed objects and operations supported for vSTP MNP G-Port feature.

**Table 6-8 vSTP MNP Managed Objects and Supported Operations**

Managed Object Name	Supported Operation
sccpmnptions	Update

### sccpmnptions - Display

Execute this command on an active SOAM to update MNPOptions:

```
/vstp/sccpmnptions
```

Example output:

```
{
  "aclen": 0,
  "atiackimsi": "none",
  "atiackmsisdn": "msisdn",
  "atiackrn": "rn",
  "atiackvlrnum": "rnspmsisdn",
  "atidfltrn": "None",
  "atidlm": "None",
  "atidentitylen": "None",
  "atinptype": "any",
  "atisnai": "nai",
  "atisuppllocinfo": "Off",
  "ativlrnumlen": 40,
  "cclen": 0,
  "ccnc1-mccmnc1": "1970-911666",
  "ccnc10-mccmnc10": "2298-911666",
  "ccnc2-mccmnc2": "9988-000000",
  "ccnc3-mccmnc3": "9988-911666",
  "ccnc4-mccmnc4": "None",
  "ccnc5-mccmnc5": "None",
  "ccnc6-mccmnc6": "None",
  "ccnc7-mccmnc7": "None",
  "ccnc8-mccmnc8": "None",
  "ccnc9-mccmnc9": "None",
  "crptt": "None",
  "defcc": "2298",
  "defmapvr": 1,
```

```
"defmcc": "911",
"defmnc": "666",
"defndc": "None",
"delccprefix": "pfx4all",
"dngtzerofill": "No",
"encdnpsdnotfound": "Off",
"encdnpsptnone": "Off",
"encodecug": "Off",
"encodenps": "On",
"gflexmaplayererrtg": "msisdn",
"inpcutnpaste": "Off",
"inpdra": "rndn",
"inpdranai": "unknown",
"inpdranp": "E164",
"inp nec": "None",
"inprelcause": 31,
"insnai1-cdpanai1": "None",
"insnai2-cdpanai2": "None",
"insnai3-cdpanai3": "None",
"insnai4-cdpanai4": "None",
"insnai5-cdpanai5": "None",
"insprestype": "continue",
"intlunknai": "No",
"maplyrrtg_actss": "On",
"maplyrrtg_authfailrpt": "On",
"maplyrrtg_dactss": "On",
"maplyrrtg_intss": "On",
"maplyrrtg_procunstrqt": "On",
"maplyrrtg_purgmobss": "Off",
"maplyrrtg_rdyform": "On",
"maplyrrtg_regss": "On",
"maplyrrtg_rstdata": "On",
"maplyrrtg_sriloc": "On",
"mnpcrp": "Off",
"mnpnpdbunavl": "dnotfound",
"mosmsaclen": 0,
"mosmsbpartychk": "Off",
"mosmsbpartygttset": "None",
"mosmsdefrn": "None",
"mosmsdigmat": "exact",
"mosmsfwd": "No",
"mosmsgta": "None",
"mosmsgttddig": "sccpcdpa",
"mosmsnai": "intl",
"mosmssa": "No",
"mosmsspfill": "Off",
"mosmstcapseg": "Off",
"mosmstype": "sprn",
"msisdntrunc": 0,
"msrndig": "rn",
"msrnlcn": 30,
"msrnnai": 2,
"msrnpn": 1,
"mtmmsackn": "ack",
"mtmmsentyn": "None",
```

```

"mtmmsgta": "None",
"mtmmslen": "None",
"mtmmstype": "rn",
"mtsmsackn": "ack",
"mtsmschksrc": "No",
"mtsmsdltr": "no",
"mtsmsdltrv": "None",
"mtsmsimsi": "mccrndn",
"mtsmsnakerr": 1,
"mtsmsnni": "rn",
"mtsmsnp": "Off",
"mtsmstype": "rn",
"multcc1": "None",
"multcc10": "None",
"multcc2": "None",
"multcc3": "None",
"multcc4": "None",
"multcc5": "None",
"multcc6": "None",
"multcc7": "None",
"multcc8": "None",
"multcc9": "None",
"serverpfx": "None",
"srfaddr": "None",
"srfnai": 0,
"srfnp": 0,
"sridn": "tcap",
"sridnnotfound": "gtt",
"srismdn": "sccp",
"srismgttrtg": "Off",
"svcrelaymapset": "2"
}

```

## 6.4.2 G-Flex Alarms and Measurements

### Alarms and Events

The following table lists the Events specific to the G-Flex support for vSTP:

**Table 6-9 Alarms and Events**

Alarm/ Event ID	Name
70321	vstpGflexNoImsi
70322	vstpGflexNoImsiSkip
70323	vstpGflexBadTcap
70324	vstpGflexInvImsi
70325	vstpGflexInvMsisdn
70326	vstpGflexInvImsiMsisdn
70327	vstpGflexE214ConversionNotPossible

For more details related to Alarms and Events, refer to Alarms and KPIs Reference document.

### Measurements

The following table lists the measurements specific to the G-Flex support for vSTP:

Measurement ID	Measurement Name
21790	VstpGflexSuccessful
21791	VstpGflexSubsNotFound
21792	VstpGflexLookupNotPerf

For more details related to measurements, refer to Measurement Reference document.

## 6.4.3 Dependencies

The G-Flex feature for vSTP has no dependency on any other vSTP operation.

The following points must be considered for G-Flex functionality:

- The vSTP does not perform any conversion in the SCCP portion of the message to support routing of messages across the domain boundary (ANSI to ITU and vice versa).
- The vSTP shall continue to support routing of messages across network boundaries (ITU-N to ITU-I and vice versa). However, GTT and/or Enhanced global title translation (EGTT) neither modify the National Indicator bit in the CdPA AI nor convert the CgPA PC to match the network type.
- For messages with E.214 numbers in the SCCP CdPA, it will be possible via a simple conversion to form an E.212 number. The E.212 number formed by such a conversion will be the full IMSI of the subscriber. That is, we assume that no truncation occurred when the E.214 number was originally formed from the E.212 number. Such truncation is allowed by the E.214 recommendation.
- The use of combination(s) of SCCP Cdpa Parameters as trigger(s) for G-Flex processing plus SSN discrimination will provide the ability to limit G-Flex processing to only the messages for which it is appropriate.
- UDR connection must be configured before any service configuration.
- UDR doesn't support HEX digits.