

**ETSI SMG3 Plenary Meeting #7,  
Madrid, Spain  
13<sup>th</sup> – 15<sup>th</sup> March 2000**

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**Agenda item:** 5.2.3  
**Source:** TSG\_N WG2  
**Title:** CRs to 3G Work Item MNP

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**Introduction:**

This document contains “9” CRs on **Work Item MNP**, that have been agreed by **TSG\_N WG2**, and are forwarded to **TSG\_N Plenary** meeting #7 for approval.

TDoc	SPEC	CR	REV	CAT	Rel	Old vers	New vers	SUBJECT
N2B000432	03.66	A014	2	D	R98	7.2.0		Results of Public Enquiry 9953
N2B000362	23.018	043	1	F	R99	3.3.0		Clarification of NPDB error detection and MNP specific call handling
N2B000462	23.018	050	3	C	R99	3.3.0		ISUP release cause value
N2B000360	23.066	007	1	D	R99	3.1.0		Editorial clean up
N2B000451	23.066	008	4	B	R99	3.1.0		Alignment of IN interface with Fixed Networks
N2B000460	23.066	009	3	B	R99	3.1.0		Detection of database synchronisation errors in SRF
N2B000433	23.066	012	2	D	R99	3.1.0		Results of Public Enquiry 9953
N2B000363	23.066	015	1	F	R99	3.1.0		Clarification of NPDB error detection and MNP specific call handling
N2B000461	29.002	063	4	B	R99	3.3.1		MNP Data base mismatch

# CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

**03.66 CR A014r2**

Current Version: **7.2.0**

GSM (AA.BB) or 3G (AA.BBB) specification number ↑

↑ CR number as allocated by MCC support team

For submission to: **CN #07**  
list expected approval meeting # here ↑

for approval   
for information

strategic   
non-strategic  (for SMG use only)

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: <ftp://ftp.3gpp.org/Information/CR-Form-v2.doc>

**Proposed change affects:**  
(at least one should be marked with an X)

(U)SIM  ME  UTRAN / Radio  Core Network

**Source:**

**N2**

**Date:**

**2000-02-29**

**Subject:**

**Result of Public Enquiry 9953**

**Work item:**

**Mobile Number Portability**

**Category:**

(only one category shall be marked with an X)

F Correction   
A Corresponds to a correction in an earlier release   
B Addition of feature   
C Functional modification of feature   
D Editorial modification

**Release:**

Phase 2   
Release 96   
Release 97   
Release 98   
Release 99   
Release 00

**Reason for change:**

Comments from the Swedish, Dutch and German National Regulatory Authorities agreed by N2B, which excludes DE1, DE2 and DE4 as per Tdoc N2B000366.

**Clauses affected:**

**2, 3, 4, 5, A.1.2 to A.1.4, A.2, B.4.2 to B.4.9, C.3, C.4, C.6**

**Other specs affected:**

Other 3G core specifications  → List of CRs:  
Other GSM core specifications  → List of CRs:  
MS test specifications  → List of CRs:  
BSS test specifications  → List of CRs:  
O&M specifications  → List of CRs:

**Other comments:**



help.doc

<----- double-click here for help and instructions on how to create a CR.

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## 2 References

### 2.1 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.
- For this Release 1998 document, references to GSM documents are for Release 1998 versions (version 7.x.y).

- [1] GSM 01.04: (ETR 350) "Digital cellular telecommunications system (Phase 2+); Abbreviations and acronyms".
- [2] ETS 300 009 (December 1991): "Integrated Services Digital Network (ISDN); CCITT Signalling System No. 7 – Signalling Connection Control Part (SCCP) [connectionless services] to support international interconnection".
- [3] GSM 02.66: "Digital cellular telecommunications system (Phase 2+); Support of Mobile Number Portability (MNP); Service description. Stage 1".
- [4] GSM 03.18: "Digital cellular telecommunications system (Phase 2+); Basic call handling ; Technical realisation".
- [5] GSM 09.02 (ETS 300 974): "Digital cellular telecommunications system (Phase 2+); Mobile Application Part (MAP) specification".
- [6] ETS 300 374-1: "Intelligent Network (IN); Intelligent Network Capability Set 1 (CS1); Core Intelligent Network Application Protocol (INAP); Part 1: protocol specification".
- [7] draft EN 302 097 V1.1.2 (1999-01): "Integrated Services Digital Network (ISDN); Signalling System No.7; ISDN User Part (ISUP); Enhancements for support of Number Portability (NP)".
- [8] draft EN 300 356-2 V4.0.0: "Integrated Services Digital Network (ISDN); Signalling System No.7; ISDN User Part (ISUP) version 4 for the international interface; Part 2: ISDN supplementary services [ITU-T Recommendation Q.730 modified]"
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## 3 Definitions and abbreviations

### 3.1 Definitions

For the purposes of the present document, the following definitions apply:

**donor network:** the subscription network from which a number is ported in the porting process. This may or may not be the number range ~~owner~~holder network.

**interrogating network entity:** the entity that submits a non-call related signalling message to interrogate the HLR;

**interrogating network:** the network in which the interrogating network entity resides;

**mobile number portability:** the ability for a mobile subscriber to change GSM subscription network within the same country whilst retaining their original MSISDN(s).

**network operator:** a GSM PLMN operator.

**non-call related signalling message:** all signalling messages where the MSISDN is used to route the message on SCCP level except MAP SRI without OR parameter set (i.e. SRI\_SMS, SRI for SOR, Send\_IMSI, CCBS\_Request etc);

**number portability database:** an Operational database (used in real time at call set-up) which provides portability information.

**number portability location register:** an internal MAP application terminating function (MATF) in the MNP-SRF network entity with an (unspecified) interface with a NPDB.

**number range ownerholder network:** the network to which the number range containing the ported number has been allocated.

**originating network:** the network where the calling party is located.

**portability clusterdomain:** a set of GSM PLMNs in a country between which MSISDNs may be ported.

**portable number:** an E.164 number that can be ported between networks in one nation.

**ported number:** a portable number that has undergone the porting process.

**ported subscriber:** the subscriber of a ported number.

**porting process:** a description of the transfer of a number between network operators.

**recipient network:** the network which receives the number in the porting process. This network becomes the subscription network when the porting process is complete.

**routeing number:** the routeing number is the data stored against the ported number in the Number Portability Database.

**service key:** the Service Key can identify to the entity holding the Number Portability Database that the service logic for Mobile Number Portability should apply. The Service Key value for Mobile Number Portability is administered in the MSC, and is passed transparently to the entity holding the Number Portability Database.

**service provider:** an entity which offers service subscriptions to individual subscribers and contracts with a network operator to implement services for a specific MSISDN. A service provider may contract with more than one network operator.

**service provider portability:** the transfer of numbers between two unique Service Providers.

**subscription network:** the network with which the customer's Service Provider has a contract to implement the customer's services for a specific MSISDN.

NOTE: The term "recipient network" is used during the porting process. The recipient network becomes the "subscription network" after the completion of the porting process.

## 3.2 Abbreviations

Abbreviations used in the present document are listed in GSM 01.04 ([1]).

For the purposes of the present document, the following abbreviations apply:

GMSC	Gateway MSC
GMSCB	The GMSC in HPLMNB
HLR	Home Location Register
HPLMNB	The subscription network of the B subscriber
IDP	Initial Detection Point
IE	Information Element
INE	Interrogating Network Entity
IF	Information Flow

IPLMN	Interrogating PLMN
MATF	MAP application Terminating Function
MNP	Mobile Number Portability
MNP-SRF	Signalling Relay Function for support of MNP
MSA	Mobile Station of the A subscriber
MSB	Mobile Station of the B subscriber
MSC	Mobile service Switching Centre
NPDB	Number Portability Database
NPLMN	The number range <u>ownerholder</u> network of the B subscriber
<u>NPLR</u>	<u>Number Portability Location Register</u>
OQoD	Originating call Query on Digit Analysis
PLMN	Public Land Mobile Network
QoHR	Query on HLR Release
RN	Routing Number
SMS	Short Message Service
SOR	Support of Optimal Routeing
SRI	Send Routeing Information
TQoD	Terminating call Query on Digit Analysis
TT	Translation Type
VMSC	The Visited MSC
VMSCB	The VMSC of the B subscriber

Further GSM related abbreviations are given in GSM 01.04.

## 4 General

### 4.1 Overview

Mobile Number Portability (MNP) is the ability for a mobile subscriber to change the GSM subscription network within a portability clusterdomain whilst retaining her original MSISDN or MSISDNs.

As part of the porting process administrative actions have to be performed by the GSM network operators of the number range ownerholder network, donor network, recipient network and, as an option, by operators of other national GSM networks as follows:

a) if the number range ownerholder network is identical with the donor network:

Recipient network:	add an entry in the HLR; add an entry in the Number Portability Database.
Donor network:	add an entry in the Number Portability Database; delete the entry related to the ported MSISDNs in the HLR.
Other networks in the portability <u>clusterdomain</u> :	add an entry in the Number Portability Database (if direct routeing is used).

b) if the number range ownerholder network is identical with the recipient network:

Recipient network:	add an entry in the HLR; delete any entry related to the ported MSISDN in the Number Portability Database.
Donor network:	delete any entry related to the ported MSISDN in the Number Portability Database; delete the entry related to the ported MSISDNs in the HLR.
Other networks in the portability <u>clusterdomain</u> :	delete any entry related to the ported MSISDN in the Number Portability Database.

c) if the number range ~~owner~~holder network is different from both the recipient and the donor network:

Recipient network:	add an entry in the HLR; add an entry in the Number Portability Database.
Number range <del>owner</del> <u>holder</u> network:	update the Number Portability Database
Donor network:	delete (or update) the entry in the Number Portability Database; delete the entry related to the ported MSISDNs in the HLR.
Other networks in the portability <del>cluster</del> <u>domain</u> :	update the Number Portability Database (if an entry for the ported MSISDN exists ).

Note that the order of sequence for the administrative actions to be performed both within a network and by different network operators is significant with respect to prevention of disruption in service to the mobile subscriber and prevention of looping calls between networks during the porting process.

Termination of a subscription for a ported number results in the deletion of any entry in an HLR and NPDB of that number.

If a call fails because databases are not correctly synchronised, the network entity which detects the inconsistency will raise an MNP specific alarm to the operation and maintenance subsystem.

The present document does not specify the porting process; it specifies the functionality needed to set-up calls to both ported and non ported subscribers (Normative Annex A and Normative Annex C) and the functionality needed to relay non-call related signalling messages to the HLR in the subscription network (Normative Annex B).

## 4.2 Compatibility

The IAM sent to the subscription network may contain additional routing information. Within a portability ~~cluster~~domain the method how to convey the Routing Number in the IAM between 2 PLMNs shall be agreed upon by the 2 network operators involved (see also [7]).

In general, IN-based and MNP-SRF (call-related) solutions are compatible and may coexist in the same portability ~~cluster~~domain. The only restriction refers to the case where the number range ~~owner~~holder network relays call-related MAP messages (i.e. SRI for national calls) to the subscription network. If this solution is selected by at least one network operator within a portability ~~cluster~~domain, all the PLMNs and transit networks affected must fulfil the following requirements:

1. The SCCP interfaces between networks in a portability ~~cluster~~domain must be agreed. This refers to the SCCP addressing mechanism being used (e.g. number lengths, natures of address and translation types for call-related MAP messages).  
For messages which do not cross network boundaries the SCCP addressing mechanism is a choice of the network operator.
2. The subscription network must be able to generate the SRI ack to allow the onward routing of the call from the number range ~~owner~~holder network to the subscription network.

In the rest of the possible architectures for MNP, no interworking problems have been identified. In these cases, network architectures used within one PLMN (e.g. IN, MNP-SRF) are regarded as operator dependent.

In order to avoid loops and incompatibility situations, all the networks within a portability ~~cluster~~domain shall use the same routing convention either direct routing, indirect routing or indirect routing with reference to the Subscription network. As an alternative, indirect routing can interwork successfully with direct routing if the routing number is transferred in the IAM or if dedicated traffic connections are used.

## 4.3 Common Functionality of the MNP-SRF

In a PLMN which supports mobile number portability, SCCP messages sent to an HLR may be relayed by an MNP-SRF. Depending on the implemented solution (IN-based or MNP-SRF-based), on the type of message (call-related or non-call-related) and on the porting status of the called subscriber the MNP-SRF may modify the SCCP called party

address and route the message to a different HLR or to the subscription network, or terminate the dialogue and response to the INE.

Figure 1 shows the general steering functionality for SCCP message routing. It shows the SCCP routing principle for mobile number portability within a network.

Note that call related messages in the IN-based solution are not routed to the MNP-SRF. Therefore Normative Annex A of the present document does not mention the MNP-SRF.

However, the usage of the IN-based solution for the call-related messages should allow operators to have the routing of the non call-related messages determined in the same database. ~~See [8] for the description of the access of the MNP-SRF (node with relay capability) to the NPDB (external database).~~

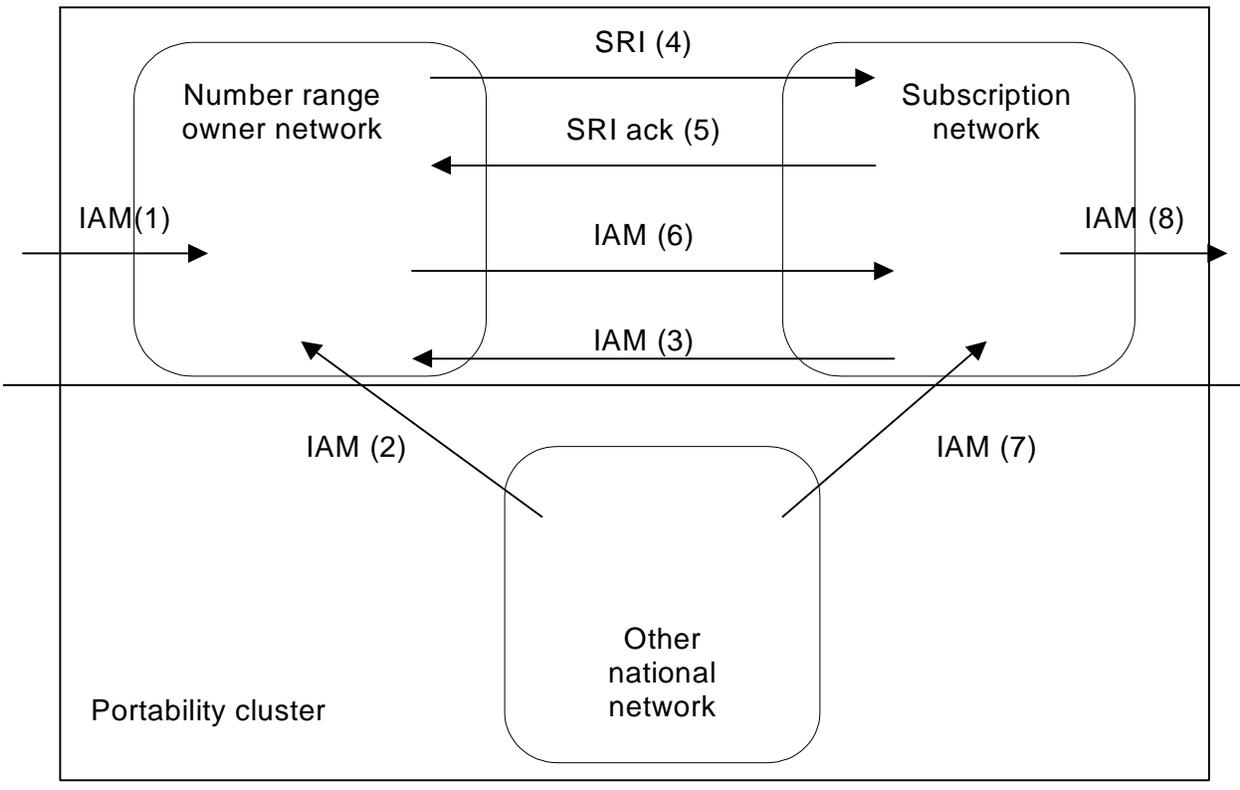
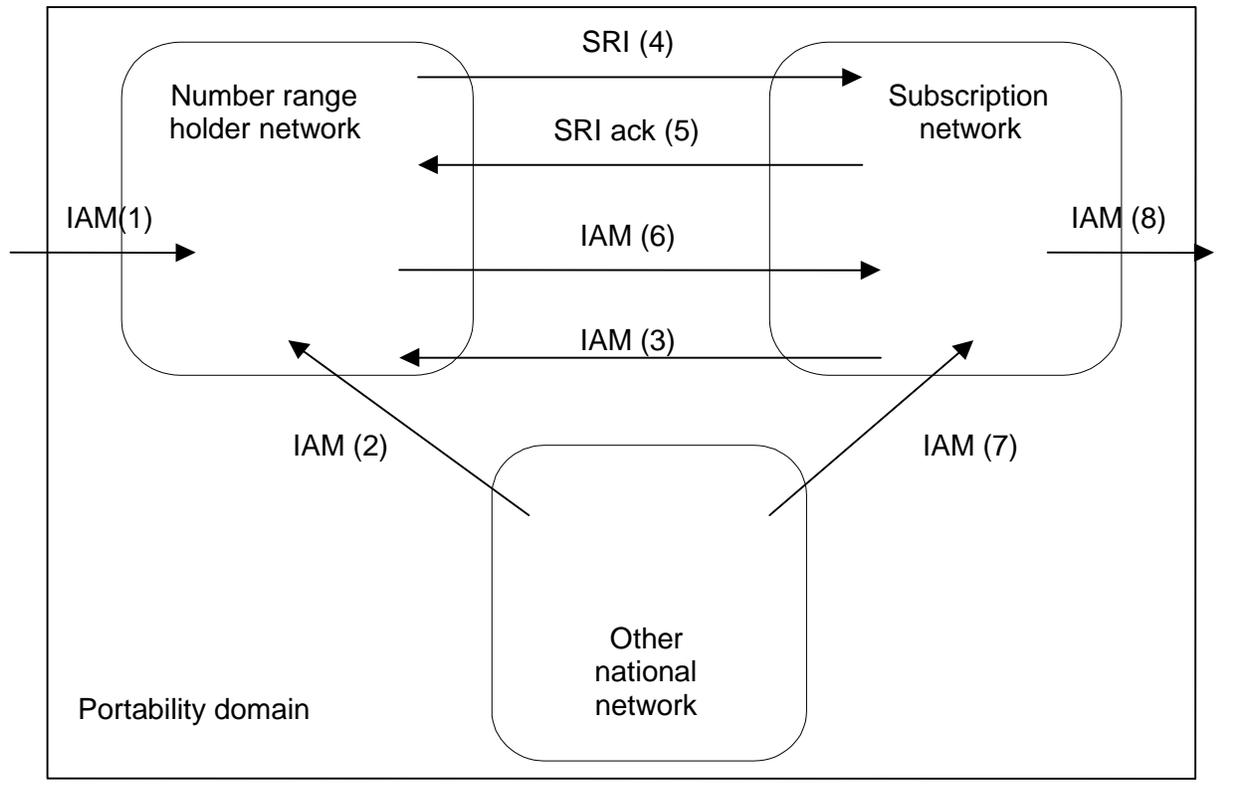
In order to guard against the possibility that the porting data for an MSISDN is inconsistent between PLMNs in a porting ~~cluster~~domain, the SCCP hop counter may be used to prevent indefinite looping of messages between PLMNs. The MNP-SRF would then decrement the SCCP hop counter for every message that is relayed. It should be noted that the use of the SCCP hop counter requires the use of unsegmented SCCP XUDT messages as defined in ITU-T 1996 SCCP recommendations.

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## 5 Common Architecture for call setup

Figure 3 shows the general architecture of a portability cluster domain for routing of calls. The more detailed architecture within the networks depends on the chosen solution (IN-based or MNP/SRF-based) and options and is described in Normative Annex A and Normative Annex C of the present document.

The architecture for non-call related signalling is described in Normative Annex B of the present document.



**Figure 3 General architecture of a portability cluster domain for routing of calls**

The following routing conventions are identified:

1. Direct Routing of calls is a PLMN option which allows to route calls directly from the PLMN supporting this option to the ported subscriber's subscription network.

2. Indirect Routing of calls is a PLMN option which allows to route calls from the PLMN supporting this option via the number range ownerholder network to the ported subscriber's subscription network.
3. Indirect Routing of calls with reference to the subscription network is a PLMN option for PLMN operators having chosen the MNP-SRF solution for call related signalling described in Normative Annex C. If all PLMNs within a portability clusterdomain support this option, calls are routed from the originating network to the number range ownerholder network. The number range ownerholder network obtains onward routing information from the subscription network and routes the call onward to the ported subscriber's subscription network.

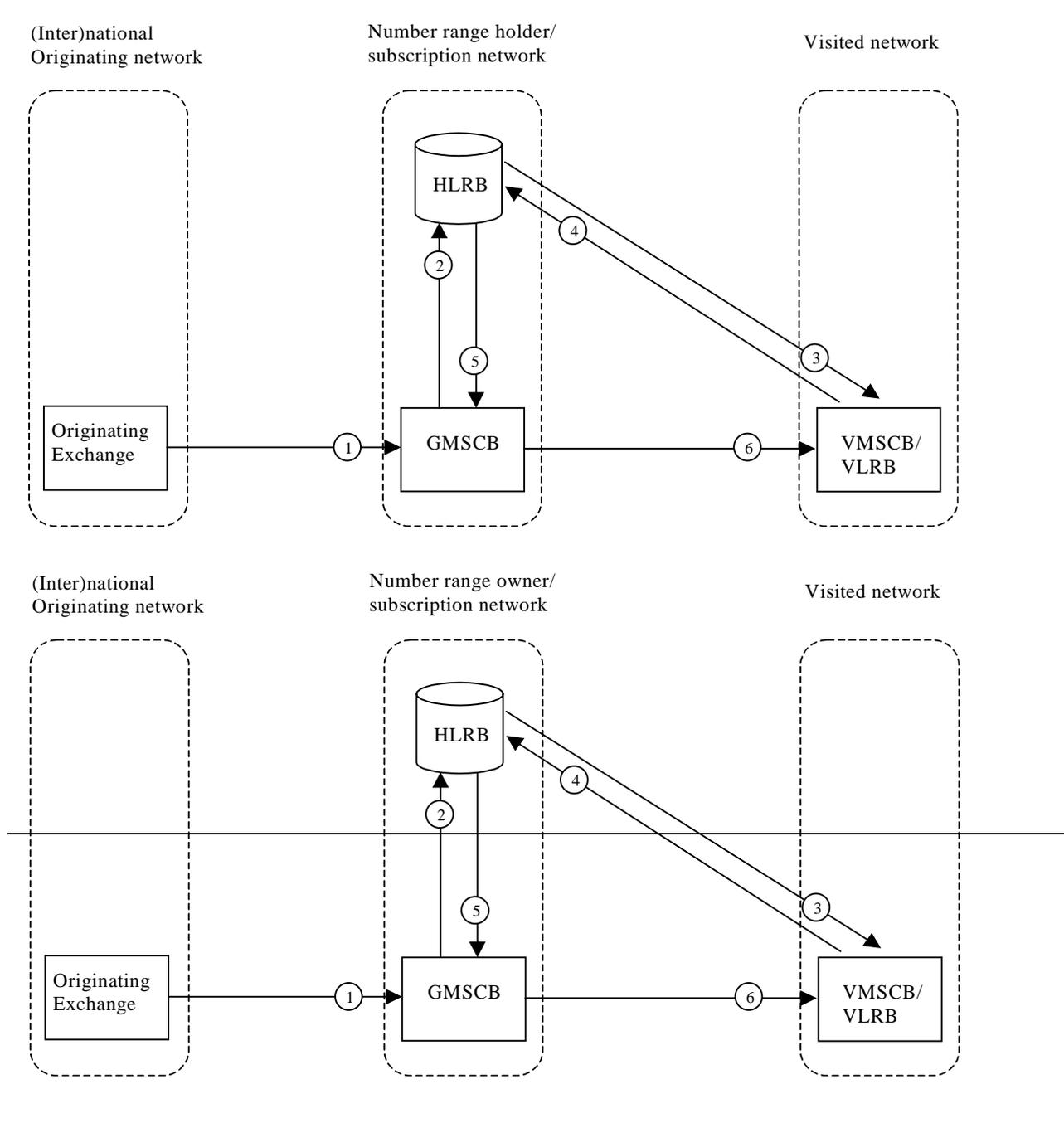
The following action in the different networks can be identified:

1. If the call is originated outside the portability clusterdomain, the IAM(1) is received by the number range ownerholder network.
- 2a. If the call is originated in another national network and the other national network does not support originating call query (i.e. Indirect Routing of calls is applicable), the IAM(2) is received by the number range ownerholder network.
- 2b. If the call is originated in another national network and the other national network supports originating call query (i.e. Direct Routing of calls is applicable), the IAM(7) containing the routing number is sent to the subscription network. If the routing number is not used in the IAM sent from the national originating network to the subscription network, all transit networks involved are required to look up an NPDB in order to retrieve routing information to route the call to the subscription network without looping.
- 3a. If the call is originated in the subscription network and the subscription network does not support originating call query (i.e. Indirect Routing of calls is applicable), the IAM(3) is received by the number range ownerholder network.
- 3b. If the call is originated in the subscription network and the subscription network supports originating call query (i.e. Direct Routing of calls is applicable), it sends an IAM(8) containing the MSRN to the visited network of the called subscriber.
- 3c. If the subscription network receives IAM(6 or 7) containing the routing number, it sends an IAM(8) containing the MSRN to the visited network of the called subscriber.
- 4a. If the call is routed via the number range ownerholder network, and the number range ownerholder network supports the MNP-SRF/MATF solution with the option 'MATF in subscription network' described in Normative Annex C of the present document (i.e. Indirect Routing of calls with reference to the subscription network is applicable), the number range ownerholder network sends SRI(4) to the subscription network. The subscription network returns SRI ack (5) containing the routing number. The number range ownerholder network then sends IAM(6) containing the routing number to the subscription network. If the routing number is not used in the IAM sent from the number range ownerholder network to the subscription network, all transit networks involved are required to look up an NPDB in order to retrieve routing information to route the call to the subscription network without looping.
- 4b. If the call is routed via the number range ownerholder network, and the number range ownerholder network supports the IN solution described in Normative Annex A of the present document or the MNP-SRF/MATF solution with the option 'MATF inside number range ownerholder network' described in Normative Annex C of the present document, the number range ownerholder network sends IAM(6) containing the routing number to the subscription network.

### A.1.2 No NP Query required – Number is not subject for portability

Figure A.1.2 shows the architecture for a call to a number that is not subject for portability. This can be for several reasons like for example:

- the national regulator has stipulated some number series as being non-portable or;
- in an initial phase only a limited amount of subscribers might port in certain number blocks and some operators might want to treat the call routing according to traditional routing plans without any change.



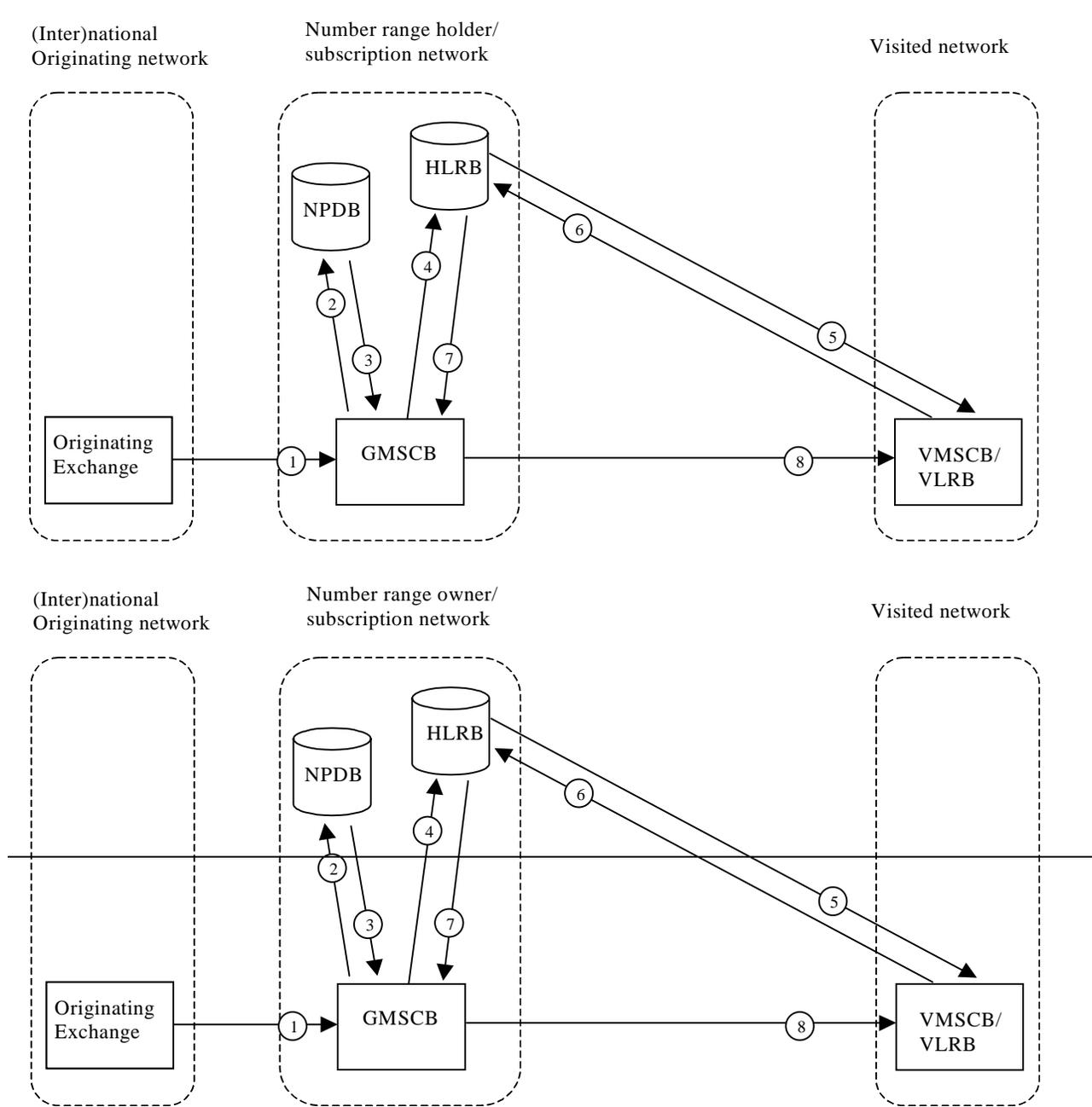
**Figure A.1.2: Call to a non-ported number, no NP query required**

- 1 From an Originating Exchange a call is set up to MSISDN. The call is routed to the Number range ~~owner~~holder network being the Subscription network;
- 2 When GMSCB receives the ISUP IAM, it requests routing information by submitting a MAP SRI to the HLRB including the MSISDN in the request;
- 3 The HLRB requests an MSRN from the MSC/VLRB where the mobile subscriber currently is registered;
- 4 The MSC/VLRB returns an MSRN back to the HLRB;
- 5 The HLRB responds to the GMSCB by sending an SRI ack with an MSRN;
- 6 GMSCB uses the MSRN to route the call to VMSCB.

## A.1.3 NP Query in Number Range ~~Owner~~Holder Network

### A.1.3.1 TQoD – Number is not ported

Figure A.1.3.1 shows the architecture for a call where the Originating network has no knowledge whether the MSISDN is ported or not and uses the traditional routing plans for routing the call to the Number range ~~owner~~holder network for further routing decisions.



**Figure A.1.3.1: Call to a non-ported number using TQoD procedure**

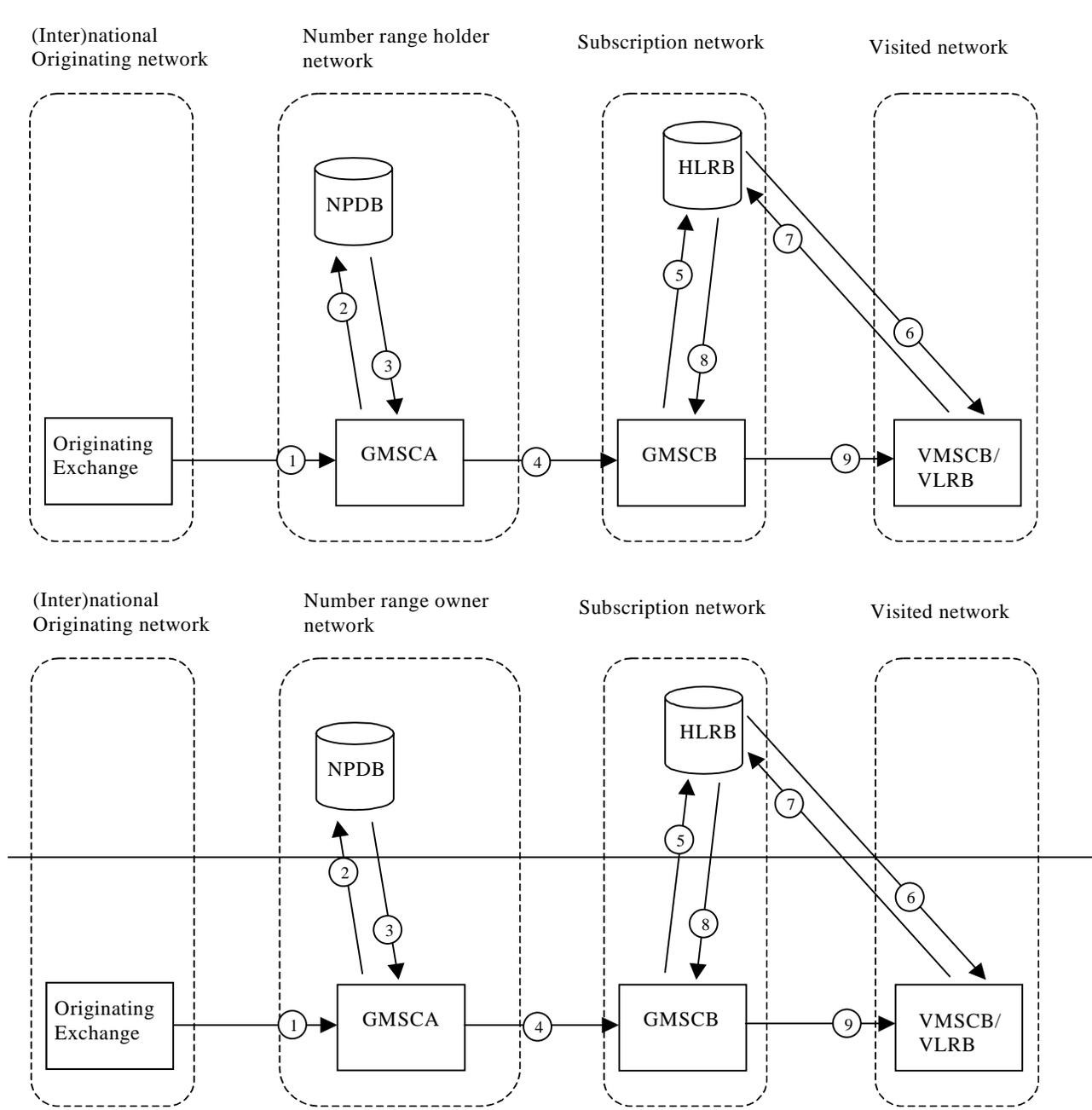
1. From an Originating Exchange a call is set up to MSISDN. The call is routed to the Number range ~~owner~~holder network being the Subscription network;
2. When GMSCB receives the ISUP IAM, it will send a database query to the NPDB as a result of analysis of the received MSISDN. The MSISDN is included in the query to the NPDB;
3. The NPDB detects that the MSISDN is not ported and responds back to the GMSCB to continue the normal call setup procedure for MT calls;
4. The GMSCB requests routing information by submitting a MAP SRI to the HLRB, including the MSISDN in the request;
5. The HLRB requests an MSRN from the MSC/VLRB where the mobile subscriber owning the MSISDN currently is registered;
6. The MSC/VLRB returns an MSRN back to the HLRB;

7. The HLRB responds to the GMSCB by sending an SRI ack with an MSRN;
8. GMSCB uses the MSRN to route the call to VMSCB.

Note that the NPDB may be outside the number range owner/holder network if a shared NPDB is used.

### A.1.3.2 TQoD – Number is ported

Figure A.1.3.2 shows the architecture for a call where the Originating network has no knowledge whether the MSISDN is ported or not and uses the traditional routing plans for routing the call to the Number range owner/holder network for further routing decisions.



**Figure A.1.3.2: Call to a ported number using TQoD procedure**

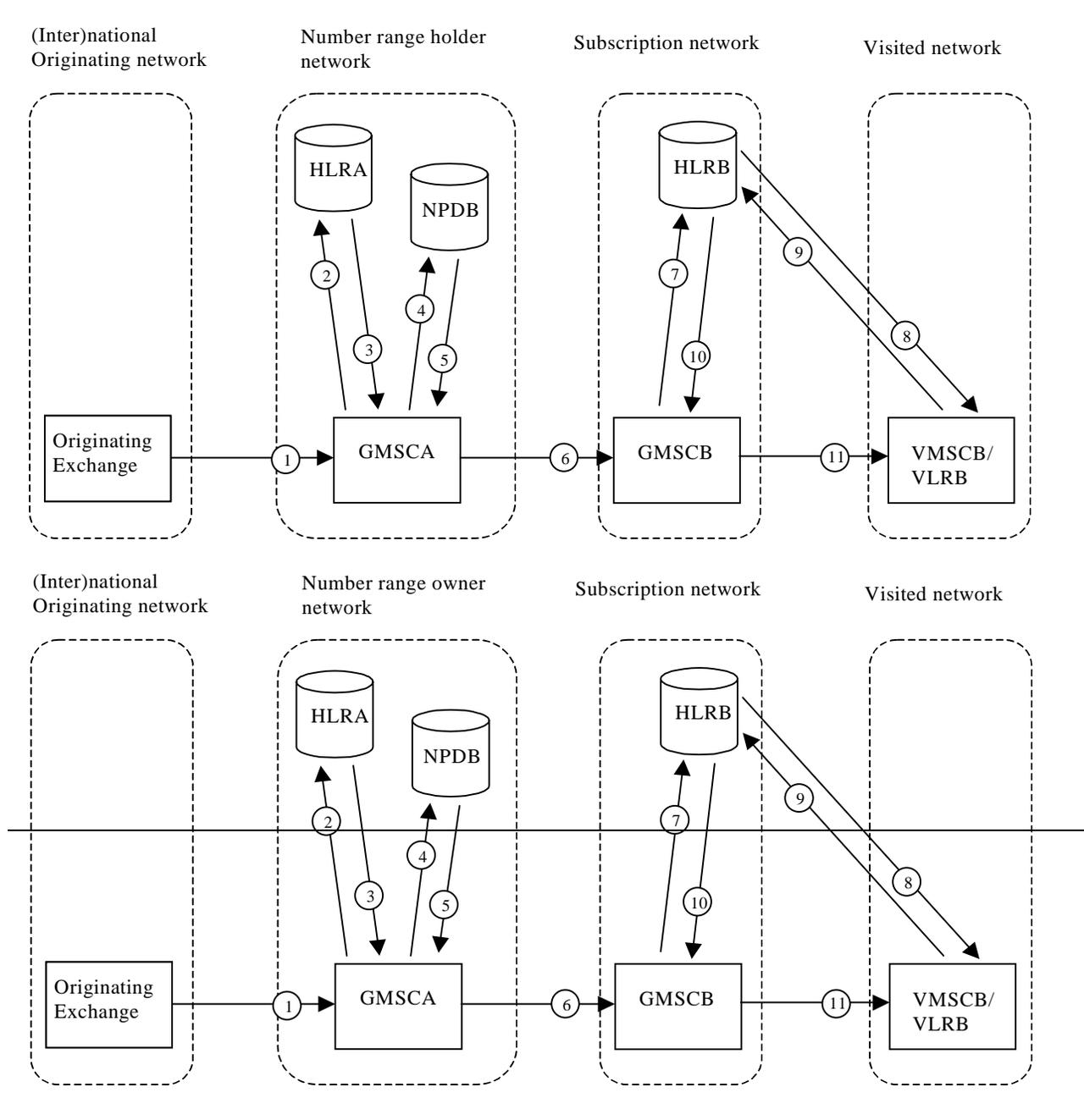
- 1 From an Originating Exchange a call is set up to MSISDN. The call is routed to the Number range owner/holder network;

- 2 When GMSCA receives the ISUP IAM, it will send a database query, including the MSISDN, to the NPDB as a result of analysis of the received MSISDN;
- 3 The NPDB detects that the MSISDN is ported and responds back to the GMSCA with a Routeing Number pointing out the Subscription network;
- 4 The call is routed to the Subscription network based on the Routeing Number carried in ISUP IAM message; also the MSISDN is included in IAM.
- 5 The GMSCB requests routeing information by submitting a MAP SRI to the HLRB, including the MSISDN in the request. The capability to route messages to the correct HLR is required.
- 6 The HLRB requests an MSRN from the MSC/VLRB where the mobile subscriber currently is registered;
- 7 The MSC/VLRB returns an MSRN back to the HLRB;
- 8 The HLRB responds to the GMSCB by sending an SRI ack with an MSRN;
- 9 GMSCB uses the MSRN to route the call to VMSCB.

Note that the NPDB may be outside the number range ~~owner~~holder network if a shared NPDB is used.

### A.1.3.3 QoHR – Number is ported

Figure A.1.3.3 shows the architecture for a call where the Originating network has no knowledge whether the MSISDN is ported or not and uses the traditional routeing plans for routeing the call to the Number range ~~owner~~holder network for further routeing decisions.



**Figure A.1.3.3: Call to a ported number using QoHR procedure**

1. From an Originating Exchange a call is set up to MSISDN. The call is routed to the number range ~~owner~~holder network;
2. When GMSCA receives the ISUP IAM, it requests routing information by submitting a MAP SRI to the HLRA including the MSISDN in the request;
3. The HLRA returns a MAP SRI ack with an “Unknown Subscriber” error since no record was found for the subscriber in the HLRA;
4. When GMSCA receives the error indication form the HLRA, this will trigger the sending of a database query to the NPDB, including the MSISDN in the query;
5. The NPDB detects that the MSISDN is ported and responds back to the GMSCA with a Routing Number pointing out the Subscription network;
6. The call is routed to the Subscription network based on the Routing Number carried in ISUP IAM message; also the MSISDN is included in IAM.

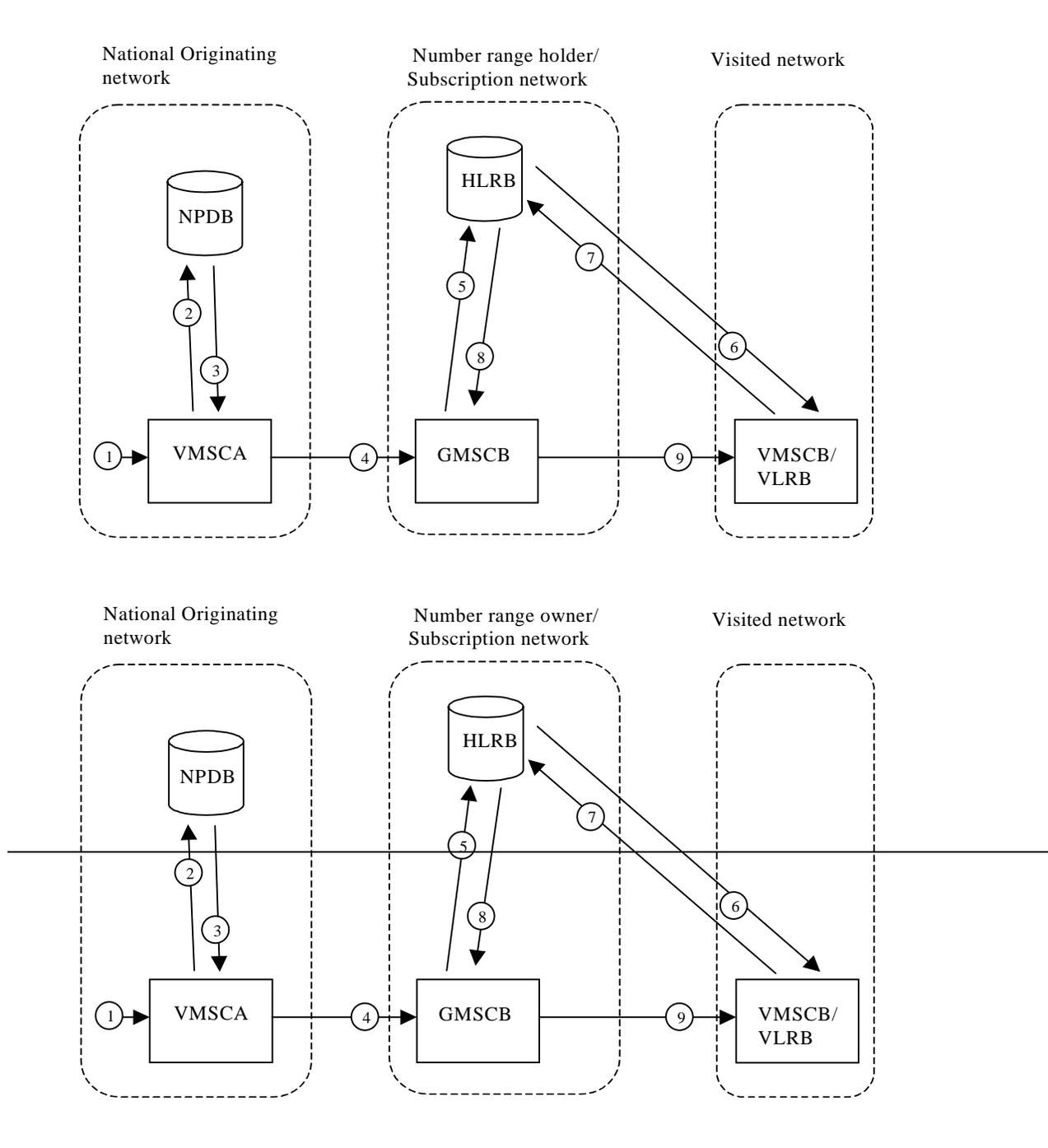
7. The GMSCB requests routing information by submitting a MAP SRI to the HLRB, including the MSISDN in the request. The capability to route messages to the correct HLR is required.
8. The HLRB requests an MSRN from the MSC/VLRB where the mobile subscriber currently is registered;
9. The MSC/VLRB returns an MSRN back to the HLRB;
10. The HLRB responds to the GMSCB by sending an SRI ack with an MSRN;
11. GMSCB uses the MSRN to route the call to VMSCB.

Note that the NPDB may be outside the number range ~~owner~~holder network if a shared NPDB is used.

## A.1.4 NP Query in Originating Network

### A.1.4.1 OQoD – Number is not ported

Figure A.1.4.1 shows the architecture for a call where already the Originating network has the knowledge whether the MSISDN is ported or not and can route the call directly to the Subscription network that in this case is the same as the Number range ~~owner~~holder network.



**Figure A.1.4.1: Call to a non-ported number using OQoD procedure**

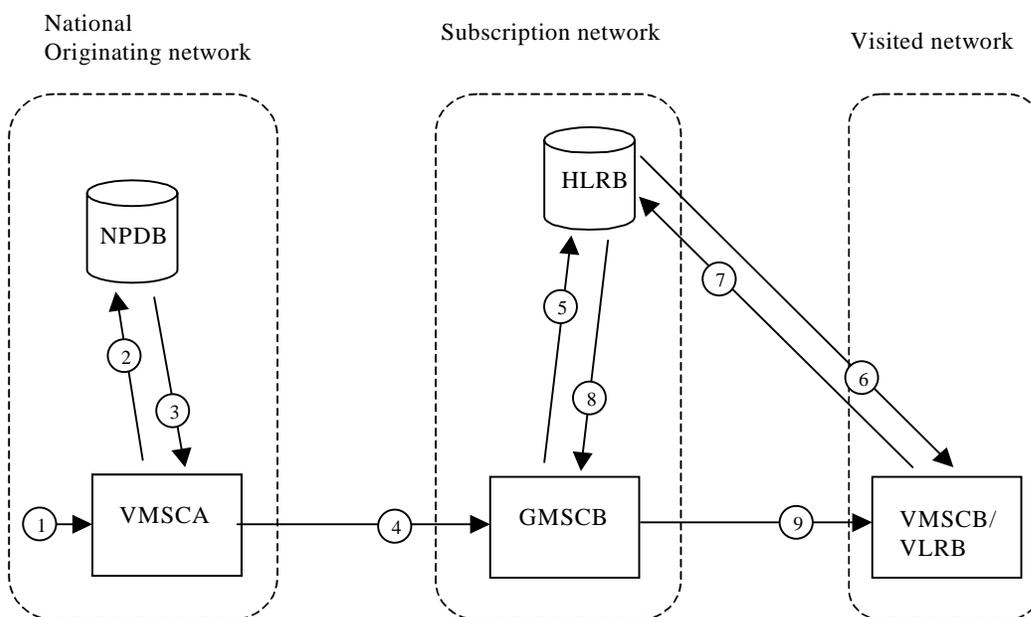
- 1 A call is initiated by Mobile Subscriber A towards Mobile Subscriber B, using MSISDN of the called subscriber;
- 2 When VMSCA receives the call setup indication, it will send a database query to the NPDB as a result of analysis of the received MSISDN, including the MSISDN in the query;
- 3 The NPDB detects that the MSISDN is not ported and responds back to the VMSCA to continue the normal call setup procedure for MO calls. Depending on database configuration option, the NPDB could either return a Routing Number on not ported calls, as done for ported calls, or the call is further routed using the MSISDN number only towards the Number range owner/holder network;
- 4 The call is routed to the Number range owner/holder/Subscription network based on the MSISDN or Routing Number carried in ISUP IAM message;

- 5 The GMSCB requests routing information by submitting a MAP SRI to the HLRB, including the MSISDN in the request;
- 6 The HLRB requests an MSRN from the MSC/VLRB where the mobile subscriber currently is registered;
- 7 The MSC/VLRB returns an MSRN back to the HLRB;
- 8 The HLRB responds to the GMSCB by sending an SRI ack with an MSRN;
- 9 GMSCB uses the MSRN to route the call to VMSCB.

Note that the NPDB may be outside the national originating network if a shared NPDB is used.

#### A.1.4.2 OQoD – Number is ported

Figure A.1.4.2 shows the architecture for a call where already the Originating network has the knowledge that the MSISDN is ported and can route the call directly to the Subscription network without involving the Number range owner/holder network.



**Figure A.1.4.2: Call to a ported number using OQoD procedure**

- 1 A call is initiated by Mobile Subscriber A towards Mobile Subscriber B, using MSISDN of the called subscriber;
- 2 When VMSCA receives the call setup indication, it will send a database query to the NPDB as a result of analysis of the received MSISDN including the MSISDN in the query;
- 3 The NPDB detects that the MSISDN is ported and responds back to the VMSCA with a Routing Number pointing out the Subscription network;
- 4 The call is routed to the Subscription network based on the Routing Number carried in ISUP IAM message; also the MSISDN is included in IAM.
- 5 The GMSCB requests routing information by submitting a MAP SRI to the HLRB, including the MSISDN in the request. The capability to route messages to the correct HLR is required.
- 6 The HLRB requests an MSRN from the MSC/VLRB where the mobile subscriber currently is registered;
- 7 The MSC/VLRB returns an MSRN back to the HLRB;
- 8 The HLRB responds to the GMSCB by sending an SRI ack with an MSRN;

9 GMSCB uses the MSRN to route the call to VMSCB.

Note that the NPDB may be outside the national originating network if a shared NPDB is used.

## A.2 Information flows

In the following figures the NPDB is shown as belonging to the number range ownerholder network or to the national originating network. However, the NPDB may be shared within one portability clusterdomain i.e. nation-wide.

Figure A.2.1 shows the information flow for successful QoHR.

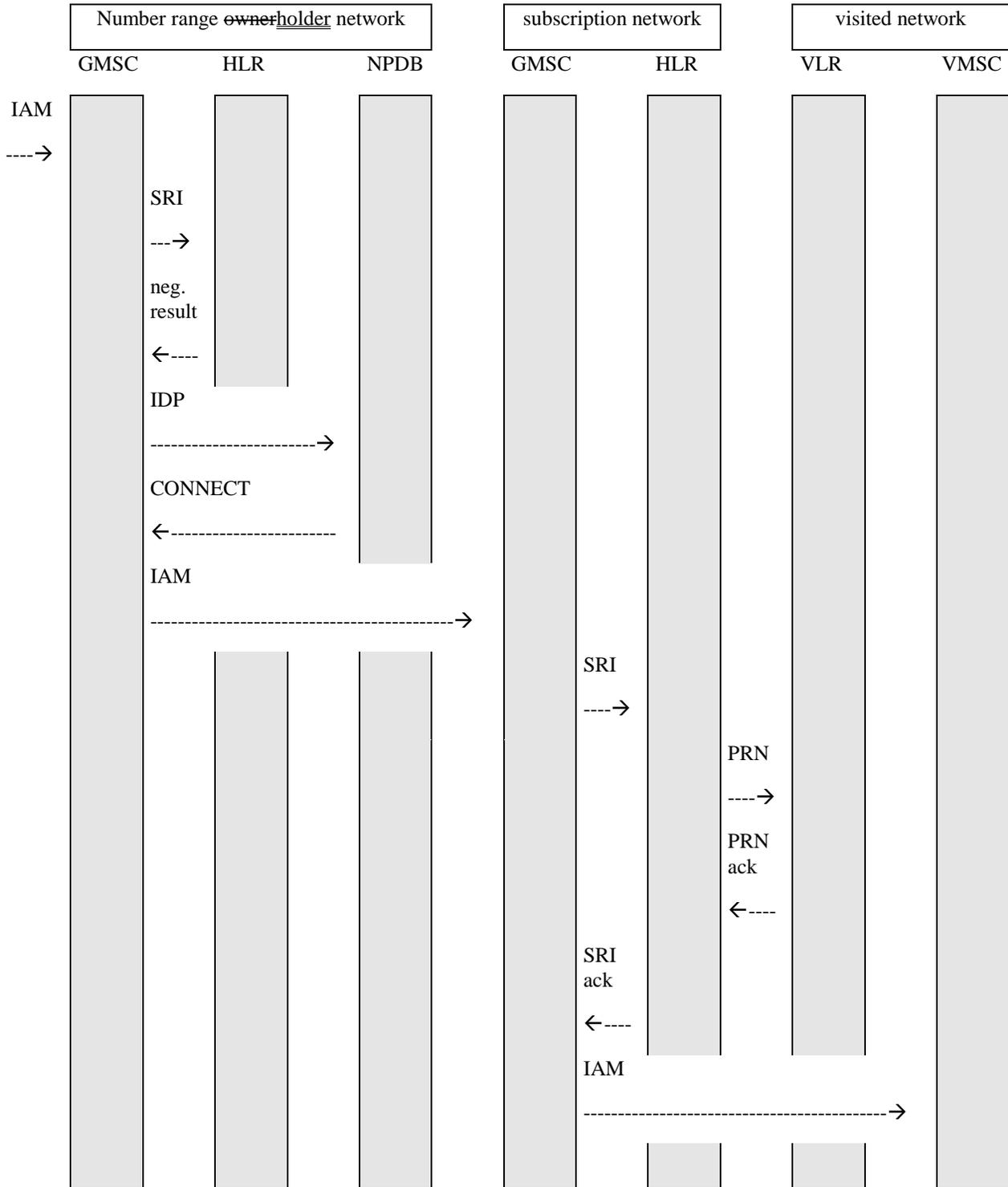


Figure A.2.1

Figure A.2.2 shows the information flow for unsuccessful QoHR (misdialed unallocated number).

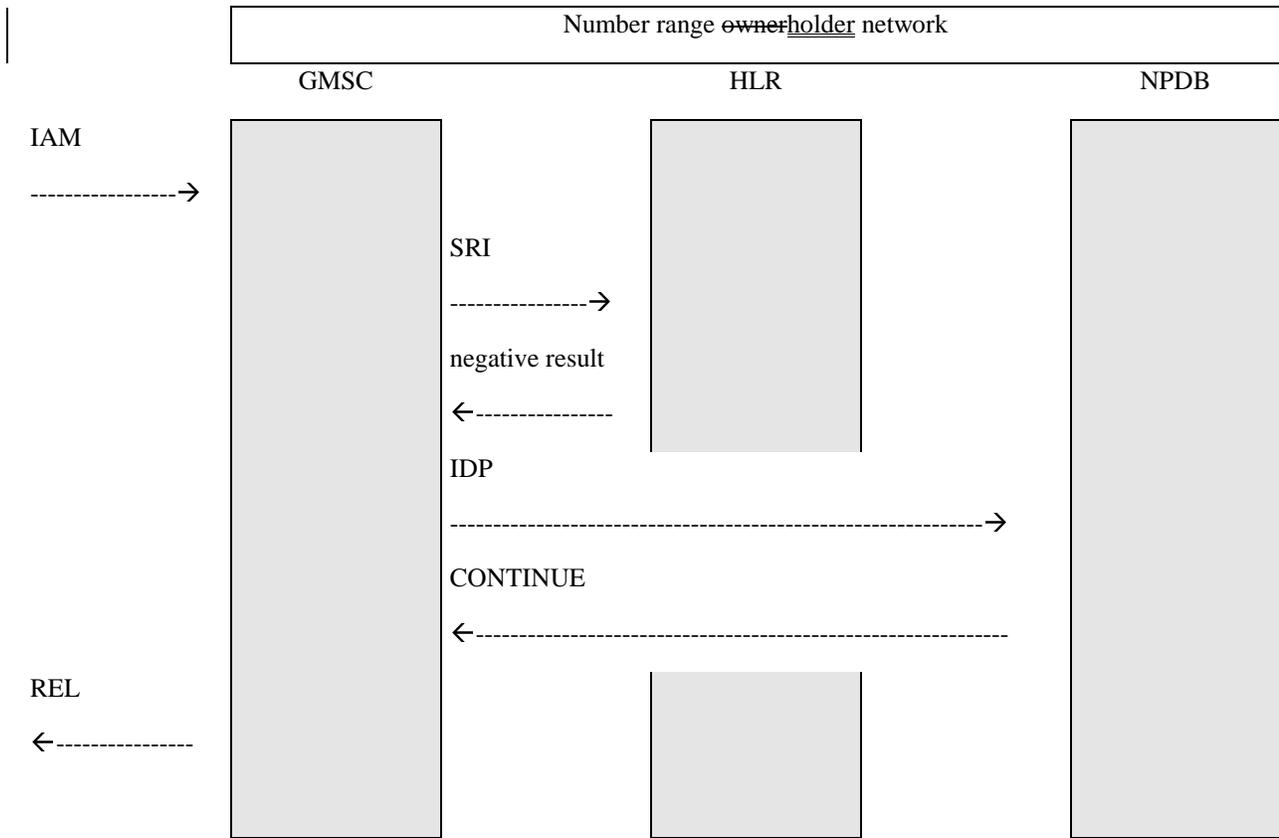


Figure A.2.2

Figure A.2.3 shows the information flow for successful TQoD.

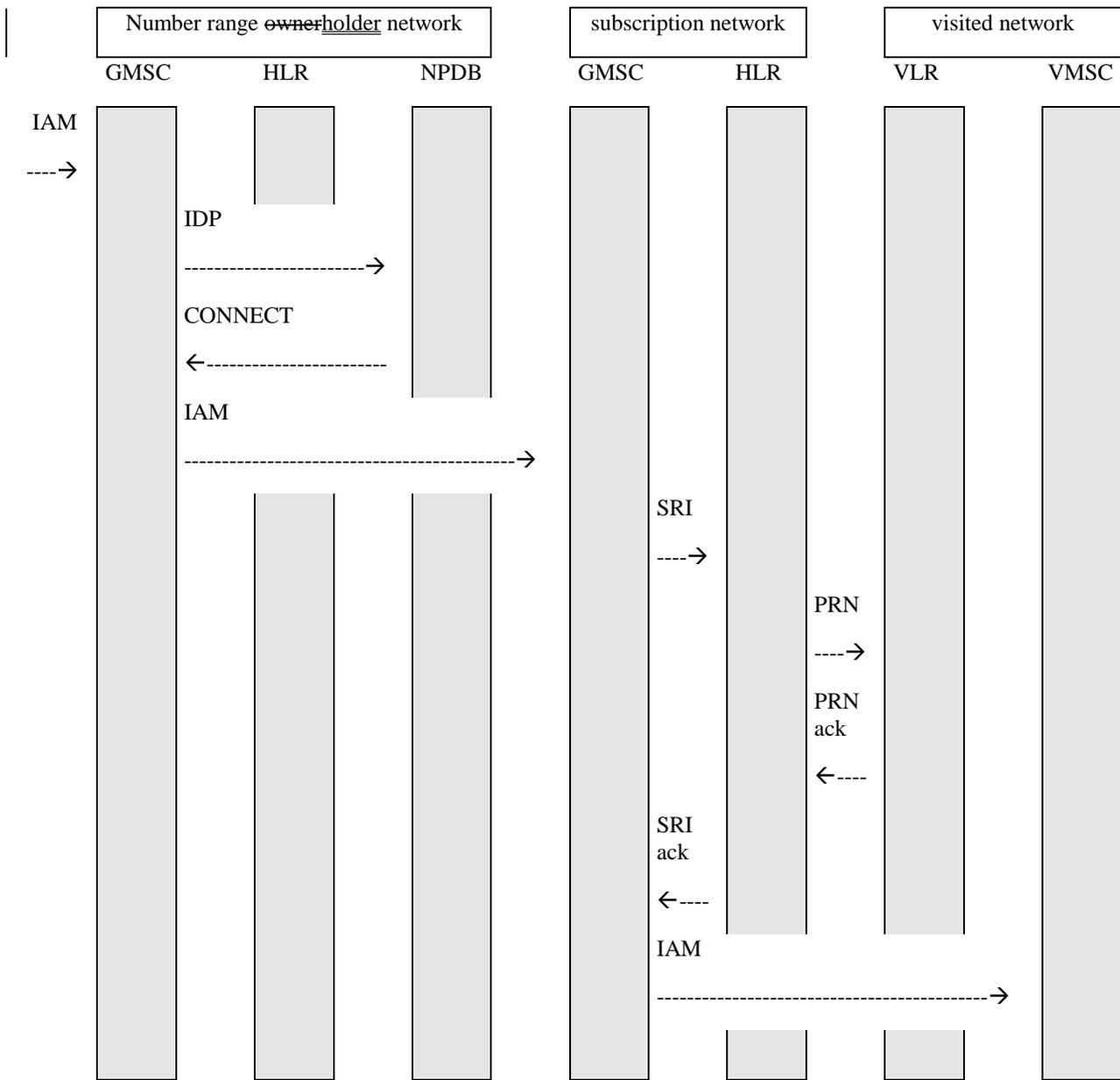


Figure A.2.3

Figure A.2.4 shows the information flow for unsuccessful TQoD (number not ported).

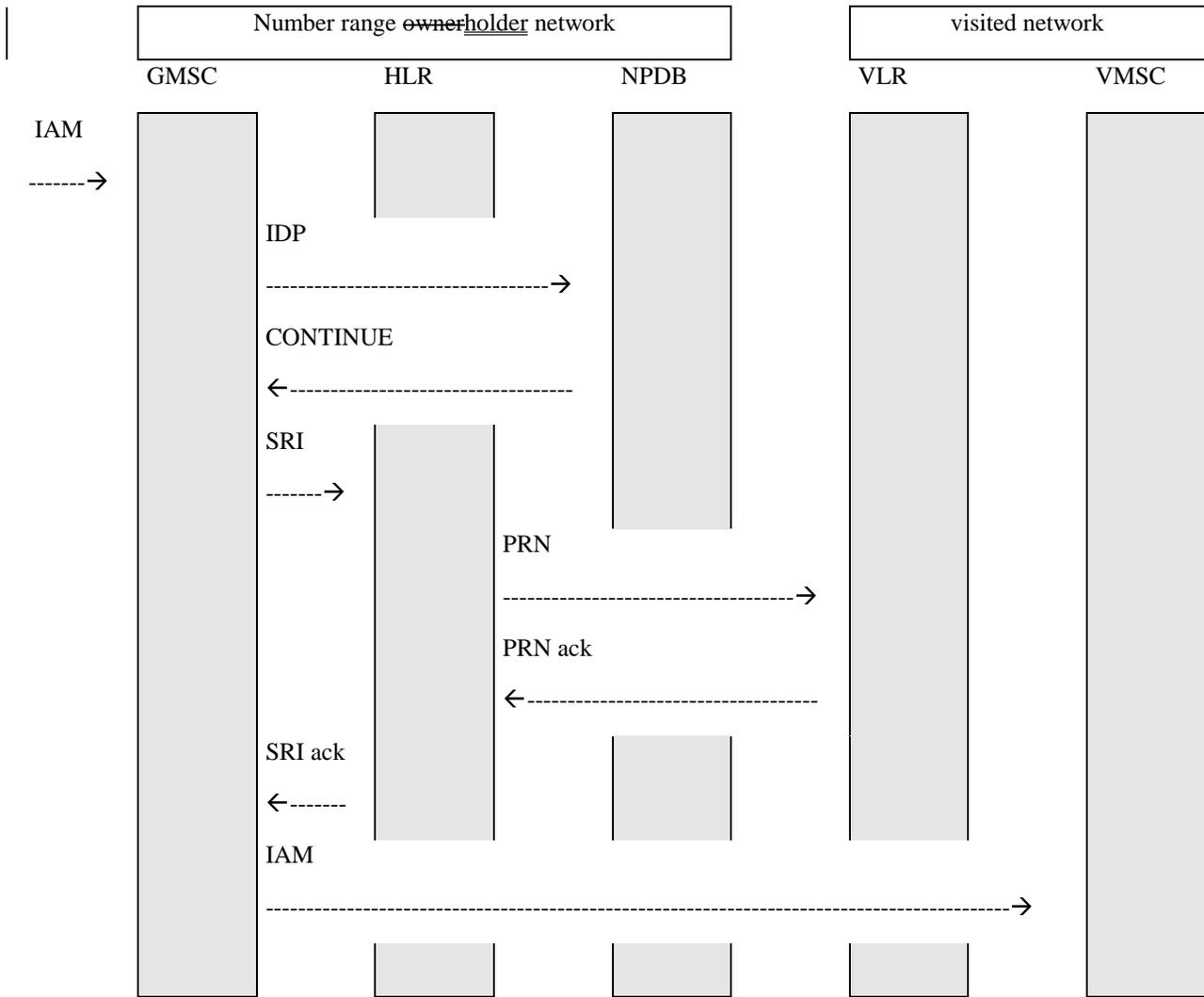


Figure A.2.4

Figure A.2.5 shows the information flow for successful OQoD (number ported ).

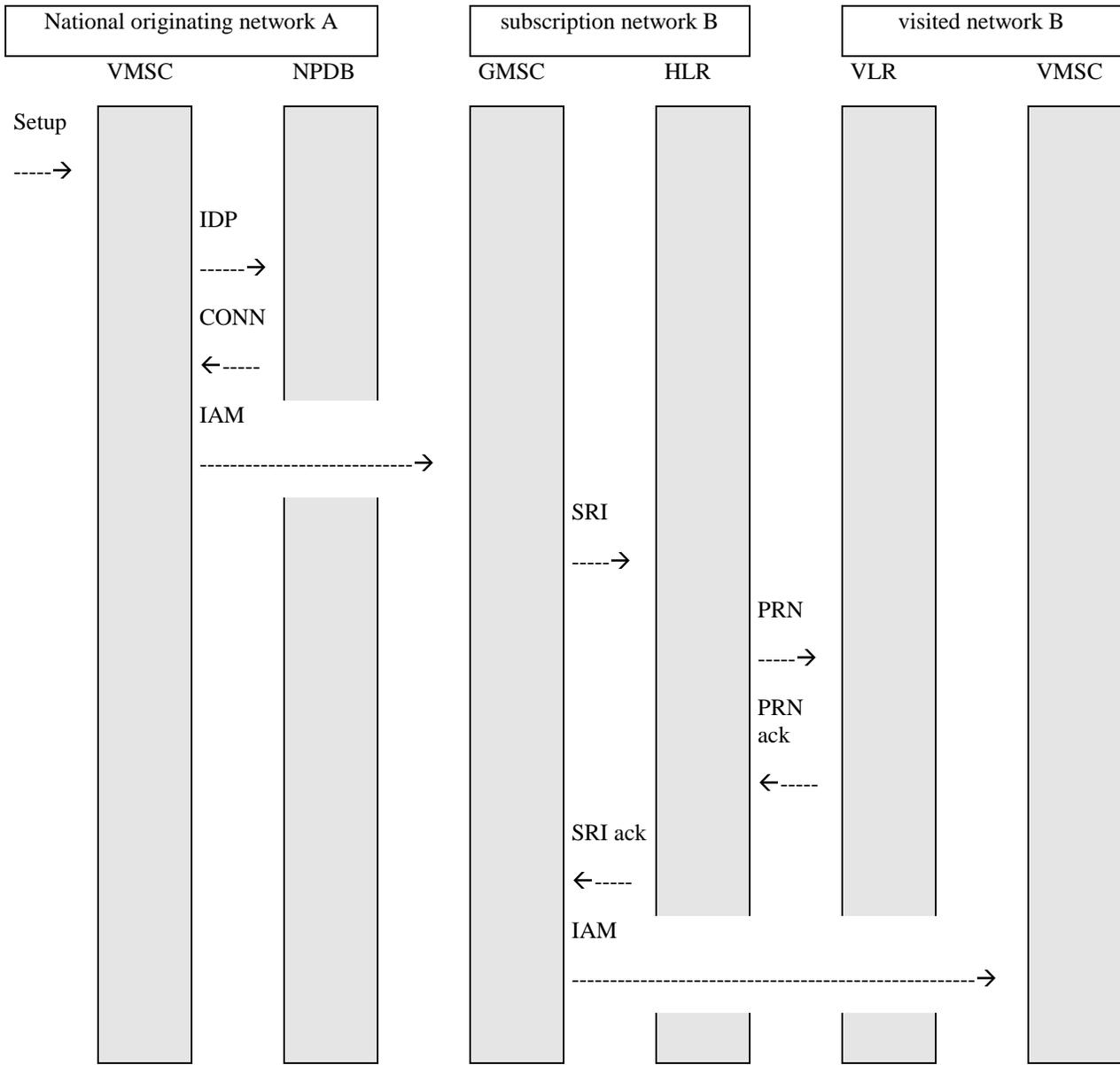


Figure A.2.5

Figure A.2.6 shows the information flow for unsuccessful OQoD (number not ported in).

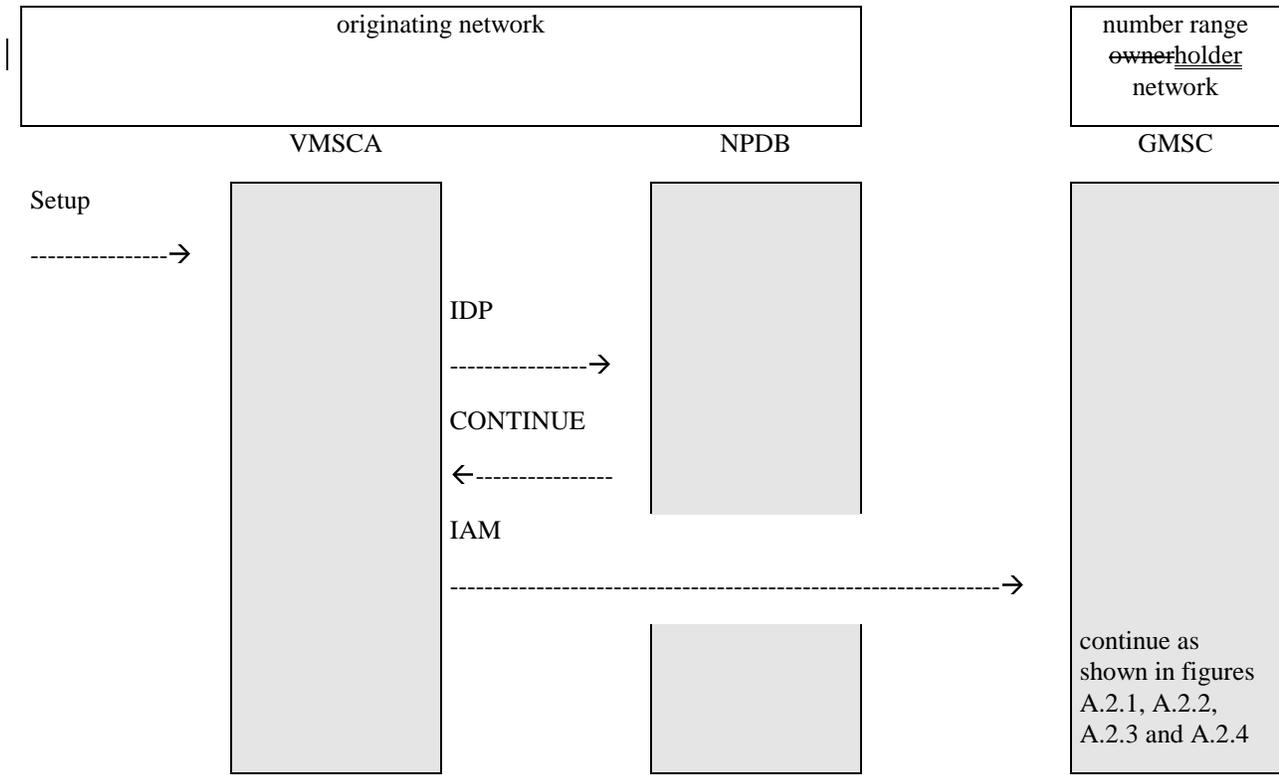


Figure A.2.6

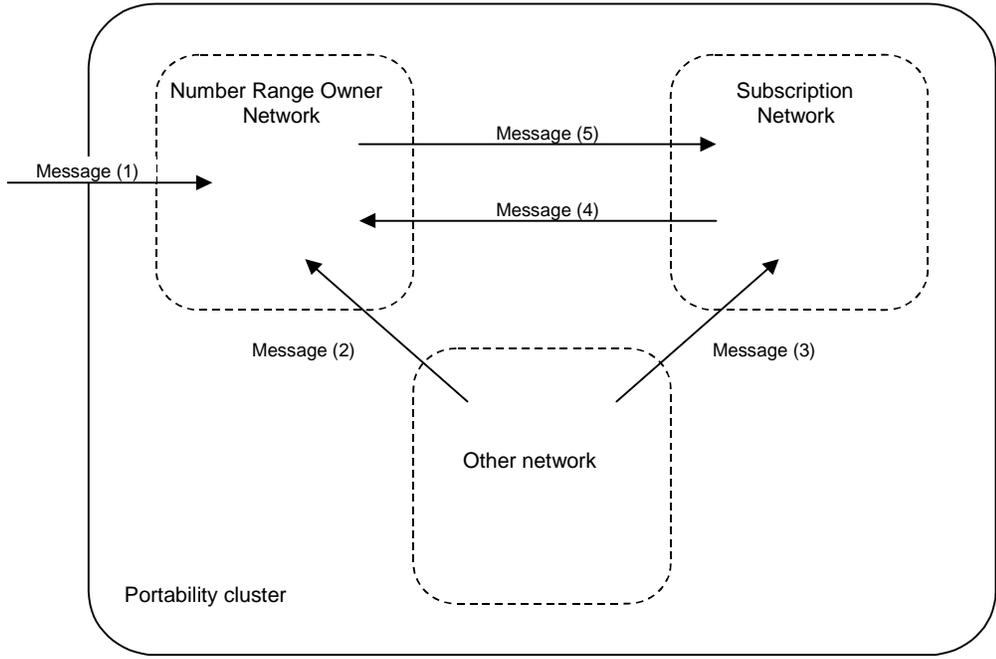
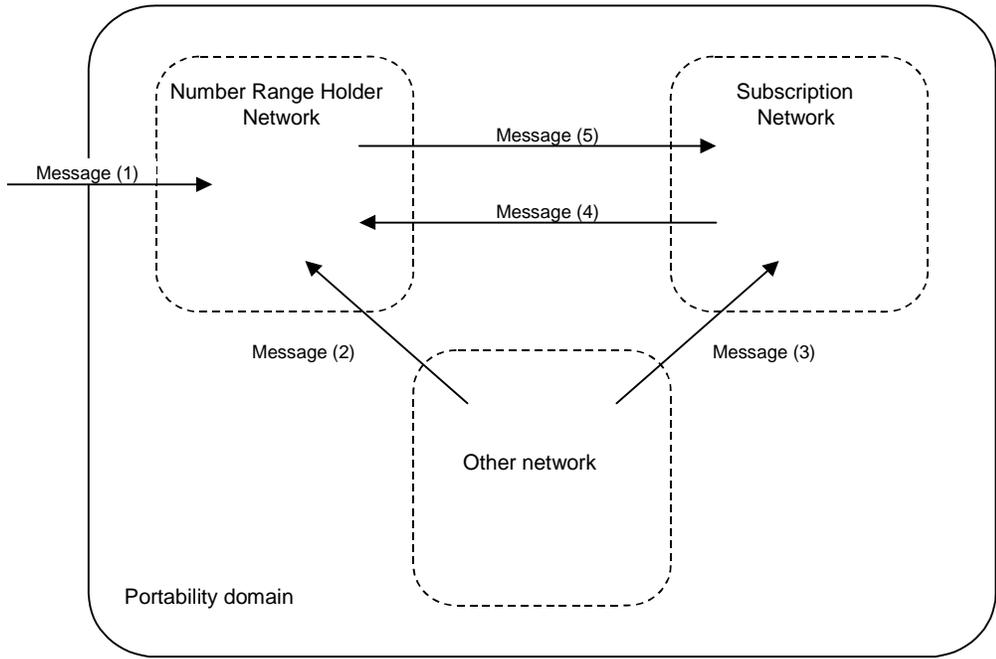
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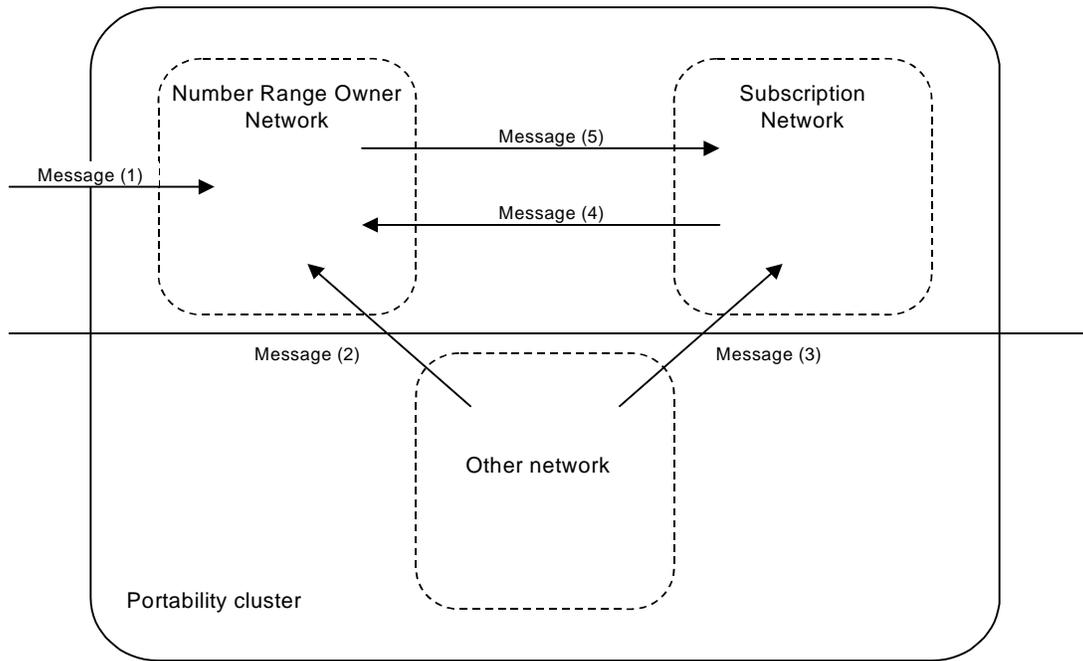
## Annex B (normative): Handling of Non-Call Related Signalling

### B.1 Handling of Non-call Related Signalling

#### B.1.1 Routeing Conventions

Figure B.1.1 illustrates the routeing of non-call related signalling messages between networks in a number portability environment.





**Figure B.1.1: Routing of non-call related signalling messages in a number portability environment**

If a non-call related signalling message is originated outside the portability cluster domain, this message (1) is received by the number range ownerholder network. The number range ownerholder network routes the message (5) onward to the subscription network.

If a non-call related signalling message is originated in a network inside the portability cluster domain and this network supports direct routing, this message (3) is routed to the subscription network.

If a non-call related signalling message is originated in a network inside the portability cluster domain and this network does not support direct routing, the message (2, 4) is routed to the number range ownerholder network. The number range ownerholder network routes the message (5) onward to the subscription network. This is referred to as indirect routing.

## B.1.2 Network Architecture

In a PLMN which supports MNP, non-call related signalling messages as mentioned in section B.1.1 are relayed by an MNP-Signalling Relay Function (MNP-SRF). The MNP-SRF provides re-routing capability for signalling messages addressed using the MSISDN. The MNP-SRF obtains routing information from the NP database to identify the subscription network associated with a particular national MSISDN. The interface between the MNP-SRF and the NP database is considered implementation dependent and is not detailed further. For further details see clause 4.3. ~~For further details of the signalling relay function, the reader is referred to [9].~~

From the perspective of the PLMN in which the MNP-SRF resides, the MSISDN in the CdPA represents either:

- 1 An own number ported out;
- 2 An own number not ported out;
- 3 A foreign number ported in;
- 4 A foreign number ported to a foreign network;
- 5 A foreign number not known to be ported.

When a PLMN supports direct routing (clause B.1.1), all non-call related signalling messages where the MSISDN in the CdPA belongs to a number range owned by a PLMN in the portability cluster domain and all non-call related

signalling messages which are relayed towards the network, are routed to the PLMN's MNP-SRF for treatment.

In case 2 and 3 the MNP-SRF relays the message to the HLR.

In case 1, 4 and 5 the MNP-SRF relays the message to subscription network.

When a PLMN does not support direct routing, only non-call related signalling messages where the MSISDN in the CdPA belongs to a number range owned by the PLMN itself and all non-call related signalling messages which are relayed towards the network are routed to the PLMN's MNP-SRF for treatment. All other messages are routed to the number range ~~owner~~holder network.

For this routing convention, only cases 1, 2 and 3 are applicable:

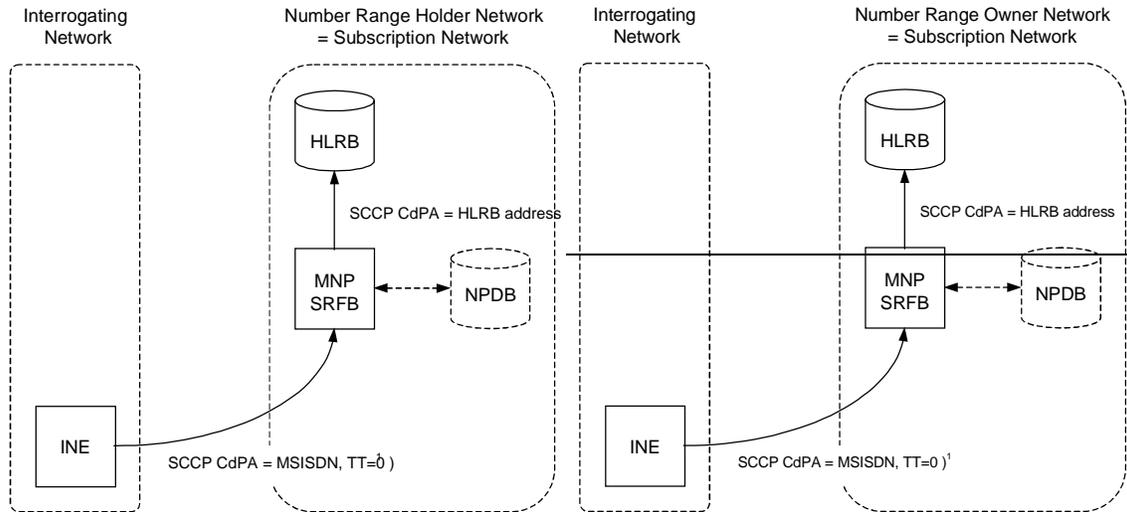
In case 2 and 3 the MNP-SRF relays the message to the HLR.

In case 1 the MNP-SRF relays the message to the subscription network.

## B.2 Signalling Scenarios

### B.2.1 Non-call Related Signalling Message for a Non-ported Number – Indirect Routing

Figure B.2.1 shows the MNP-SRF operation for routing a non-call related signalling message for a non-ported number where the interrogating network is inside the portability cluster domain and indirect routing is used or the interrogating network is outside the portability cluster domain.



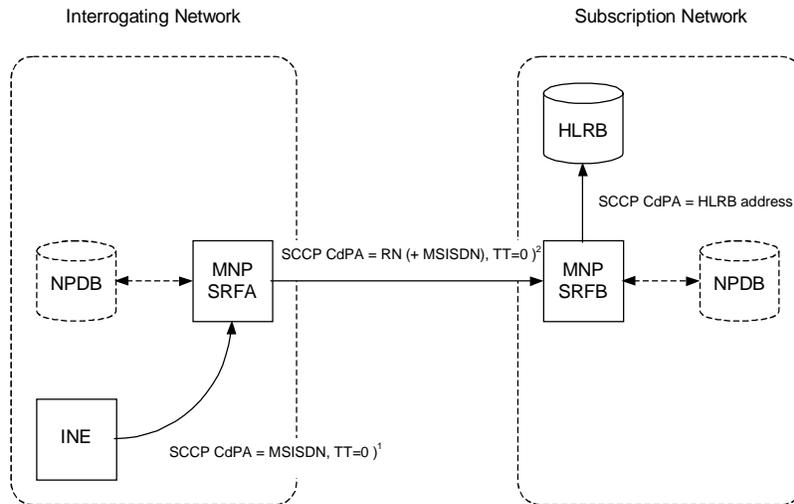
**Figure B.2.1: MNP-SRF operation for routing a non-call related signalling message for a non-ported number where the interrogating network is inside the portability cluster domain and indirect routing is used or the interrogating network is outside the portability cluster domain.**

<sup>1</sup> Note that the TT may have a different value, e.g. TT=17 in the case of CCBS Requests.

The Interrogating Network Entity (INE) submits a non-call related signalling message. When MNP-SRFB receives the message, MNP-SRF operation is triggered. The MNP-SRF functionality analyses the MSISDN in the CdPA and identifies the MSISDN as being non-ported using information which may be retrieved from an NP database. The MNP-SRF function then reroutes the message to HLRB.

## B.2.2 Non-call Related Signalling Message for a Ported or Non-ported Number – Direct Routing

Figure B.2.2 shows the MNP-SRF operation for routing a non-call related signalling message for a ported or non-ported number where the interrogating network supports direct routing. If the interrogating network is the subscription network, MNP-SRFA and MNP-SRFB coincide, i.e. the signalling message passes the MNP-SRF only once.



**Figure B.2.2: MNP-SRF operation for routing a non-call related signalling message for a ported or non-ported number where the interrogating network supports direct routing.**

- 1** Note that the TT may have a different value, e.g. TT=17 in the case of CCBS Requests.
- 2** The CdPA may have different values in the GT address and the nature of address fields.

The Interrogating Network Entity (INE) submits a non-call related signalling message. When MNP-SRFA receives the message, MNP-SRF operation is triggered. The MNP-SRF functionality analyses the MSISDN in the CdPA and identifies the subscription network using information which may be retrieved from an NP database. The MNP-SRF function then modifies the CdPA according to the rules agreed for the portability ~~cluster~~ domain and routes the message to MNP-SRFB in the subscription network.

When MNP-SRFB receives the message, MNP-SRF operation is triggered. The MNP-SRF functionality analyses the MSISDN in the CdPA and identifies the MSISDN as being ported into the network using information which may be retrieved from an NP database. The MNP-SRF function then re-routes the message to HLRB.

### B.2.3 Non-call Related Signalling Message for a Ported Number – Indirect Routeing

Figure B.2.3 shows the MNP-SRF operation for indirectly routeing (i.e. via the number range ownerholder network) a non-call related signalling message for a ported subscriber.

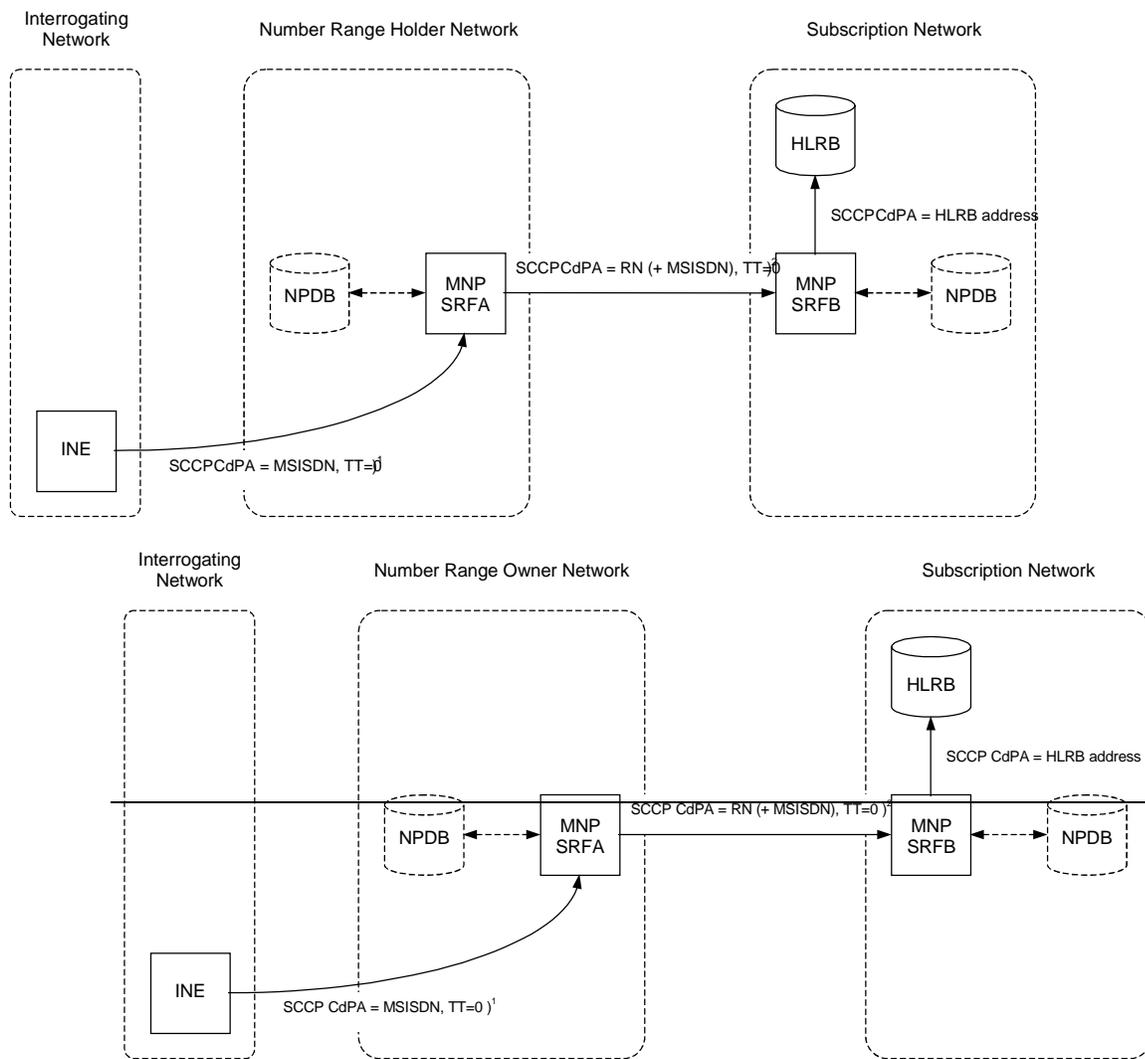


Figure B.2.3: **MNP-SRF operation for indirectly routeing (i.e. via the number range ownerholder network) a non-call related signalling message for a ported subscriber.**

- 1 Note that the TT may have a different value, e.g. TT=17 in the case of CCBS Requests.
- 2 The CdPA may have different values in the GT address and the nature of address fields.

The Interrogating Network Entity (INE) submits a non-call related signalling message. This message is routed on MSISDN global title to MNP-SRFA in the number range ownerholder network.

When MNP-SRFA receives the message, MNP-SRF operation is triggered. The MNP-SRF functionality analyses the MSISDN in the CdPA and identifies the subscription network using information which may be retrieved from an NP database. The MNP-SRF function then modifies the CdPA according to the rules agreed for the portability clusterdomain and routes the message to MNP-SRFB in the subscription network.

When MNP-SRFB receives the message, MNP-SRF operation is triggered. The MNP-SRF functionality analyses the MSISDN in the CdPA and identifies the MSISDN as being ported into the network using information which may be retrieved from an NP database. The MNP-SRF function then reroutes the message to HLRB.

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## B.3 Functional Requirements of Network Entities

### B.3.1 Procedure MNP\_SRF\_Non\_Call\_Related

Figure B.3.1 shows the procedure MNP\_SRF\_Non\_Call\_Related. This procedure handles non-call related signalling messages. It is called from the process MNP\_SRF (see chapter 4.3).

The check “CdPA contains own number ported out?” identifies all mobile numbers from number ranges allocated to the network the MNP-SRF is located in and which are ported to other networks. In this case the message is relayed to the subscription network.

The check “CdPA contains own number not ported out?” identifies all mobile numbers from the number ranges allocated to the network the MNP-SRF is located in and which are still served by the network the MNP-SRF is located in, i.e. the numbers are not ported out. In this case the message is relayed to the HLR in the network.

The check “CdPA contains foreign number ported in?” identifies all mobile numbers from the number ranges not allocated to the network the MNP-SRF is located in and which are served by the network the MNP-SRF is located in, i.e. the numbers are ported in. In this case the message is relayed to the HLR in the network.

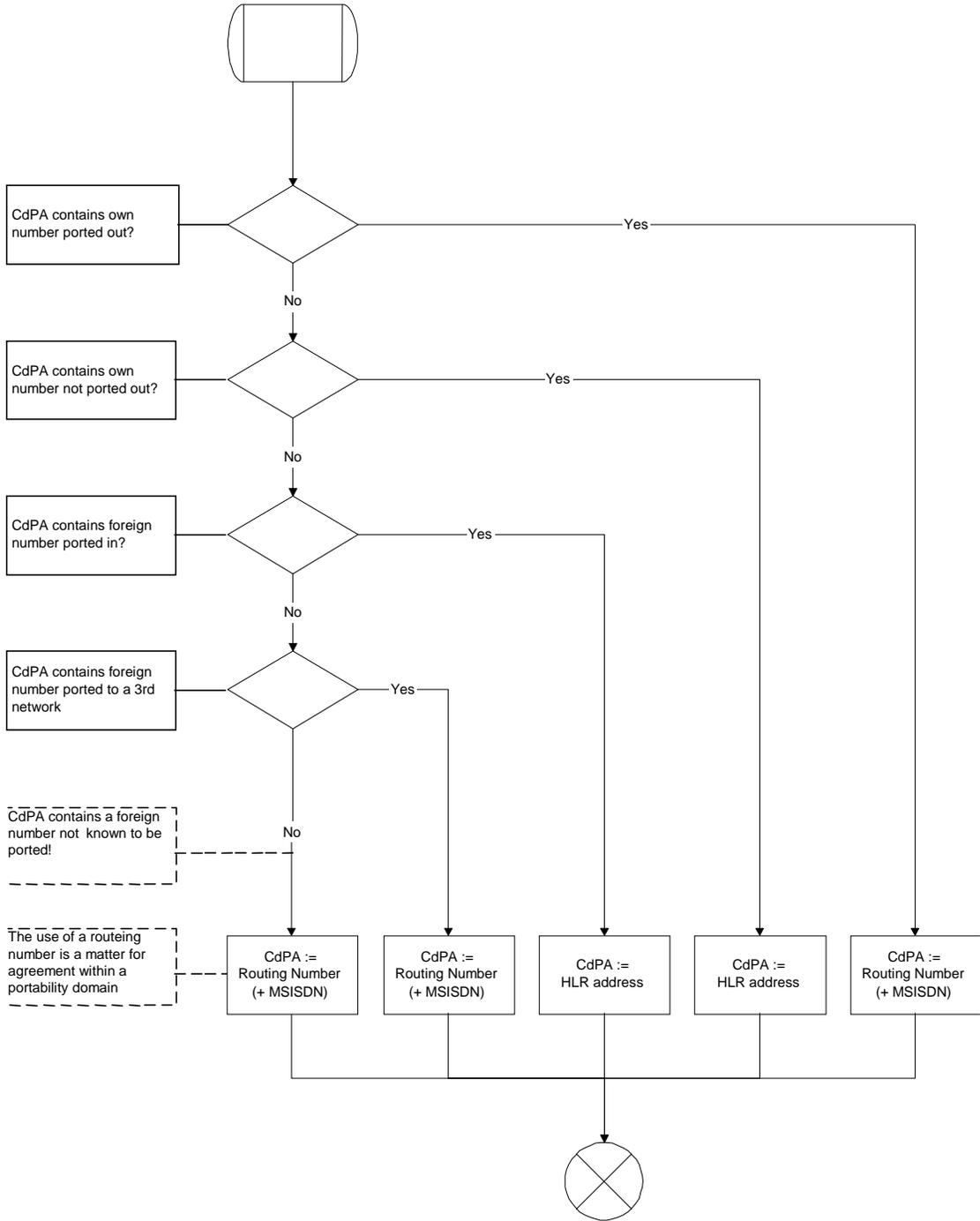
The check “CdPA contains foreign number ported to a foreign network?” identifies all mobile numbers from the number ranges not allocated to the network the MNP-SRF is located in and which are not served by the MNP-SRF is located in and not served by the network the number range is allocated to, i.e. the numbers are ported to a foreign network. In this case the message is relayed to the subscription network.

The remaining numbers “CdPA contains number not known to be ported ?” are mobile numbers from the number ranges not allocated to the network the MNP-SRF is located in and which are also not served by the network the MNP-SRF is located in. In this case the message is relayed to the number range ~~owner~~holder network.

### Procedure MNP\_SRF\_Non\_Call\_Related

Procedure in MNP\_SRF  
to handle the Signalling  
Relation of Mobile  
Portability for Non Call  
Related Messages

Procedure  
MNP\_SRF\_Non\_Call\_Related  
FPAR IN/OUT Called  
Address



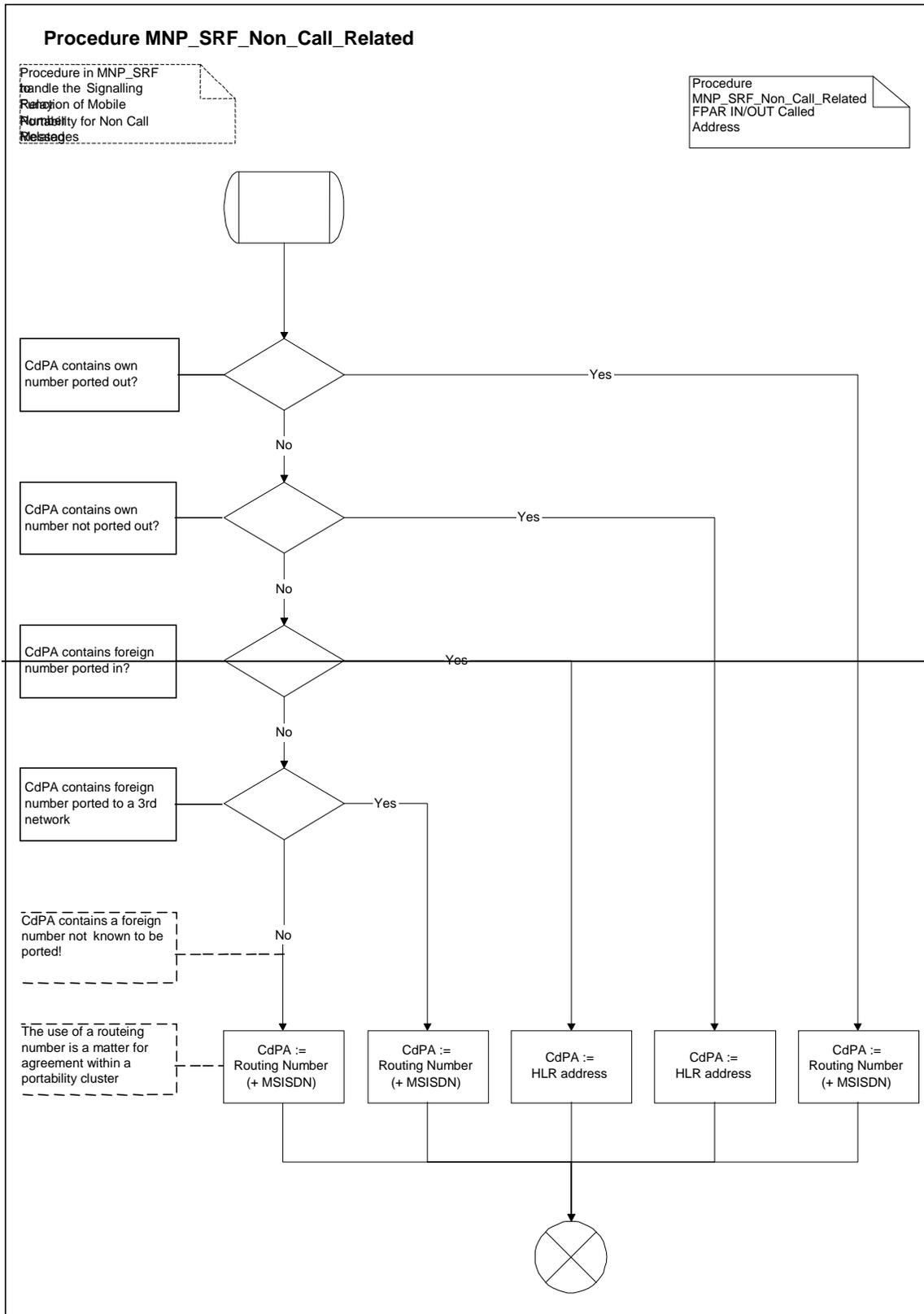
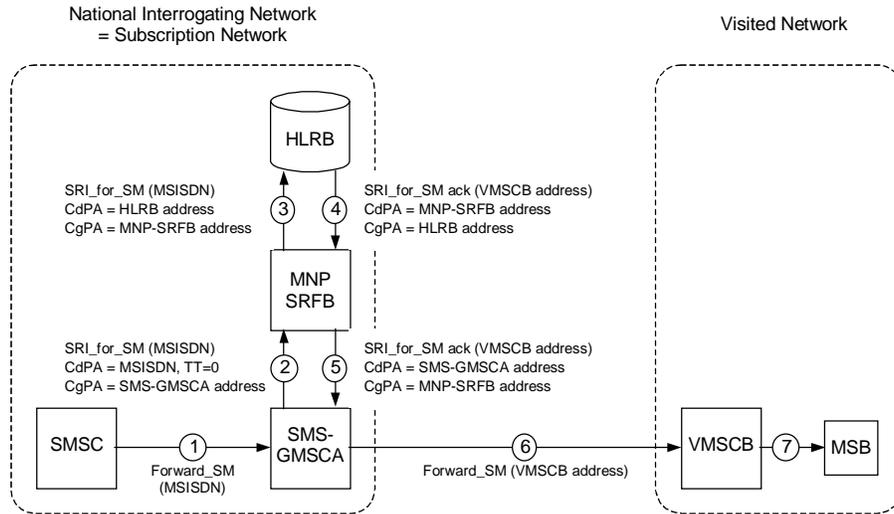


Figure B.3.1: Procedure MNP\_SRF\_Non\_Call\_Related

## B.4.2 Delivery of SMS to a Non-ported Number - Direct Routing – MNP-SRF acts as Higher-level Relay

Figure B.4.2 shows the MNP-SRF operation for delivering an SMS message to a non-ported number where the SRI\_for\_SM message is submitted by a national interrogating network. For further details of the higher level relay function (e.g. TC relay), the reader is referred to [8].



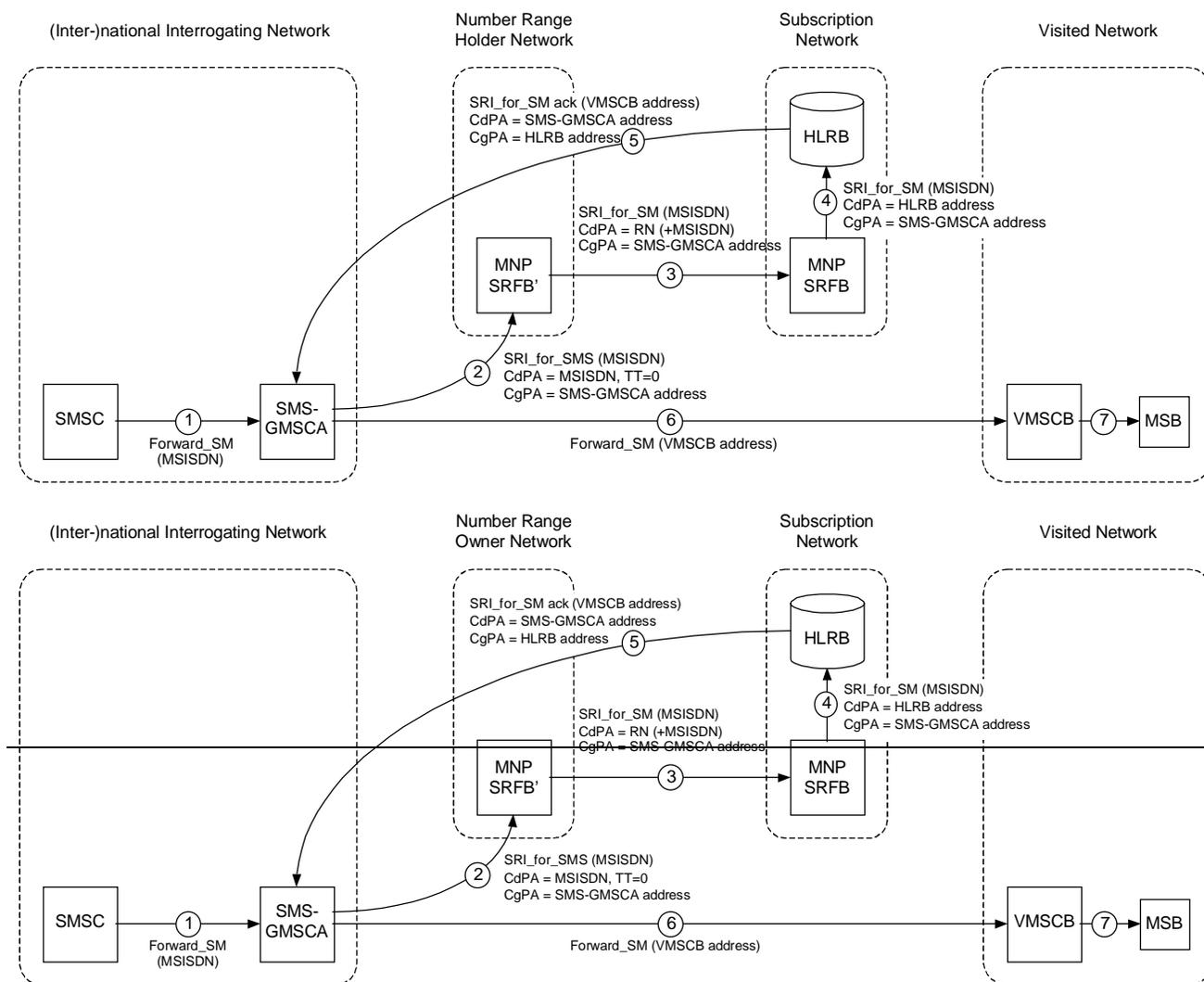
**Figure B.4.2: SRF operation for delivering an SMS message to a non-ported number where the SRI\_for\_SM message is submitted by a national interrogating network**

1. The SMSC forwards a SM to the SMS-GMSCA via a proprietary interface;
2. The SMS-GMSCA generates a routing enquiry for SM delivery. The MAP SRI\_for\_SM message is routed to the network's MNP-SRF;
3. When MNP-SRFB receives the message it terminates the TCAP dialogue and an MNP-SRF operation is triggered. The MNP-SRF functionality analyses the MSISDN in the TCAP portion of the message and identifies the MSISDN as being non-ported using information which may be retrieved from an NP database. The MNP-SRF function then initiates a new dialogue and routes the message to HLRB;
4. HLRB responds to the routing enquiry by sending back an SRI\_for\_SM ack with the address of the VMSCB;
5. MNP-SRFB responds to the routing enquiry by sending back an SRI\_for\_SM ack with the address of the VMSCB to the SMS-GMSCA
6. The SMS-GMSCA can now deliver the message to the VMSCB using a Forward\_SMS message.
7. VMSCB further delivers the message to MSB.

## B.4.3 Delivery of SMS to a Ported Number – Indirect Routing

Figure B.4.3 shows the MNP-SRF operation for delivering an SMS message to a ported number where the interrogating network does not support direct routing.

The message flows for this scenario are based on the use of an SCCP-relay function in the MNP-SRF(s). If the MNP-SRF(s) use(s) a higher-level relay function (e.g. TC-relay), then the response message will go via the MNP-SRF as shown in B.4.2. For further details of the signalling relay functions, the reader is referred to [8].



**Figure B.4.3: SRF operation for delivering an SMS message to a ported number where the interrogating network does not support direct routing**

1. The SMSC forwards a SM to the SMS-GMSCA via a proprietary interface;
2. The SMS-GMSCA generates a routing enquiry for SM delivery. The MAP SRI\_for\_SM message is routed to the number range owner/holder network's MNP-SRFB;
3. When MNP-SRFB' receives the message, MNP-SRF operation is triggered. The MNP-SRF functionality analyses the MSISDN in the CdPA and identifies the MSISDN as being ported using information which may be retrieved from an NP database. As the message is non-call related, the MNP-SRF function then populates the CdPA with either a routing number or a concatenation of a routing number and MSISDN. After modifying the CdPA, the message is routed to MNP-SRFB in the subscription network;
4. When MNP-SRFB receives the message, MNP-SRF operation is triggered. The MNP-SRF functionality analyses the MSISDN in the CdPA and identifies the MSISDN as being ported into the network using

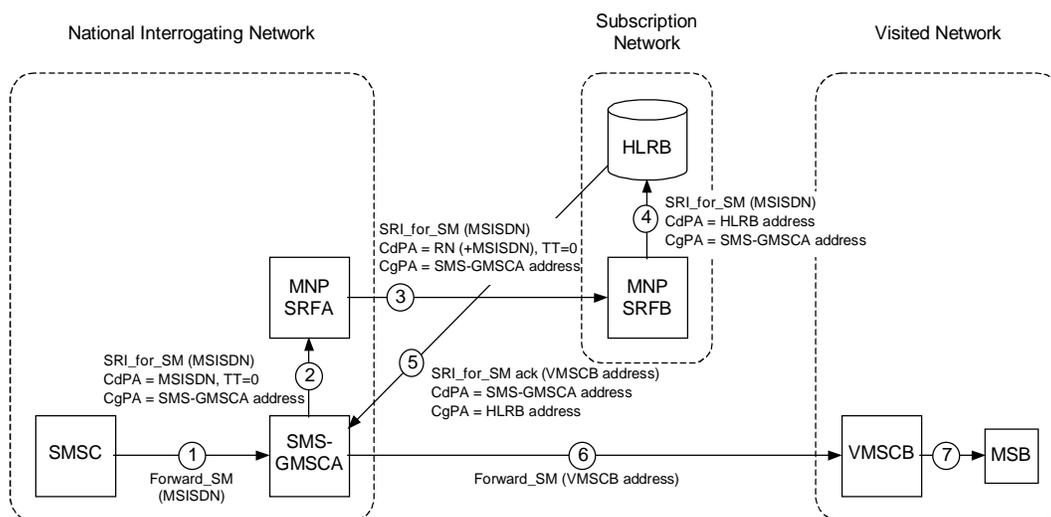
information which may be retrieved from an NP database. The MNP-SRF function then populates the CdPA with an HLRB address. After modifying the CdPA, the message is routed to HLRB;

5. HLRB responds to the routing enquiry by sending back an SRI\_for\_SM ack with the address of the VMSC;
6. The SMS-GMSC can now deliver the message to the VMSCB using a Forward\_SMS message.
7. VMSCB further delivers the message to MSB.

## B.4.4 Delivery of SMS to a Ported Number – Direct Routing

Figure B.4.4 shows the MNP-SRF operation for delivering an SMS message to a ported number where the interrogating network supports direct routing.

The message flows for this scenario are based on the use of an SCCP-relay function in the MNP-SRFs. If the MNP-SRFs use a higher-level relay function (e.g. TC-relay), then the response message will go via the MNP-SRF as shown in B.4.2. For further details of the signalling-relay functions, the reader is referred to [8].



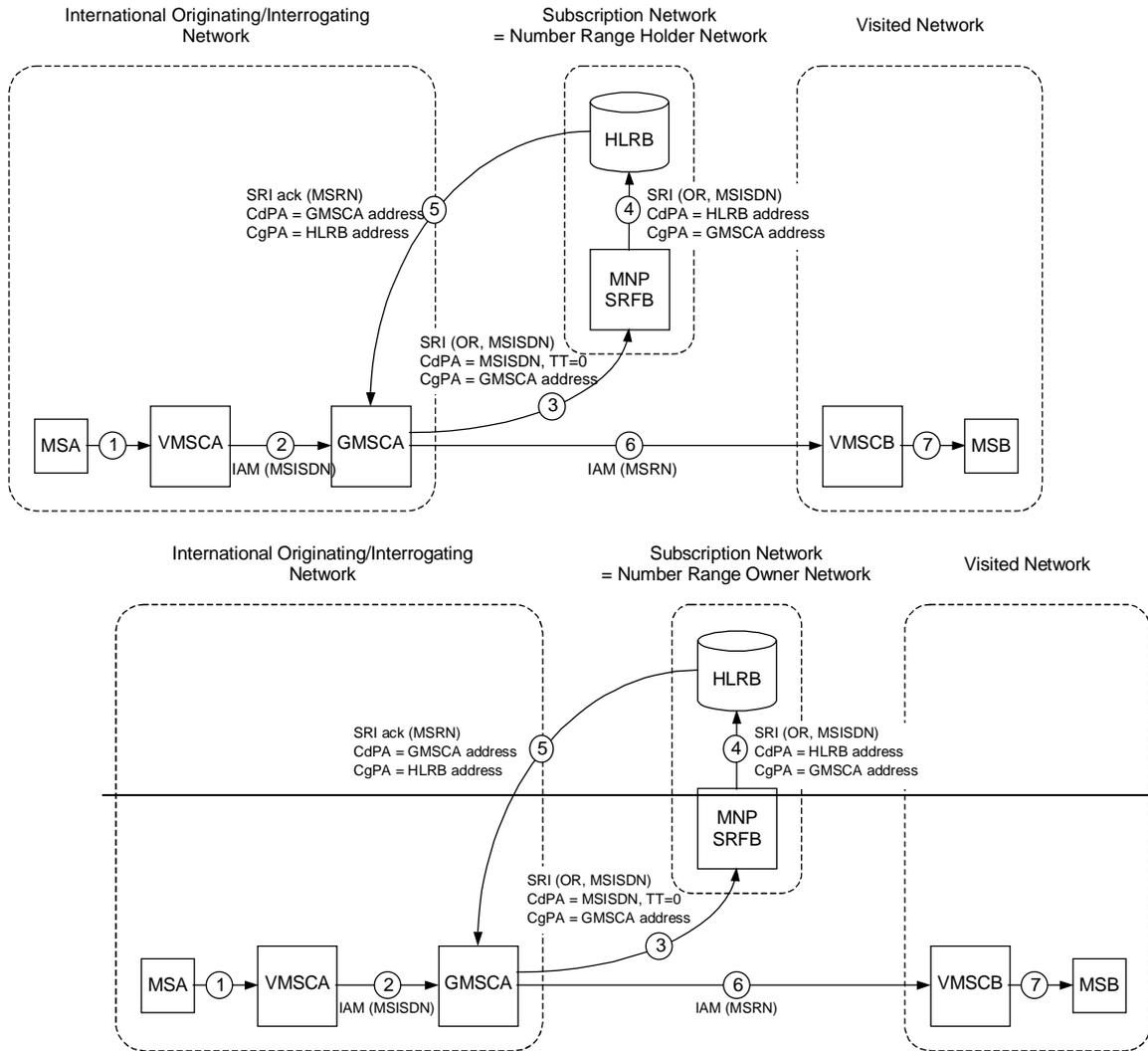
**Figure B.4.4: SRF operation for delivering an SMS message to a ported number where the interrogating network supports direct routing**

1. The SMSC forwards a SM to the SMS-GMSCA via a proprietary interface;
2. The SMS-GMSCA generates a routing enquiry for SM delivery. The MAP `SRI_for_SM` message is routed to the network's MNP-SRF;
3. When MNP-SRFA receives the message, MNP-SRF operation is triggered. The MNP-SRF functionality analyses the MSISDN in the CdPA and identifies the MSISDN as being ported using information which may be retrieved from an NP database. As the message is non-call related, the MNP-SRF function then populates the CdPA with either a routing number or a concatenation of a routing number and MSISDN. After modifying the CdPA, the message is routed to MNP-SRFB in the subscription network;
4. When MNP-SRFB receives the message, MNP-SRF operation is triggered. The MNP-SRF functionality analyses the MSISDN in the CdPA and identifies the MSISDN as being ported into the network using information which may be retrieved from an NP database. The MNP-SRF function then populates the CdPA with an HLRB address. After modifying the CdPA, the message is routed to HLRB;
5. HLRB responds to the routing enquiry by sending back an `SRI_for_SM ack` with the address of the VMSCB;
6. The SMS-GMSCA can now deliver the message to the VMSCB using a `Forward_SMS` message.
7. VMSCB further delivers the message to MSB.

## B.4.5 International SOR for a Non-ported Number

Figure B.4.5 shows the MNP-SRF operation for optimally routing an international call to a non-ported number.

The message flows for this scenario are based on the use of an SCCP-relay function in the MNP-SRF. If the MNP-SRF uses a higher-level relay function (e.g. TC-relay), then the response message will go via the MNP-SRF as shown in B.4.2. For further details of the signalling-relay functions, the reader is referred to [8].



**Figure B.4.5: SRF operation for optimally routing an international call to a non-ported number**

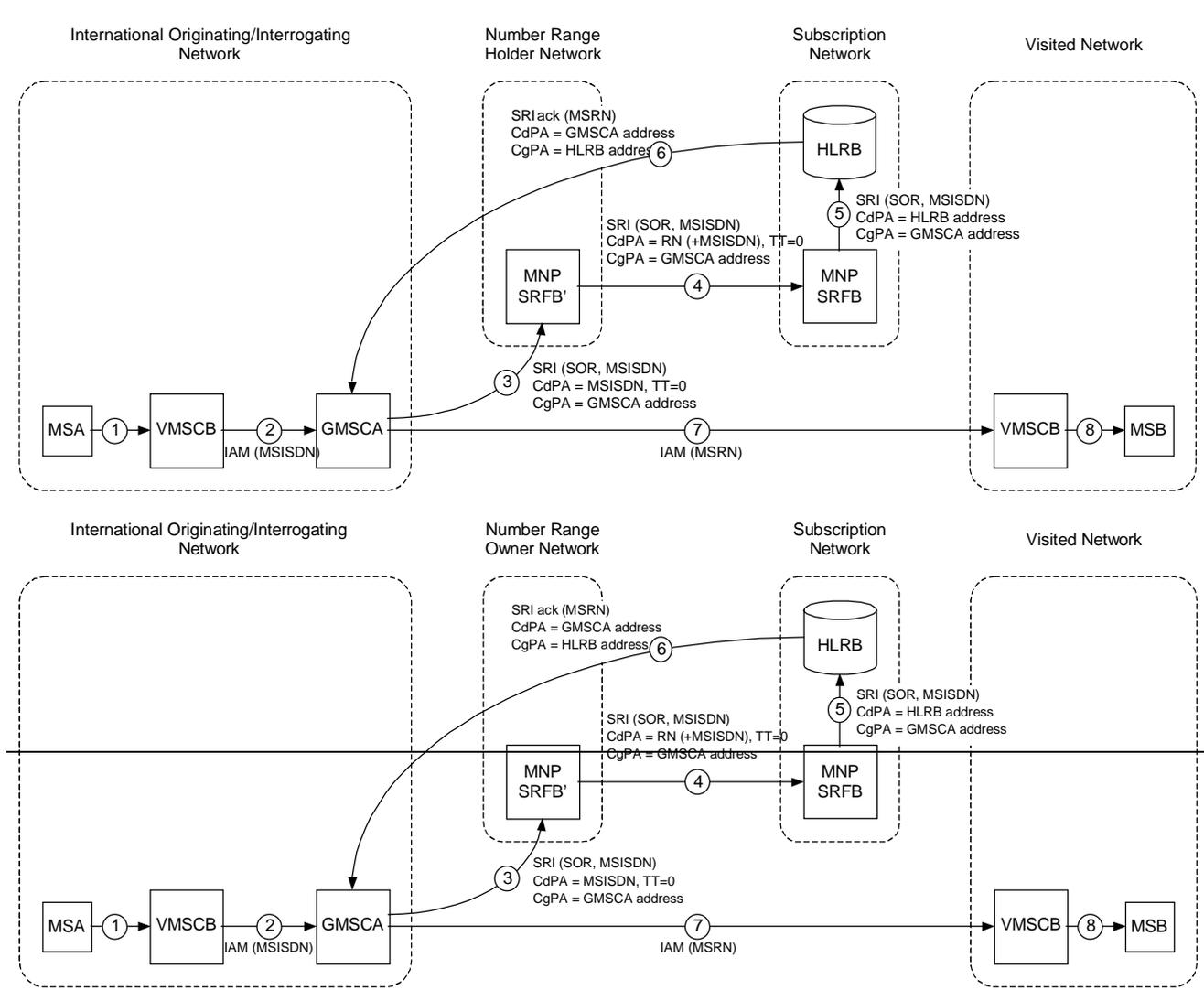
1. MSA originates a call to MSISDN;
2. VMSCA routes the call to the originating network's GMSCA;
3. When GMSCA receives the ISUP IAM, it requests routing information by submitting a MAP SRI with SOR parameter set to the number range owner/holder network of the dialled MSISDN. Within the number range owner/holder network, the message is routed to the network's MNP-SRF;
4. When MNP-SRFB receives the message, MNP-SRF operation is triggered. The MNP-SRF functionality analyses the MSISDN in the CdPA and identifies the MSISDN as being non-ported using information which may be retrieved from an NP database. The MNP-SRF function then populates the CdPA with an HLRB address. After modifying the CdPA, the message is routed to HLRB;
5. When HLRB receives the SRI, it responds to the GMSCA by sending back an SRI ack with a MSRN;

6. GMSCA uses the MSRN to route the call to VMSCB;
7. VMSCB further establishes a traffic channel to MSB.

### B.4.6 SOR for a Ported Number – Indirect Routing

Figure B.4.6 shows the MNP-SRF operation for optimally routing a call (using SOR) to a ported number where the interrogating network does not support direct routing.

The message flows for this scenario are based on the use of an SCCP-relay function in the MNP-SRFs. If the MNP-SRFs use a higher-level relay function (e.g. TC-relay), then the response message will go via the MNP-SRF as shown in B.4.2. For further details of the signalling-relay functions, the reader is referred to [8].



**Figure B.4.6: MNP-SRF operation for optimally routing a call (using SOR) to a ported number where the interrogating network does not support direct routing**

1. MSA originates a call to MSISDN;
2. VMSCA routes the call to the network’s GMSCA;
3. When GMSCA receives the ISUP IAM, it requests routing information by submitting a MAP SRI with SOR parameter set to the number range ~~owner~~holder network of the dialled MSISDN. Within the number range ~~owner~~holder network, the message is routed to the network’s MNP-SRF;
4. When MNP-SRFB’ receives the message, MNP-SRF operation is triggered. The MNP-SRF functionality analyses the MSISDN in the CdPA and identifies the MSISDN as being ported using information which may be retrieved from an NP database. As the message is non-call related, the MNP-SRF function then populates the

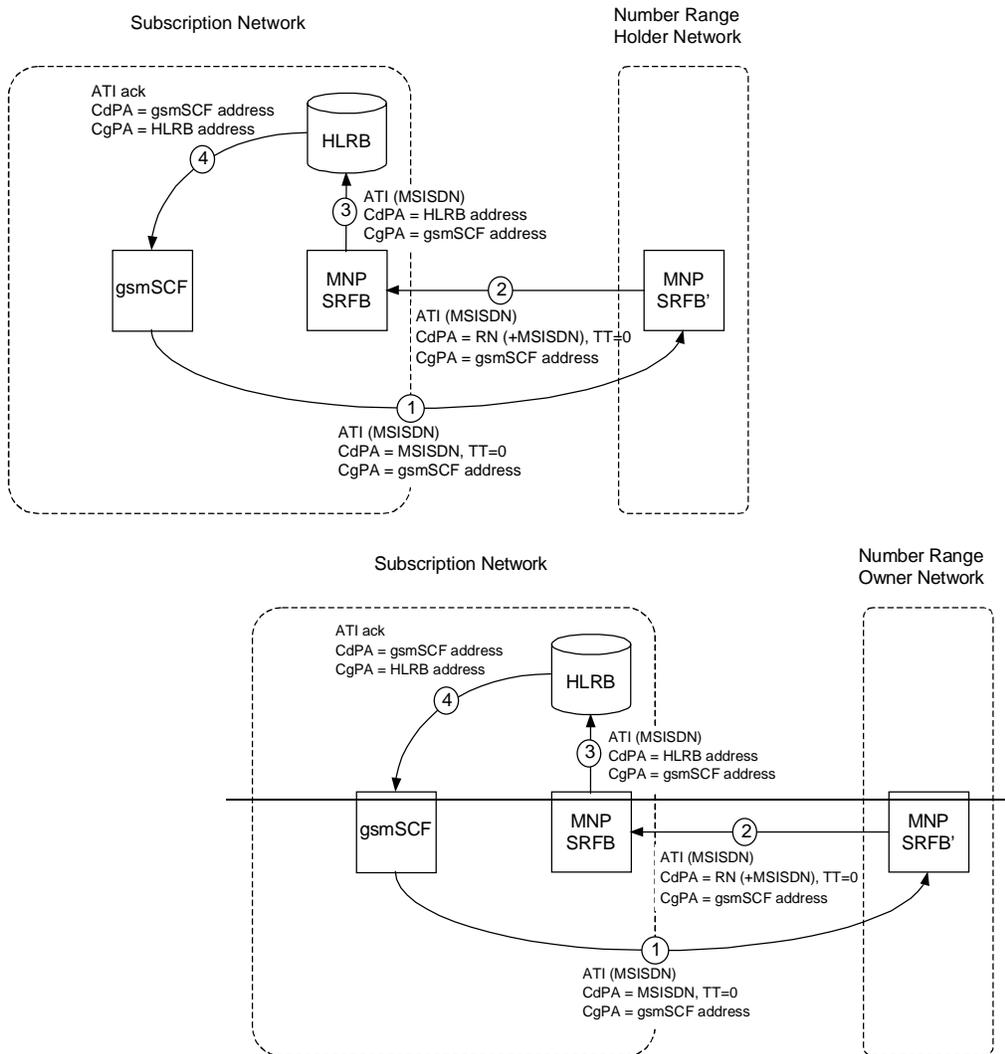
CdPA with either a routing number or a concatenation of a routing number and MSISDN. After modifying the CdPA, the message is routed to MNP-SRFB in the subscription network;

5. When MNP-SRFB receives the message, MNP-SRF operation is triggered. The MNP-SRF functionality analyses the MSISDN in the CdPA and identifies the MSISDN as being ported into the network using information which may be retrieved from an NP database. The MNP-SRF function then populates the CdPA with an HLRB address. After modifying the CdPA, the message is routed to HLRB;
6. When HLRB receives the SRI, it responds to the GMSCA by sending back an SRI ack with a MSRN;
7. GMSCA uses the MSRN to route the call to VMSCB;
8. VMSCB further establishes a traffic channel to MSB.

### B.4.7 Any Time Interrogation for a Ported Number – Indirect Routing

Figure B.4.7 shows the MNP-SRF operation for routing an Any\_Time\_Interrogation message for a ported number where the interrogating network does not support direct routing.

The message flows for this scenario are based on the use of an SCCP-relay function in the MNP-SRFs. If the MNP-SRFs use a higher-level relay function (e.g. TC-relay), then the response message will go via the MNP-SRF as shown in B.4.2. For further details of the signalling relay functions, the reader is referred to [8].



**Figure B.4.7: MNP-SRF operation for routing an Any\_Time\_Interrogation message for a ported number where the interrogating network does not support direct routing**

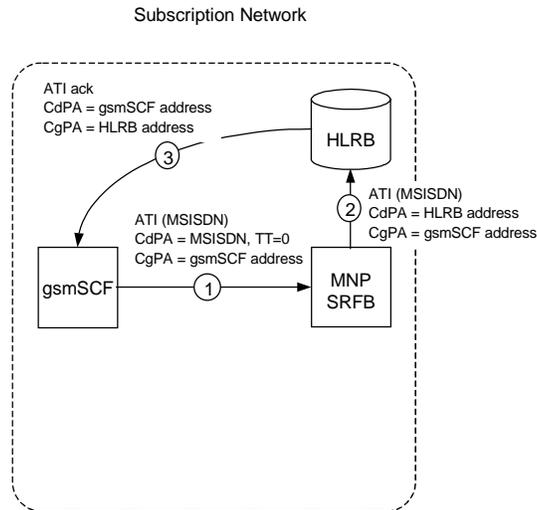
1. The gsmSCF generates an Any\_Time\_Interrogation (ATI) message. The message is routed to the number range owner/holder network's MNP-SRF;
2. When MNP-SRFB' receives the message, MNP-SRF operation is triggered. The MNP-SRF functionality analyses the MSISDN in the CdPA and identifies the MSISDN as being ported using information which may be retrieved from an NP database. As the message is non-call related, the MNP-SRF function then populates the CdPA with either a routing number or a concatenation of a routing number and MSISDN. After modifying the CdPA, the message is routed to MNP-SRFB in the subscription network;

3. When MNP-SRFB receives the message, MNP-SRF operation is triggered. The MNP-SRF functionality analyses the MSISDN in the CdPA and identifies the MSISDN as being ported into the network using information which may be retrieved from an NP database. The MNP-SRF function then populates the CdPA with an HLRB address. After modifying the CdPA, the message is routed to HLRB;
4. HLRB responds to the ATI by sending back an ATI ack with the requested information;

## B.4.8 Any Time Interrogation for a Ported Number – Direct Routeing

Figure B.4.8 shows the MNP-SRF operation for routeing an Any\_Time\_Interrogation message for a ported number where the interrogating network supports direct routeing.

The message flows for this scenario are based on the use of an SCCP-relay function in the MNP-SRF. If the MNP-SRF uses a higher-level relay function (e.g. TC-relay), then the response message will go via the MNP-SRF as shown in B.4.2. For further details of the signalling relay functions, the reader is referred to [8].



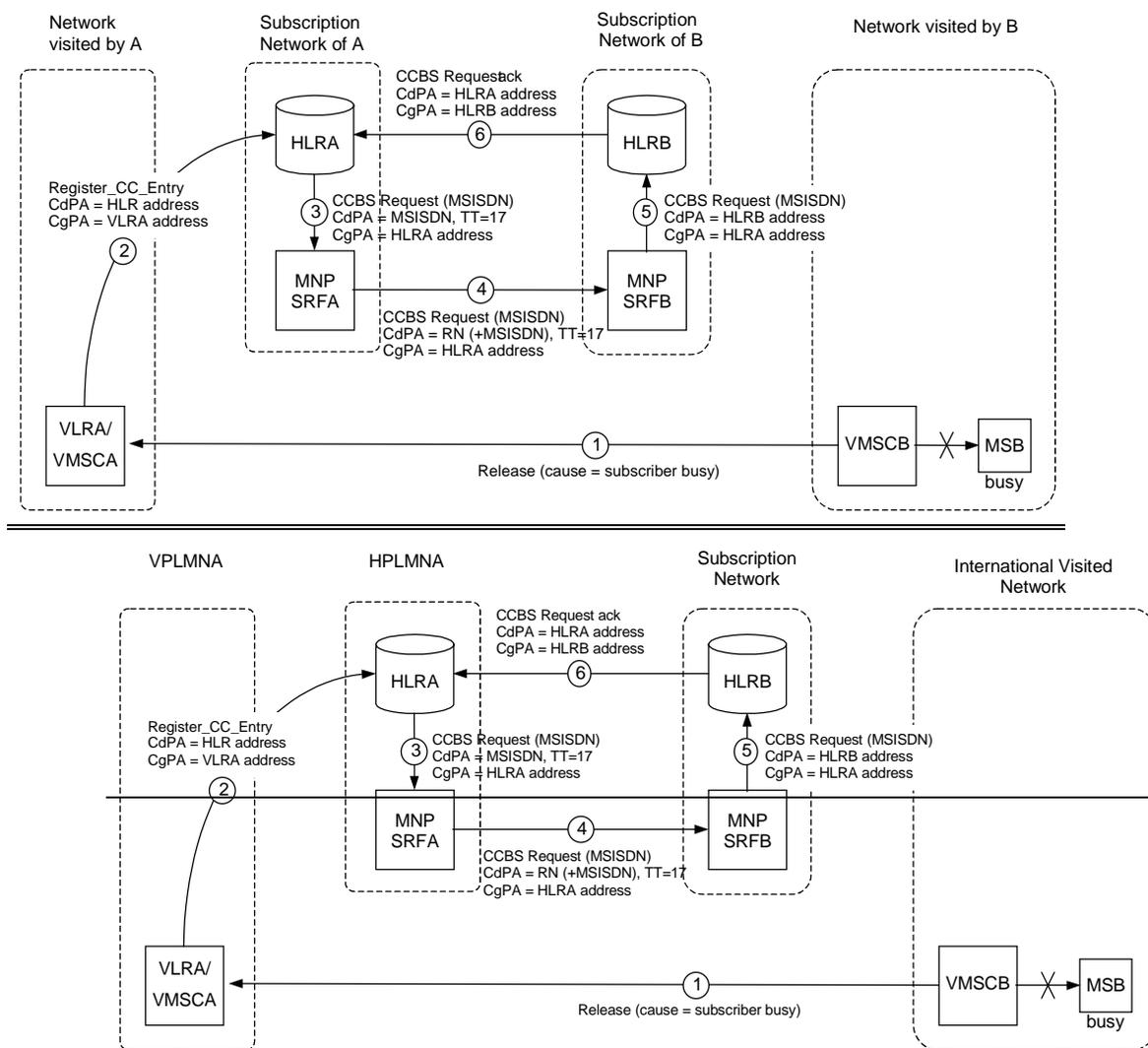
**Figure B.4.8: MNP-SRF operation for routeing an Any\_Time\_Interrogation message for a ported number where the interrogating network supports direct routeing**

1. The gsmSCF generates an Any\_Time\_Interrogation (ATI) message. The message is routed to the network's MNP-SRF;
2. When MNP-SRFB receives the message, MNP-SRF operation is triggered. The MNP-SRF functionality analyses the MSISDN in the CdPA and identifies the MSISDN as being ported into the network using information which may be retrieved from an NP database. The MNP-SRF function then populates the CdPA with an HLRB address. After modifying the CdPA, the message is routed to HLRB;
3. HLRB responds to the ATI by sending back an ATI ack with the requested information;

## B.4.9 CCBS where the Busy Subscriber is a Ported Subscriber – Direct Routing

Figure B.4.9 shows the MNP-SRF operation for routing a CCBS Request for a ported number where the interrogating network supports direct routing.

The message flows for this scenario are based on the use of an SCCP-relay function in the MNP-SRFs. If the MNP-SRFs use a higher-level relay function (e.g. TC-relay), then the response message will go via the MNP-SRF as shown in B.4.2. For further details of the signalling relay functions, the reader is referred to [8].



**Figure B.4.9: MNP-SRF operation for routing a CCBS Request for a ported number where the interrogating network supports direct routing**

1. The VMSCA receives a ISUP Release message with cause value ‘subscriber busy’ from VMSCB;
2. VLRA/VMSCA sends a Register\_CC\_Entry to HLRA using the HLR address as CdPA on SCCP;
3. The HLRA sends a CCBS Request message to the networks MNP-SRFA;
4. When MNP-SRFA receives the message, MNP-SRF operation is triggered. The MNP-SRF functionality analyses the MSISDN in the CdPA and identifies the MSISDN as being ported using information which may be retrieved from an NP database. As the message is non-call related, the MNP-SRF function then populates the CdPA with either a routing number or a concatenation of a routing number and MSISDN. After modifying the CdPA, the message is routed to MNP-SRFB in the subscription network;

5. When MNP-SRFB receives the message, MNP-SRF operation is triggered. The MNP-SRF functionality analyses the MSISDN in the CdPA and identifies the MSISDN as being ported into the network using information which may be retrieved from an NP database. The MNP-SRF function then populates the CdPA with an HLRB address. After modifying the CdPA, the message is routed to HLRB;
6. HLRB can now respond to HLRA by sending back a CCBS ack message;

# Annex C (normative): MNP Signalling Relay Function - Call Related Signalling

## C.1 Handling of Call Related Signalling

The only call related MAP message affected by MNP is the ~~MAP~~ MAP SEND\_ROUTEING ROUTING INFORMATION (SRI) message without OR parameter set sent to the HLR.

In a PLMN supporting MNP with direct routeing using signalling relay, all incoming calls and calls originating in the network for which the called party number is within the ranges owned by any network in the portability ~~cluster~~ domain, the gateway MSCs will send an SRI such that it will be handled by the MNP-SRF in that network.

In a PLMN supporting MNP with indirect routeing using signalling relay, all incoming calls and calls originating in the network for which the called party number is within the range owned by the network, the gateway MSCs will send SRI such that it will be handled by the MNP-SRF in that network.

The MNP-SRF obtains routeing information from the NP database to identify the subscription network associated with a particular national MSISDN. The interface between the MNP-SRF and the NP database is considered implementation dependent and is not detailed further.

From the perspective of the PLMN in which the MNP-SRF resides, the CdPA represents one of:

1. An own number ported out;
2. An own number not ported out;
3. A foreign number ported in;
4. A foreign number ported to a foreign network;
5. A foreign number not known to be ported.

Cases 4 and 5 are applicable only for direct routeing.

In case 1, the MNP-SRF may perform one of the following depending on agreements within the number portability ~~cluster~~ domain.

- a. An SRI response is sent containing the necessary routeing information to route the call to the subscription network. This is performed by an internal MAP Application Termination Function (MATF) known as the Number Portability Location Register (NPLR).
- b. If indirect routeing of calls with reference to the subscription network is used, the message is relayed to the MNP-SRF in the subscription network, whose NPLR provides the necessary routeing information in an SRI response. The use of an NPLR in the subscription network can only be by agreement within the number portability ~~cluster~~ domain.

In cases 2 and 3 the MNP-SRF relays the message to the HLR. ~~For further details of the signalling relay function, the reader is referred to [8].~~

In case 4, an SRI response is sent, containing the necessary routeing information to route the call to the subscription network.

In case 5, an SRI response is sent, containing the necessary routeing information to route the call to the number range ~~owner~~ holder network.

---

## C.2 Functional Requirements of Network Entities

### C.2.1 Procedure MNP\_SRF\_MATF\_Call\_Related

Figure C.2.1.1 shows the procedure MNP\_SRF\_MATF\_Call\_Related. This procedure handles call-related signalling messages. It is called from the process MNP\_SRF (see clause 4.3).

The check “message has been relayed” identifies all call related signalling messages which are relayed from the number range ownerholder network towards the subscription network in the case of Indirect Routeing with reference to subscription network implementation. These messages only refer to numbers ported into the network.

The check “own number not ported out” identifies all mobile numbers from number ranges allocated to the network the MNP-SRF/MATF is located in and which are not ported to other networks. In this case the call related message is relayed to the HLR in the network

The check “foreign number ported in” identifies all mobile numbers from the number ranges not allocated to the network the MNP-SRF/MATF is located in and which are served by the network the MNP-SRF/MATF is located in. In this case the call related message is relayed to the HLR in the network.

The check “foreign number not known to be ported” identifies all mobile numbers from the number ranges not allocated to the network the MNP-SRF/MATF is located in and which are also not served by the network the MNP-SRF/MATF is located in. In this case the call is sent to the SRF\_MATF procedure for handling.

The check “foreign number ported to foreign network” identifies all mobile numbers from the number ranges not allocated to the network the MNP-SRF/MATF is located in and which are not served by the network the MNP-SRF is located in and not served by the network the number range is allocated to, i.e. the number is ported between two other networks. In this case the call related message is sent to the SRF\_MATF procedure for handling.

The remaining cases “own number ported out” are mobile numbers allocated to the network the MNP-SRF/MATF is located in and which are served by other networks, i.e. the number is ported out to another network. In this case the call is relayed to the MATF in the subscription network if this option is the one used by the operator, or sent to the SRF\_MATF procedure for handling if not.

### C.2.2 Process SRI\_NPLR

Figure C.2.2 shows the process SRI\_NPLR.

The check “unknown subscriber” identifies a subscriber without any associated available information.

If the GMSC is in the database own network then a routeing number is provided to route to the number range ownerholder network.

If the GMSC is not in the database own network then the enquiry has been routed from the number range ownerholder network, so the call should fail.

The database query uses the MSISDN received at the application level in the SRI, rather than the CdPA of the SCCP level.

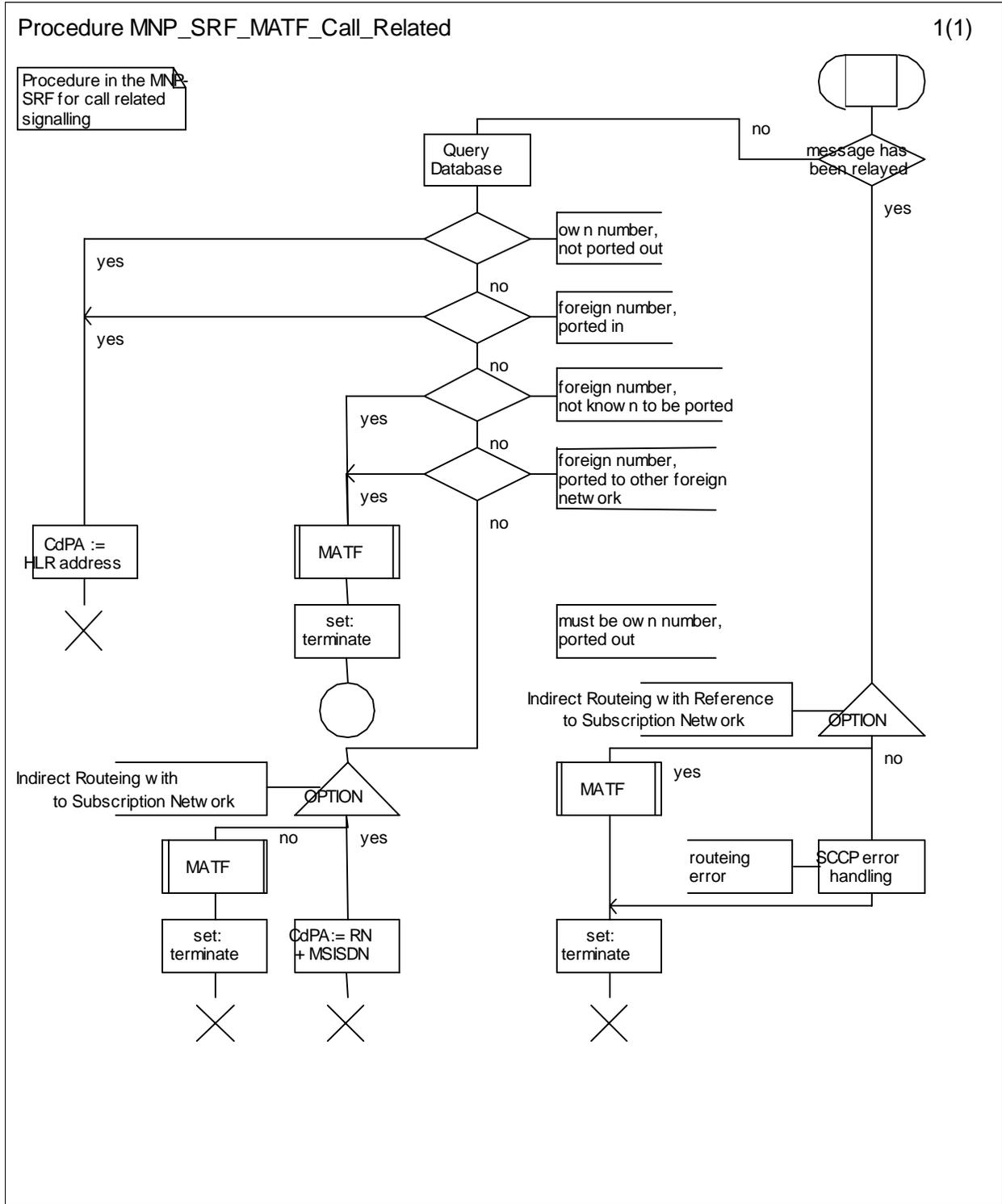


Figure C.2.1.1: Procedure MNP\_SRF\_MATF\_Call\_Related

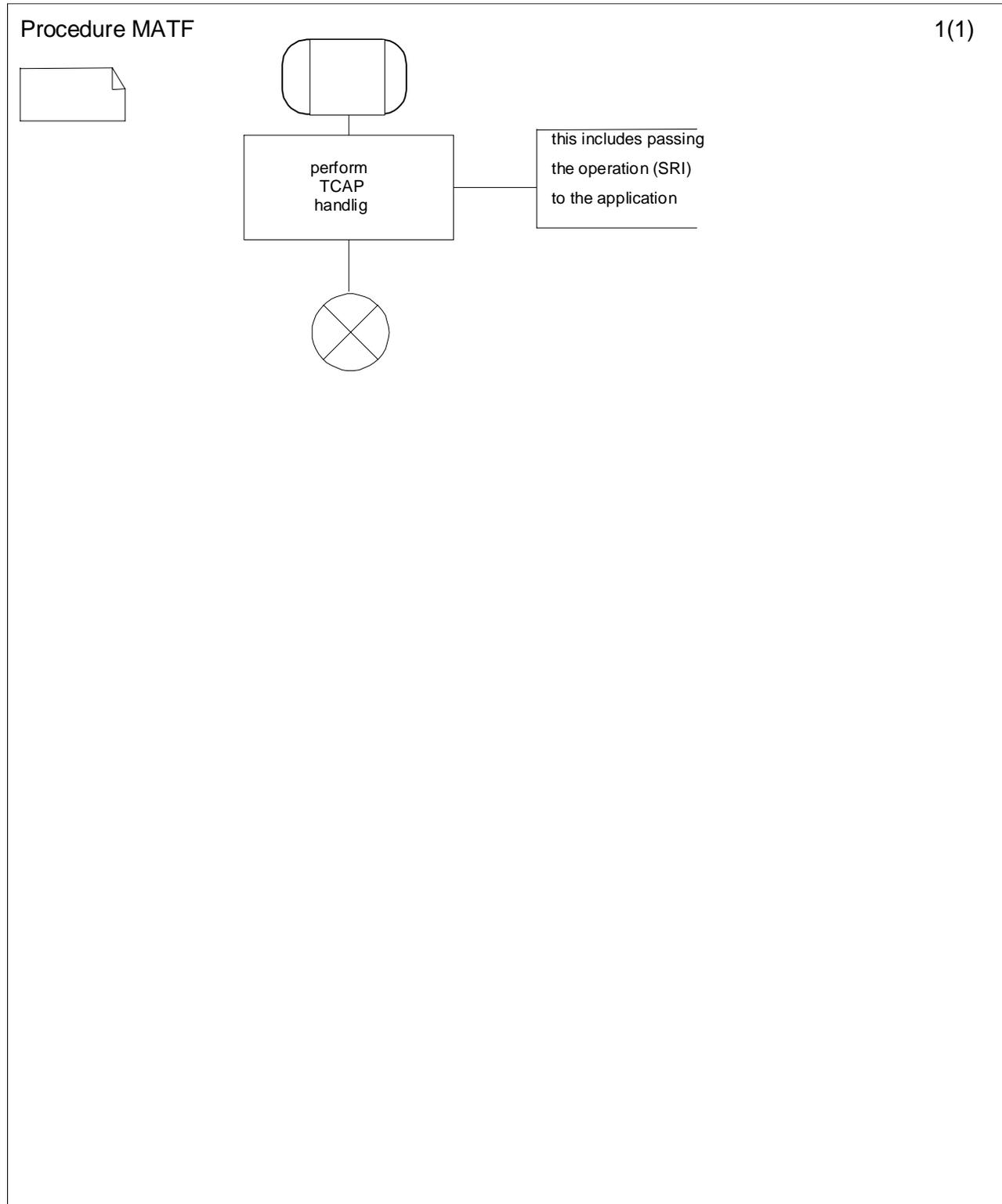
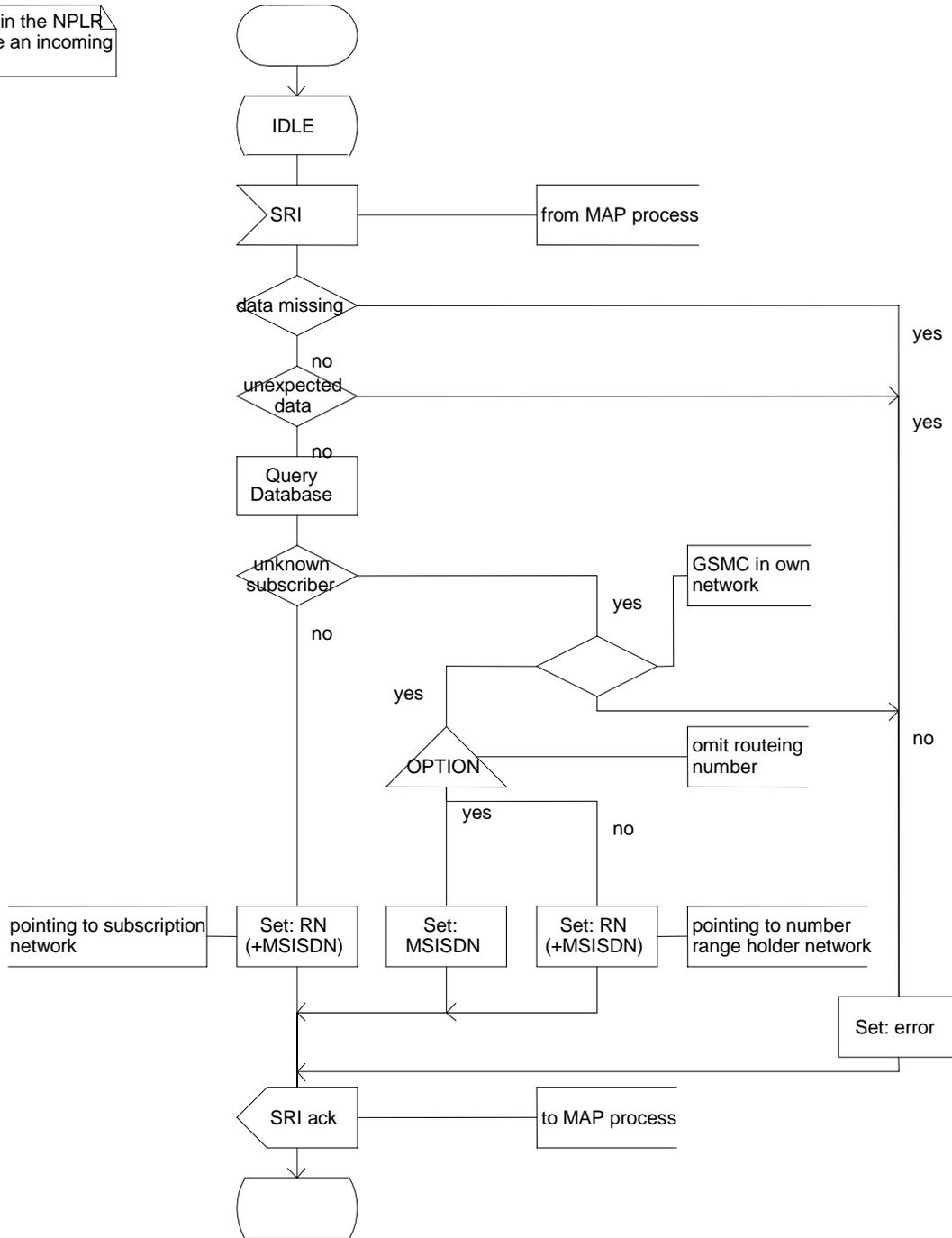


Figure C.2.1.2: Procedure MATF

### Process SRI\_NPLR

1(1)

Process in the NPLR to handle an incoming SRI



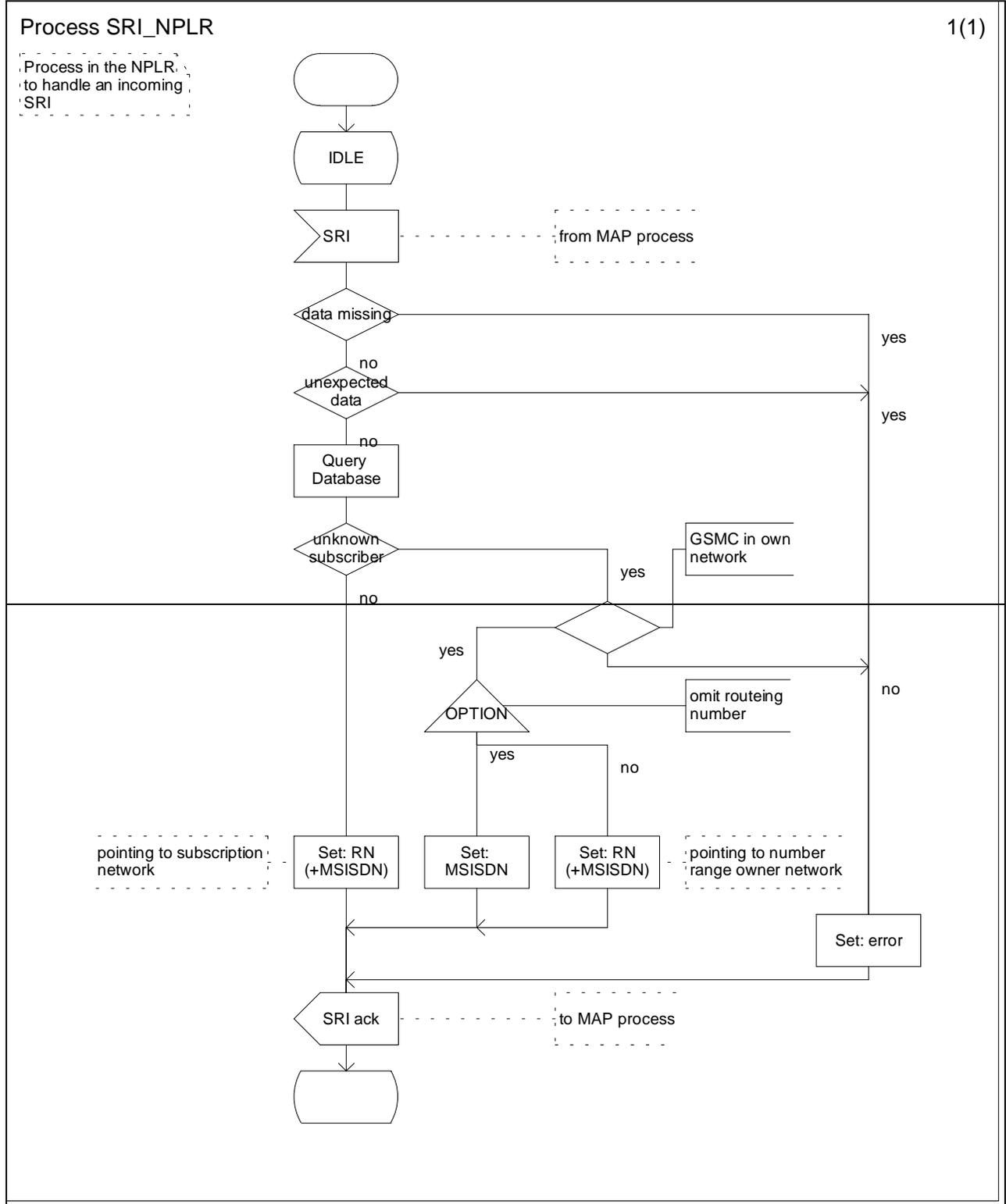


Figure C.2.2: Process SRI\_NPLR

## C.3 Call Scenarios

The notation TT=SRI in diagrams in this section assumes that SRI=CRMNP. The use of other translation types is for further study. The message flows for the following scenarios are based on the use of an SCCP relay function in MNP-SRF(s). The message flows for the higher level relay function (e.g. TC relay) in MNP-SRF are not covered here, but the principle can be found in C.5B.4.2. For further details of the signalling relay function, the reader is referred to [8].

### C.3.1 Call to a Non-Ported Number or Number Ported into the Network

Figure C.3.1 shows the signalling involved for a call to a non-ported number or number ported into the network (see GSM 03.18 [4]).

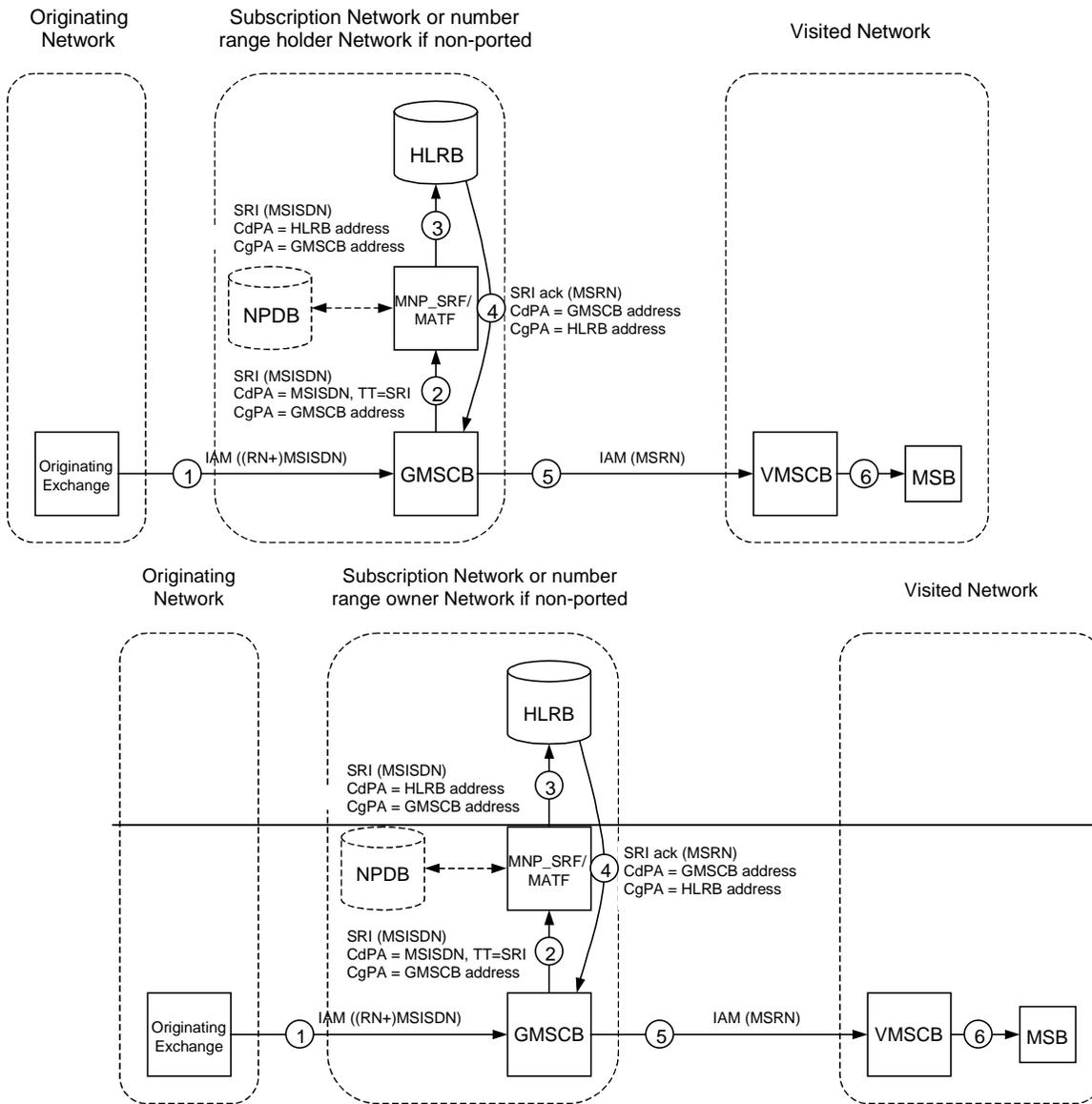
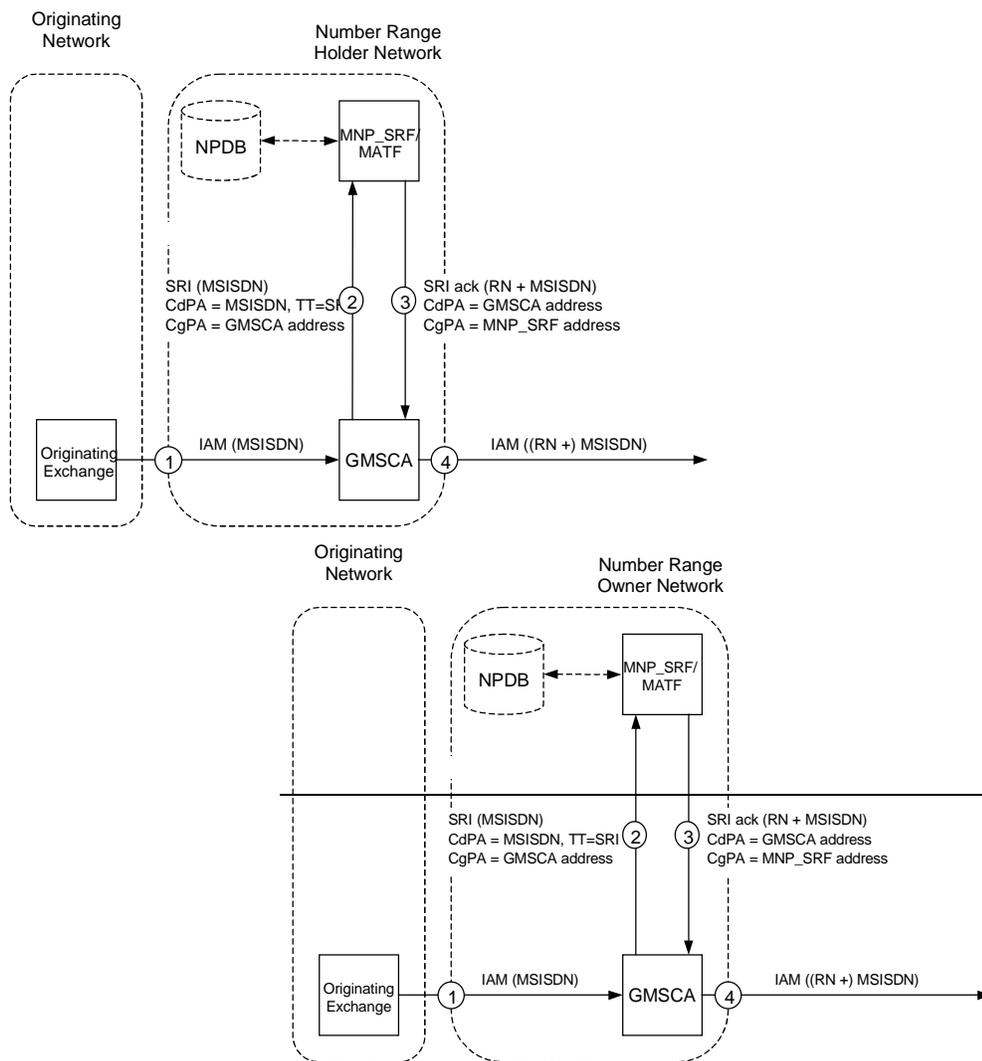


Figure C.3.1: Call to a non-ported number

1. From an Originating Exchange a call is set up to MSISDN. The call is routed to the subscription network being the number range ~~owner~~holder network, if the number is non-ported.
2. When GMSCB receives the ISUP IAM, it requests routing information by submitting a MAP SRI to the MNP\_SRF/MATF. The TT on SCCP may be set to 'SRI'.
3. When the MNP\_SRF/MATF receives the message, the MNP\_SRF/MATF analyses the MSISDN in the CdPA and identifies the MSISDN as being non-ported. The MNP\_SRF/MATF function then replaces the CdPA by an HLRB address. After modifying the CdPA, the message is routed to HLRB.
4. When HLRB receives the SRI, it responds to the GMSCB by sending an SRI ack with an MSRN that identifies the MSB in the VMSCB;
5. GMSCB uses the MSRN to route the call to VMSCB.

### C.3.4 Call to a Ported Number – Indirect Routing

Figure C.3.4 shows the signalling involved for a call to a ported number via indirect routing.

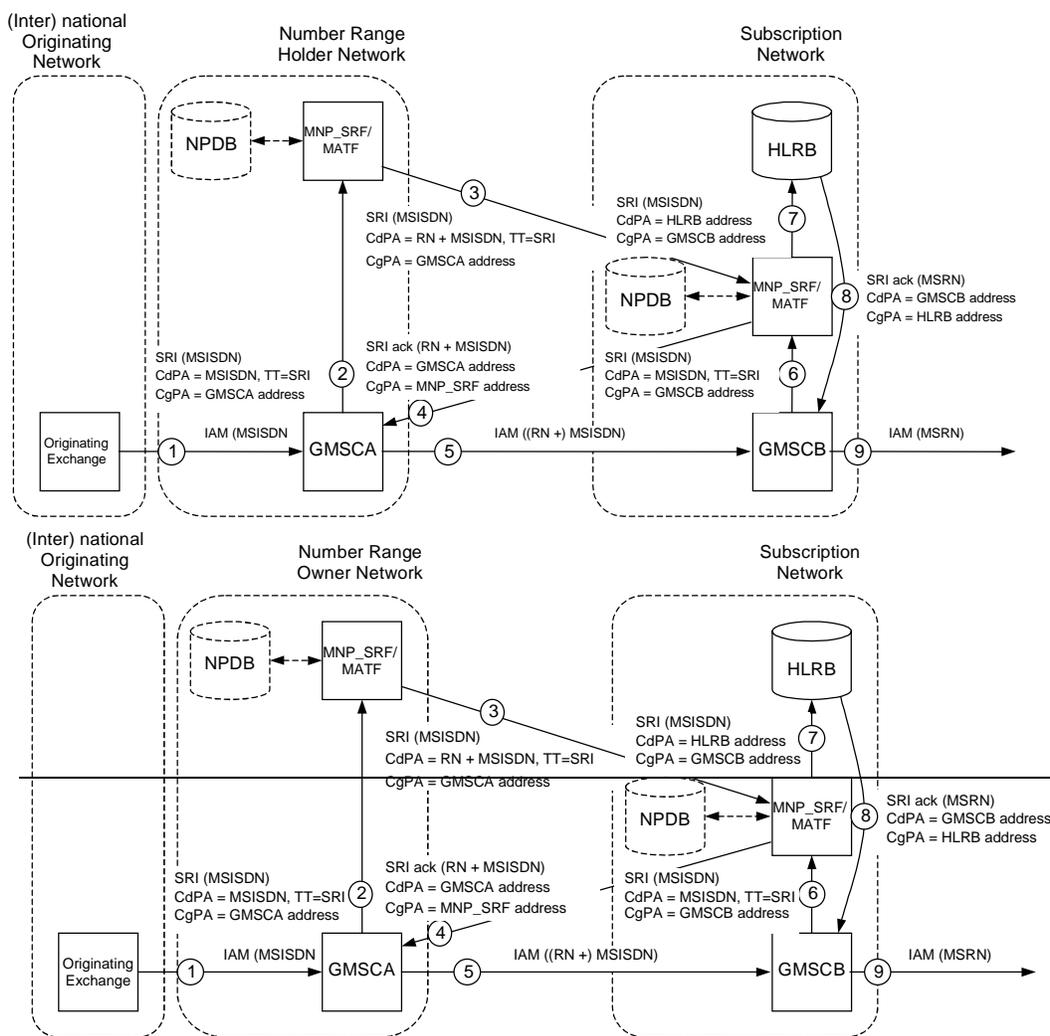


**Figure C.3.4: Call to a ported number via indirect routing**

1. From an Originating Exchange a call is set up to MSISDN. The call is routed to the number range ~~owner~~holder network;
2. When GMSCA in the number range ~~owner~~holder network receives the ISUP IAM, it requests routing information by submitting a MAP SRI to MNP\_SRF/MATF. The TT on SCCP may be set to ‘SRI’;
3. When the MNP\_SRF/MATF receives the message, it analyses the MSISDN in the CdPA and identifies the MSISDN as being ported to another network. As the message is an SRI message, the MNP\_SRF/MATF responds to the GMSCA by sending an SRI ack with a RN + MSISDN;
4. GMSCA uses the RN + MSISDN to route the call to GMSCB in the subscription network. Depending on the interconnect agreement, the RN will be added in the IAM or not.

### C.3.5 Call to a Ported Number – Indirect Routing with Reference to Subscription Network

Figure C.3.5 shows the signalling involved for a call to a ported number where indirect routing with reference to the subscription network is used.



**Figure C.3.5: National or international originated call to a ported number where indirect routing with reference to the subscription network is used**

1. From an Originating Exchange a call is set up to MSISDN. The call is routed to the number range owner/holder network;
2. When GMSCA in the number range owner/holder network receives the ISUP IAM, it requests routing information by submitting a MAP SRI to the MNP\_SRF/MATF. The TT on SCCP may be set to 'SRI';
3. When MNP\_SRF/MATF receives the message, MNP\_SRF/MATF operation is triggered. The MNP\_SRF/MATF functionality analyses the MSISDN in the CdPA and identifies the MSISDN as being ported to another network. As the message is a SRI message, the MNP\_SRF/MATF function relays the message to the subscription network by adding a routing number to the CdPA which information may be retrieved from a database. After modifying the CdPA, the message is routed to the subscription network;
4. When MNP\_SRF/MATF in the subscription network receives the SRI, it responds to the GMSCA in the number range owner/holder network by sending a SRI ack with a RN + MSISDN;
5. GMSCA uses the (RN +) MSISDN to route the call to GMSCB in the subscription network; Depending on the interconnect agreement, the RN will be added in the IAM or not.

6. When GMSCB in the subscription network receives the ISUP IAM, it requests routing information by submitting a MAP SRI to MNP\_SRF/MATF. The TT on SCCP may be set to 'SRI';
7. When MNP\_SRF/MATF receives the message, MNP\_SRF/MATF operation is triggered. The MNP\_SRF/MATF functionality analyses the MSISDN in the CdPA and identifies the MSISDN as being ported into the network. The MNP\_SRF/MATF function then replaces the CdPA by an HLRB address which information may be retrieved from a database. After modifying the CdPA, the message is routed to HLRB;
8. When HLRB receives the SRI, it responds to the GMSCB by sending an SRI ack with an MSRN that identifies the MSB in the VMSCB;
9. GMSCB uses the MSRN to route the call to VMSCB.

NOTE: The MNP\_SRF/MATF in this scenario has only information about all ported numbers to one subscription network, except those for which subscription information is held in the subscription networks HLR. In this scenario the routing depends always on the number range owner holder and the subscription network.

## C.4 Information Flows

Figure C.4.1 shows the information flow for a successful delivery of a call to a non-porting number or number ported into the network. The figure is related to figure C.3.1.

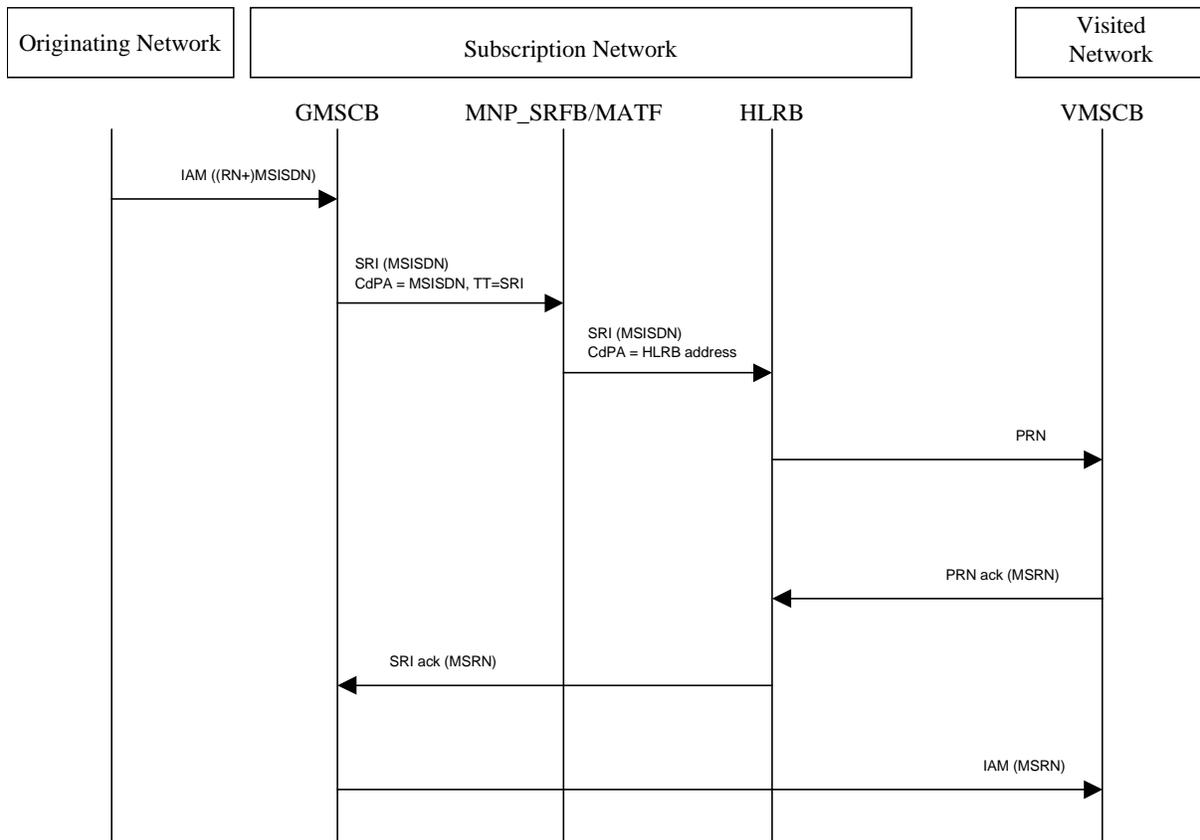
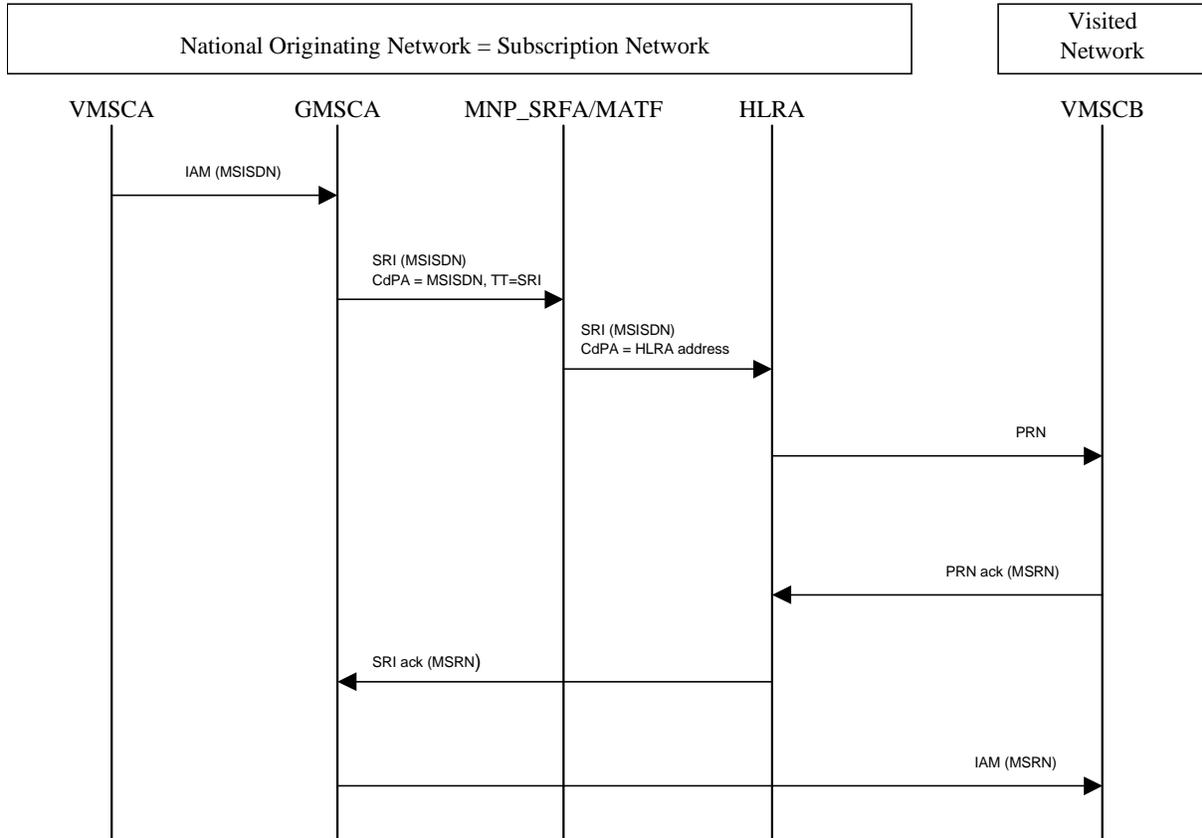


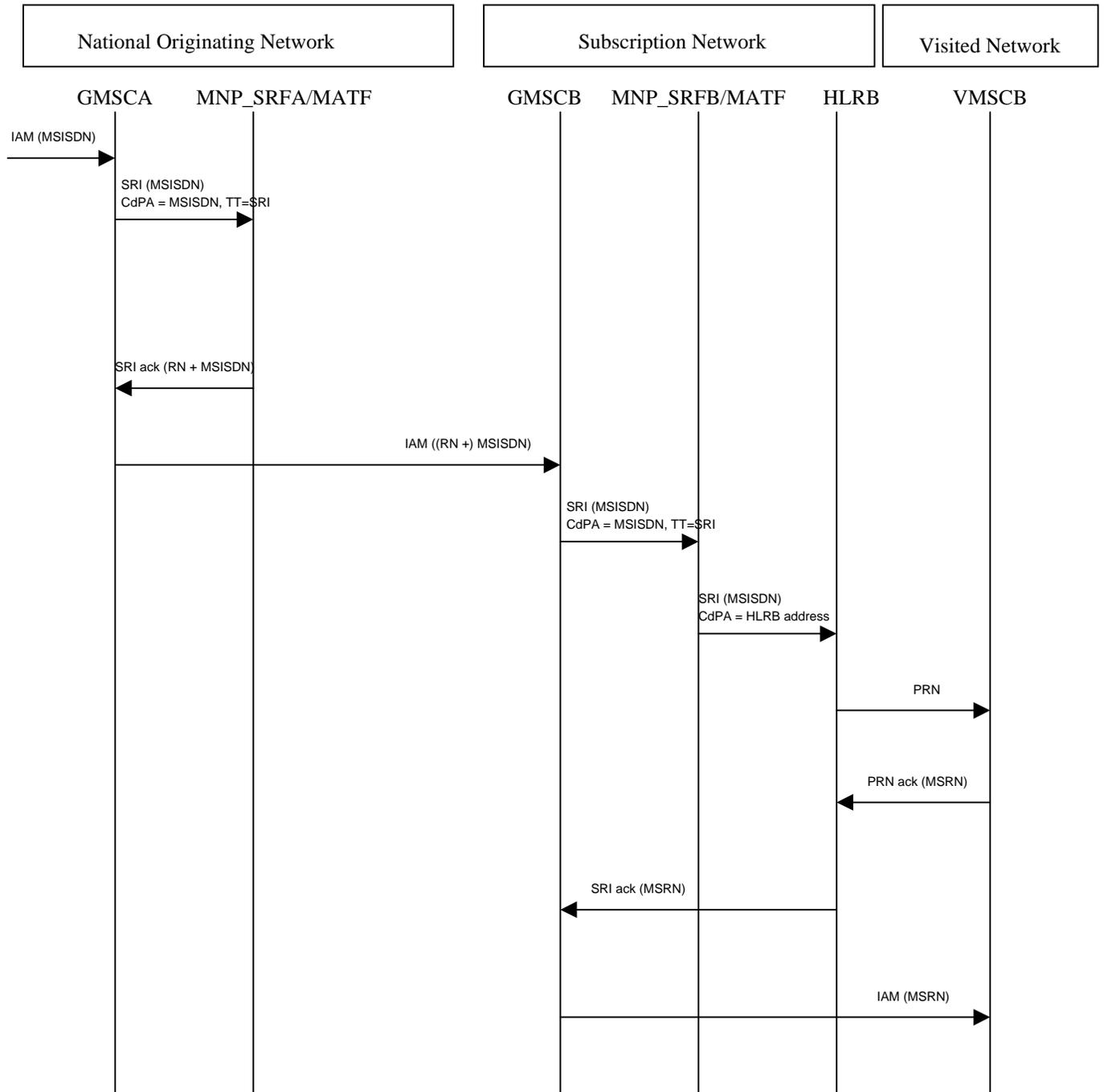
Figure C.4.1: Successful delivery of a call to a non-porting subscriber or number ported into the network

Figure C.4.2 shows the signalling involved for a call to a ported number via direct routing where the call is originated in the subscription network. The figure is related to figure C.3.2.



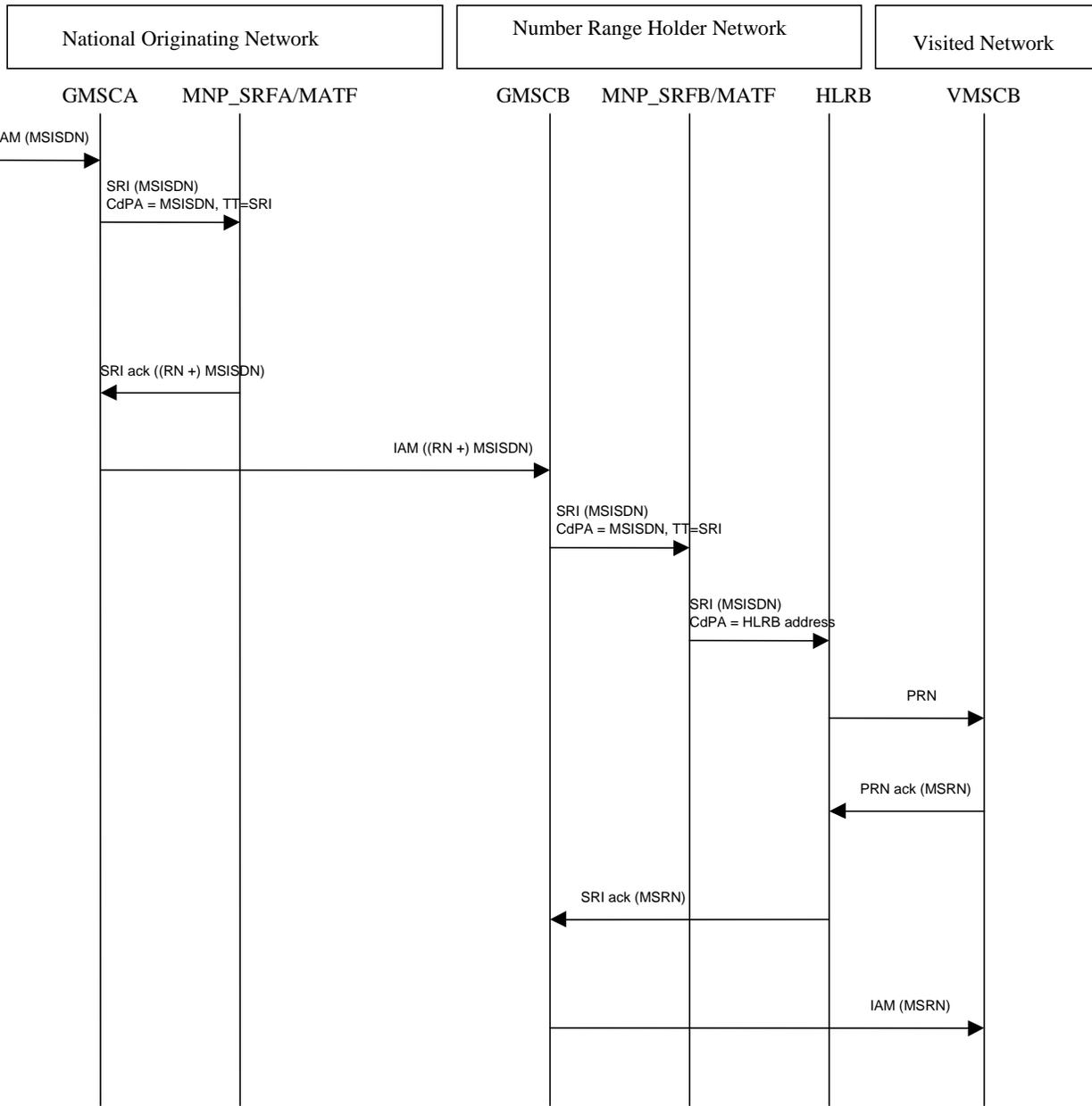
**Figure C.4.2: Successful delivery of a call to a ported number via direct routing where the call is originated in the subscription network**

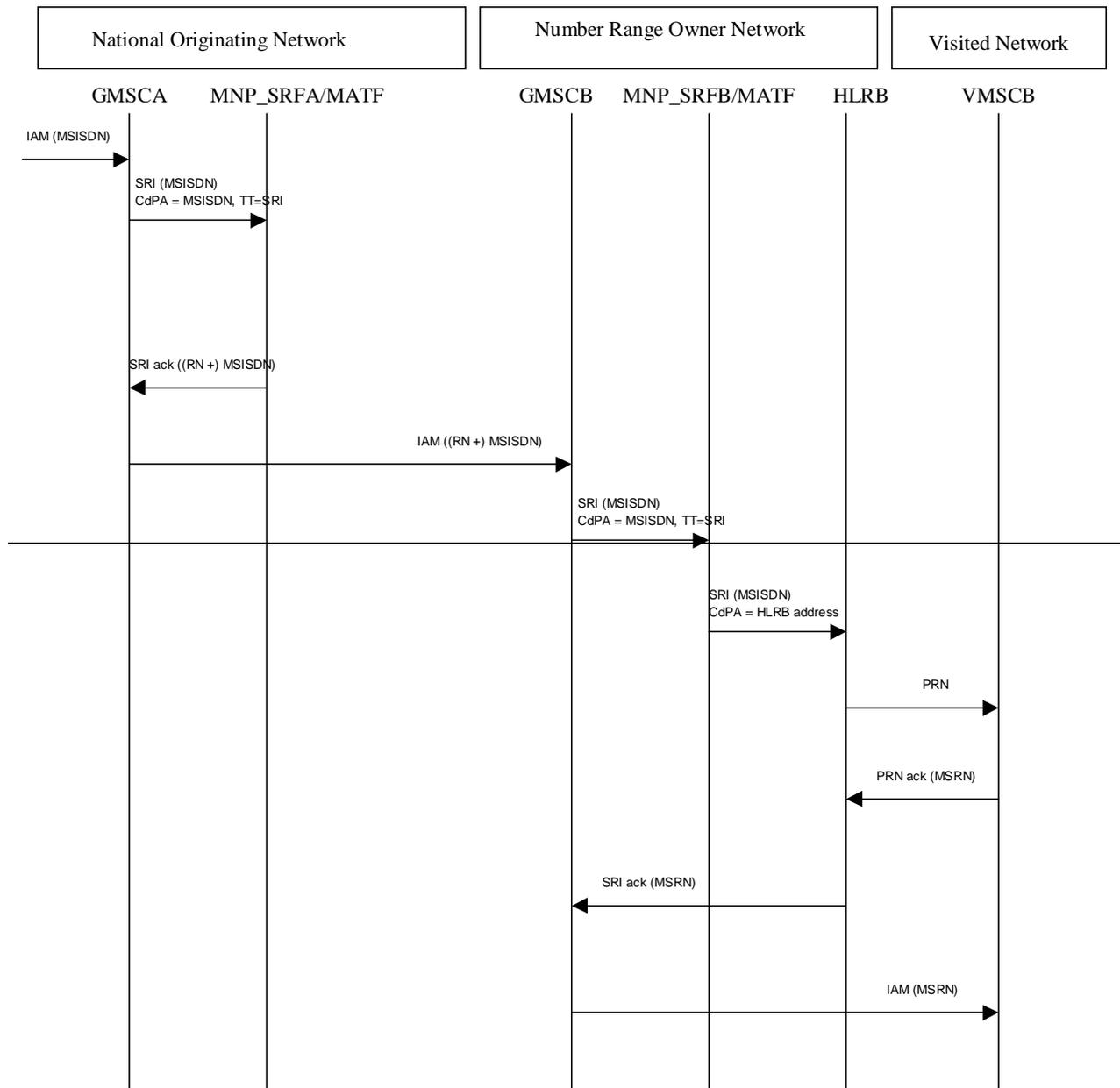
Figure C.4.3 shows the signalling involved for a national mobile originated call to a ported number via direct routing. The figure is related to figure C.3.3



**Figure C.4.3: Successful delivery of a national mobile originated call to a ported number via direct routing**

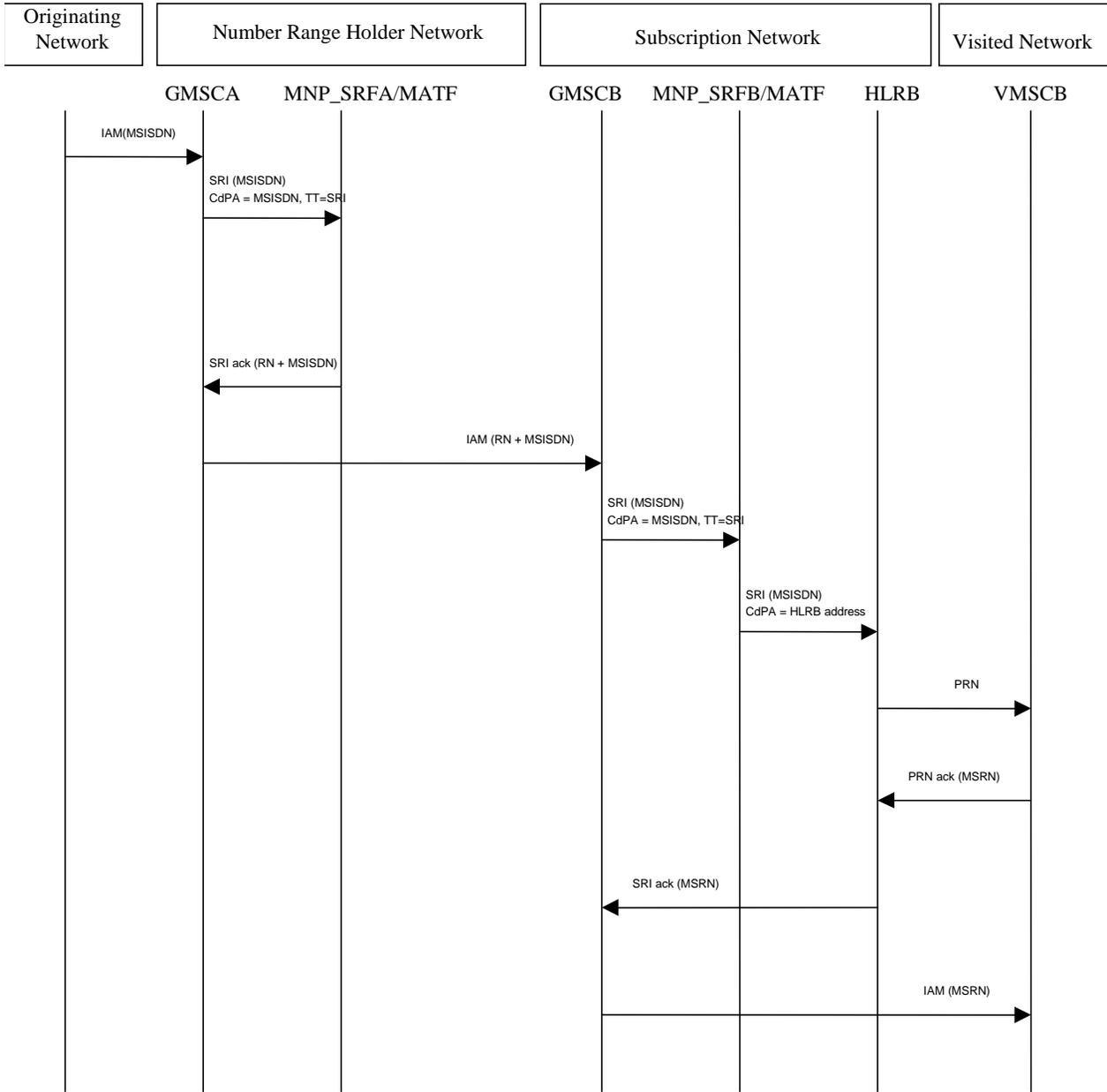
Figure C.4.4 shows the signalling involved for a national mobile originated call to a not known to be ported number via direct routing. The figure is related to figure C.3.3.





**Figure C.4.4: Successful delivery of a national mobile originated call to a not known to be ported number via direct routing**

Figure C.4.5 shows the signalling involved for a call to a ported number via indirect routing. The figure is related to figure C.3.4



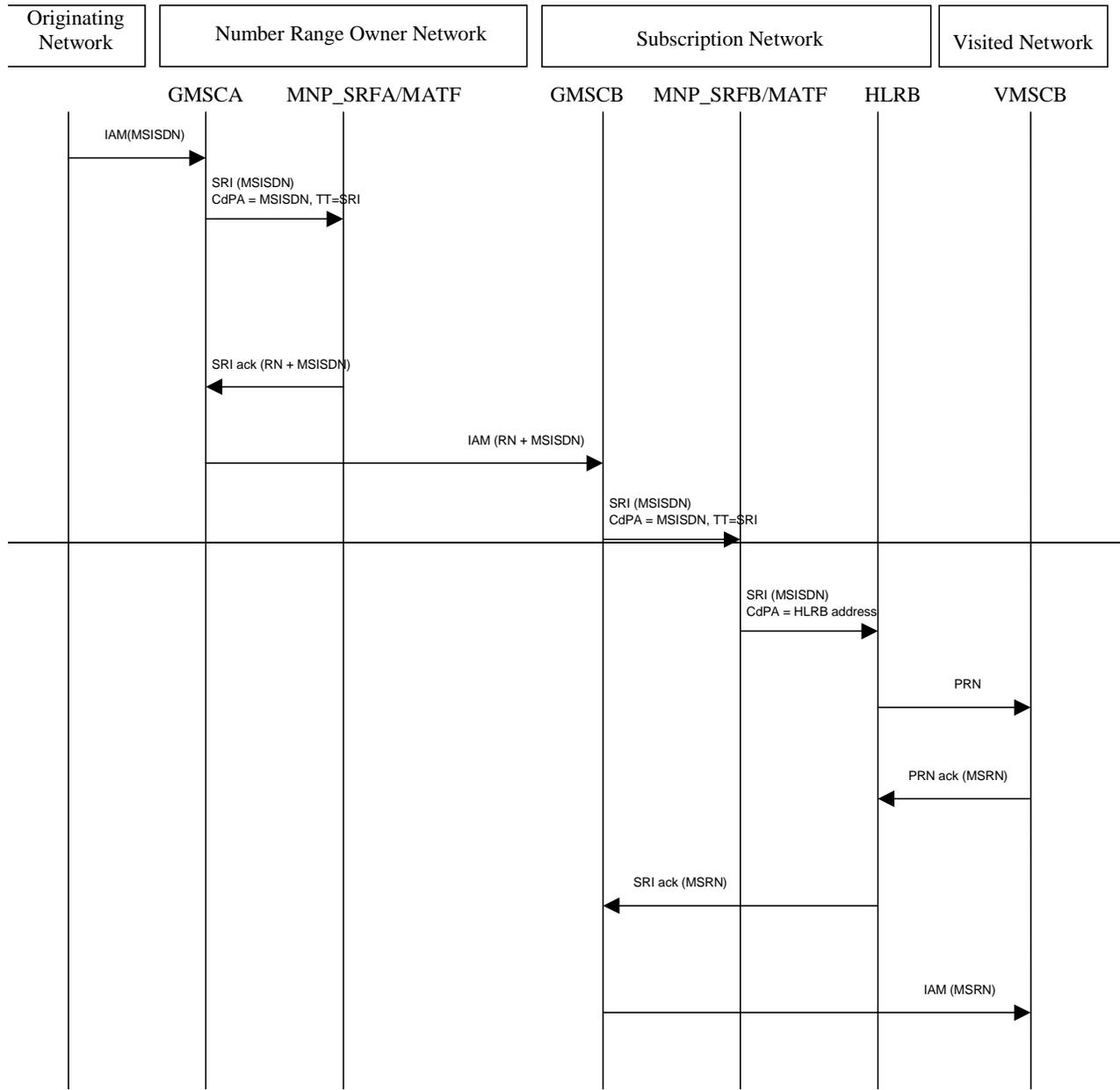
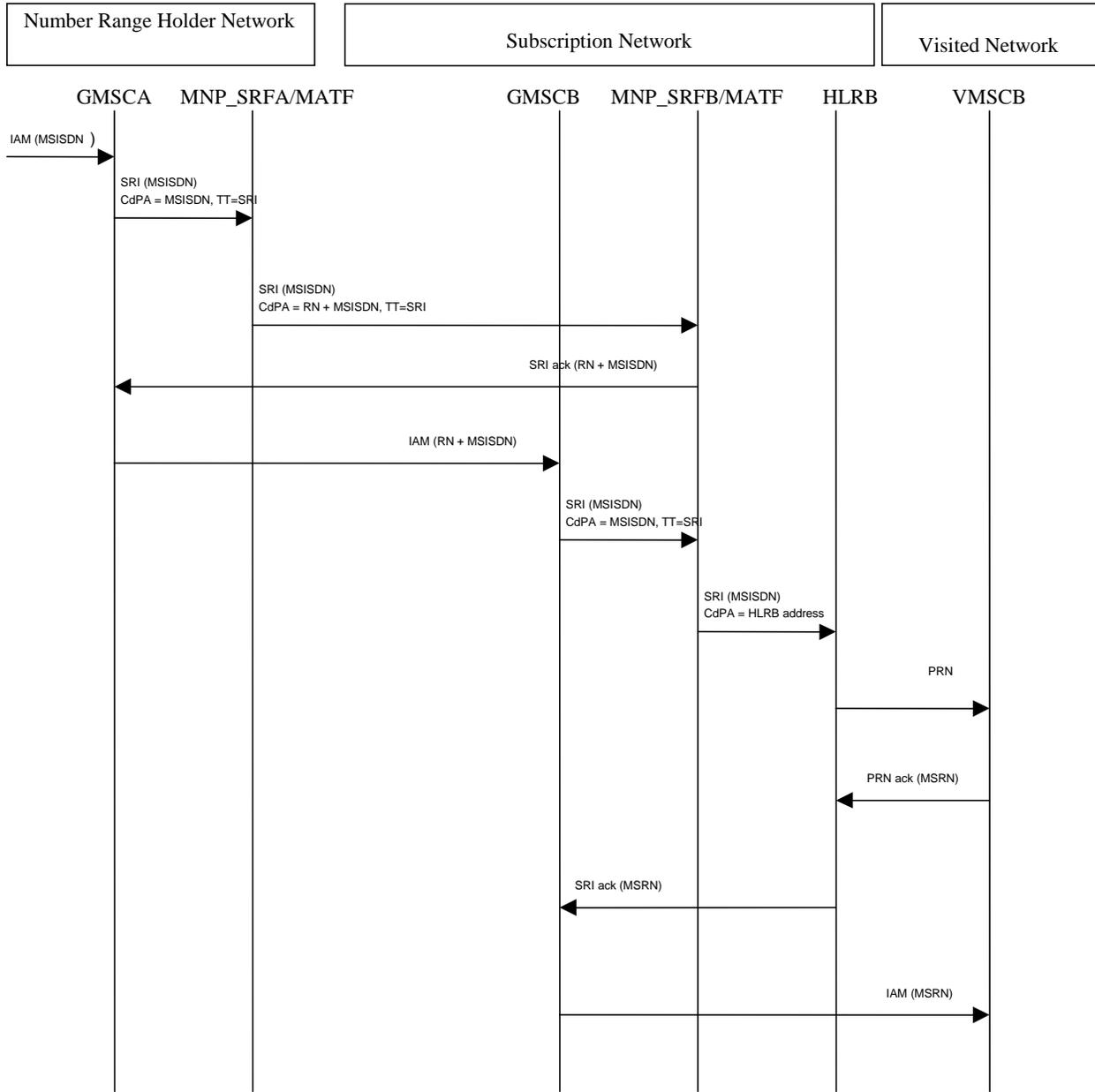


Figure C.4.5: Successful delivery of a call to a ported number via indirect routing

Figure C.4.6 shows the signalling involved for a call to a ported number where indirect routing with reference to the subscription network is used. The figure is related to figure C.3.5.



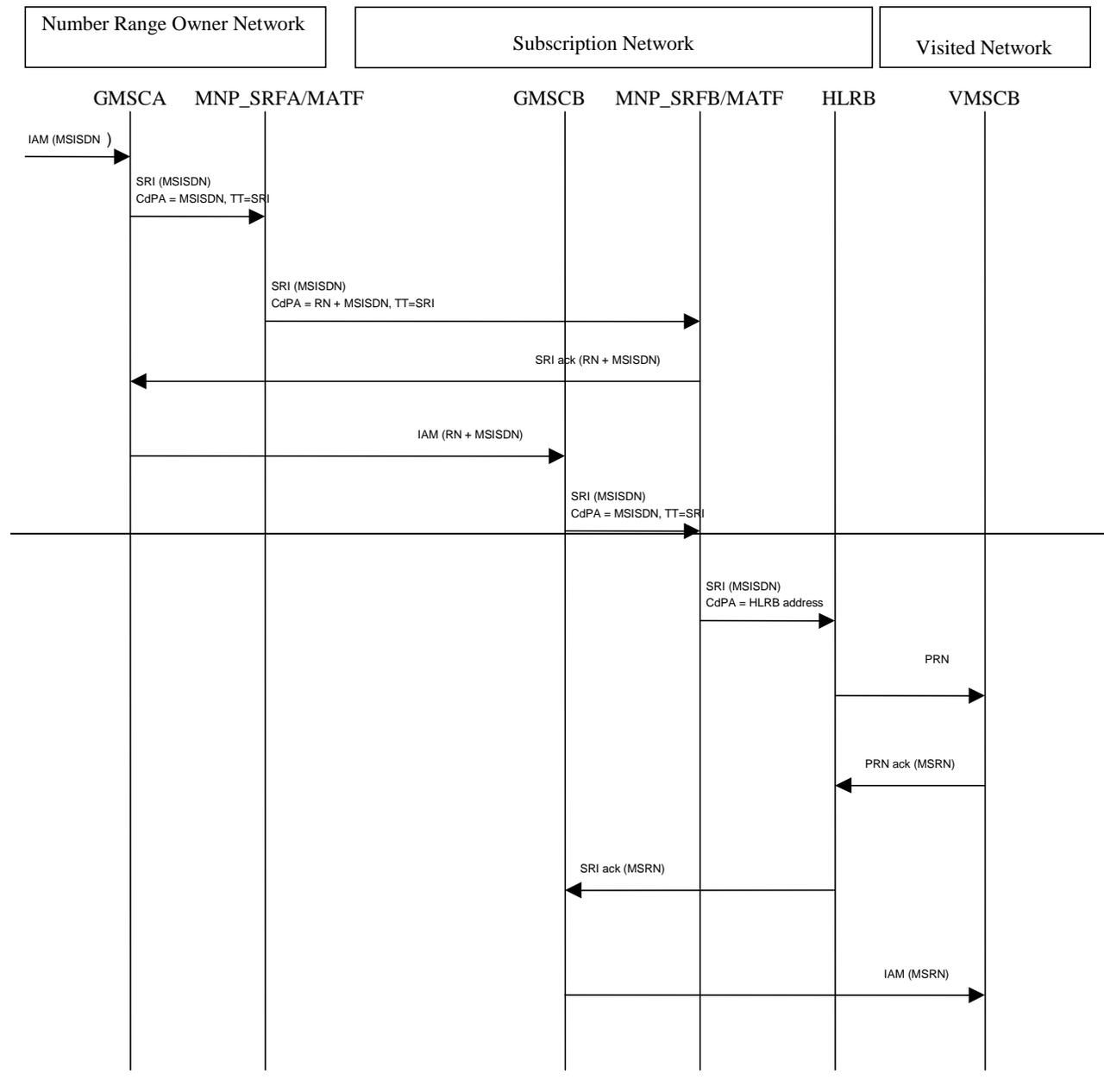


Figure C.4.6: Successful delivery for a call to a ported number where indirect routing with reference to the subscription network is used

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## C.6 Handling of MAP to ISUP mapping (informative)

Different configurations can be possible within a portability clusterdomain depending on the versions of MAP and ISUP protocols being used. The following sections describe possible interworking scenarios.

### C.6.1 Mapping direction: ISUP to MAP

The GMSC always constructs the Send Routeing Info message using the MSISDN. If the incoming IAM corresponds to a ported number the GMSC shall retrieve the MSISDN from the corresponding parameter in the IAM.

### C.6.2 Mapping direction: MAP to ISUP

In MAP SRIack messages from NPLR, MAP versions 1 and 2 only support concatenate addressing for MNP. If MSISDN parameter is present in the SRIack, this means that separate addressing is used in MAP; this is only possible if MAP version 3 is used. MAP version 3 can also support concatenate addressing. In all cases, when a Routeing Number is returned, it is included in the MSRN parameter of the SRIack.

Regardless of how MAP is established, the possible mappings of the parameters in ISUP IAM message is one of these 4 options (see also [7]):

- 1. CdPN parameter includes only the MSISDN
- 2. CdPN parameter includes both RN and MSISDN concatenated
- 3. CdPN parameter includes the MSISDN and NRN parameter includes the Routeing Number
- 4. CdPN parameter includes the Routeing Number and CDN parameter includes the MSISDN

In all cases, the method to transport the routing number in the IAM depends on the interfaces agreed by the operators in the portability clusterdomain.

# CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

**23.018 CR 043r1**

Current Version: **3.3.0**

GSM (AA.BB) or 3G (AA.BBB) specification number ↑

↑ CR number as allocated by MCC support team

For submission to: **CN#07** for approval   
list expected approval meeting # here ↑ for information

strategic  (for SMG use only)  
non-strategic

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

**Proposed change affects:** (U)SIM  ME  UTRAN / Radio  Core Network   
(at least one should be marked with an X)

**Source:** **N2** **Date:** **16.2.2000**

**Subject:** **Clarification of NPDB error detection and MNP specific call handling**

**Work item:** **Mobile Number Portability**

**Category:** F Correction  **Release:** Phase 2   
(only one category shall be marked with an X) A Corresponds to a correction in an earlier release  Release 96   
B Addition of feature  Release 97   
C Functional modification of feature  Release 98   
D Editorial modification  Release 99   
Release 00

**Reason for change:** At the moment possible error situations due to NPDB synchronisation errors are not clearly identified. A mechanism to detect NPDB synchronisation errors in GMSC is introduced and MNP specific call handling for IN and signalling relay based call related solutions is clarified.

**Clauses affected:** **7.2.1.1, 7.2.1.2, Annex A**

**Other specs affected:** Other 3G core specifications  → List of CRs: **23.066**  
Other GSM core specifications  → List of CRs:  
MS test specifications  → List of CRs:  
BSS test specifications  → List of CRs:  
O&M specifications  → List of CRs:

**Other comments:**



help.doc

<----- double-click here for help and instructions on how to create a CR.

### 7.2.1.1 Process MT\_GMSC

Sheet 1: the variables ACM sent, Answer sent, Network connect sent, Reconnect and Resume call are global data, accessible to the procedures CCBS\_MT\_GMSC\_Check\_CCBS Possible, CCBS\_Set\_Diagnostic\_For\_Release, Obtain\_Routeing\_Address, Send\_ACM\_If\_Required, Send\_Answer\_If\_Required and Send\_Network\_Connect\_If\_Required.

Sheet 1: the variable UUS CF interaction is specific to UUS; it is accessible to all UUS specific procedures in the GMSC.

[Sheet 1: the procedure MNP\\_MT\\_GMSC\\_Set\\_MNP\\_Parameters is specific to Mobile Number Portability; it is specified in TS 23.066 \[Error! Reference source not found.\].](#)

Sheet 1: the procedure OR\_Set\_ORA\_Parameters is specific to Support of Optimal Routeing; it is specified in GSM 03.79 [Error! Reference source not found.].

Sheet 1: the procedure CAMEL\_Set\_ORA\_Parameters is specific to CAMEL; it is specified in GSM 03.78 for CAMEL Phase 1 [Error! Reference source not found.] and GSM 03.78 for CAMEL Phase 2 [Error! Reference source not found.].

Sheet 1: the parameters "Reference address", "OR" and "Own PLMN" are passed to the procedure Obtain\_Routeing\_Address only if the GMSC supports Optimal Routeing. The parameter "Destination address" is returned by the procedure Obtain\_Routeing\_Address only if the GMSC supports Optimal Routeing of mobile-to-mobile calls. The Send Routeing Info negative response information element received in the execution of the procedure Obtain\_Routeing\_Address is global data, available to the parent process.

Sheet 1: the suggested mapping from values of the Send Routeing Info negative response information element to values of the ISUP release cause (see ITU-T Recommendation Q.850 [Error! Reference source not found.]) is shown in table 1. The mapping used is a matter for the network operator, depending on the telephony signalling system used.

**Table 1: Suggested mapping of Send Routeing Info (SRI) negative responses to ISUP release causes**

SRI negative response	ISUP release cause number	ISUP release cause name
Absent subscriber	20	Subscriber absent
Bearer service not provisioned	57	Bearer capability not authorised
Call barred (ODB)	21	Call rejected
Call barred (SS barring)	21	Call rejected
CUG reject (Called party SS interaction violation)	21	Call rejected
CUG reject (Incoming calls barred within CUG)	55	Incoming calls barred within CUG
CUG reject (Subscriber not member of CUG)	87	User not member of CUG
CUG reject (Requested basic service violates CUG constraints)	87	User not member of CUG
Data missing	111	Protocol error, unspecified
Facility not supported	69	Requested facility not implemented
Forwarding violation	21	Call rejected
Number changed	22	Number changed
System failure	111	Protocol error, unspecified
Teleservice not provisioned	57	Bearer capability not authorised
Unexpected data value	111	Protocol error, unspecified
Unknown subscriber	1	Unallocated (unassigned) number

Sheet 1: it is an operator option whether to send an Address Complete message if the Number Portability Database returns a routeing number. If the GMSC sends an Address Complete message, it shall include the called party's status field of the Backward call indicator set to "no indication".

Sheet 1: the called party address sent in the IAM to the process MT\_CF\_MSC is the Forwarded-to number received in the Perform Call Forwarding ack.

Sheet 1: the procedure CAMEL\_Store\_Destination\_Address is specific to CAMEL phase 3; it is specified in TS 23.078 for CAMEL Phase 3 [Error! Reference source not found.].

Sheet 1: it is an operator option whether to send an Address Complete message if the HLR returns forwarding information. If the GMSC sends an Address Complete message, it shall include the called party's status field of the Backward call indicator set to "no indication".

Sheet 2: the procedures CAMEL\_Start\_TNRy and CAMEL\_Stop\_TNRy are specific to CAMEL phase 2; they are specified in GSM 03.78 for CAMEL Phase 2 [**Error! Reference source not found.**].

Sheet 2, sheet 3: the procedure CAMEL\_MT\_GMSC\_ANSWER is specific to CAMEL; it is specified in GSM 03.78 for CAMEL Phase 1 [**Error! Reference source not found.**] and GSM 03.78 for CAMEL Phase 2 [**Error! Reference source not found.**]. If the GMSC does not support CAMEL, processing continues from the "Pass" exit of the test "Result".

Sheet 2, sheet 3: the task "Set destination address parameter" is executed only if the GMSC supports Optimal Routeing of mobile-to-mobile calls.

Sheet 3: the procedure Handle\_COLP\_Forwarding\_Interaction is specific to COLP.

Sheet 4: the input signal Resume Call Handling and all the subsequent processing on this sheet are specific to Support of Optimal Routeing, and will occur only if the GMSC supports Optimal Routeing. The procedure OR\_Handle\_RCH is specified in GSM 03.79 [**Error! Reference source not found.**].

Sheet 4, sheet 6: the procedure CCBS\_MT\_GMSC\_Check\_CCBS\_Possible is specific to CCBS; it is specified in GSM 03.93 [**Error! Reference source not found.**].

Sheet 5: the input signal TNRy expired and all the subsequent processing are specific to CAMEL phase 2, and will occur only if the GMSC supports CAMEL phase 2. The procedure CAMEL\_MT\_GMSC\_DISC5 is specified in GSM 03.78 for CAMEL phase 2 [**Error! Reference source not found.**].

Sheet 6: the procedures CAMEL\_MT\_GMSC\_DISC3, CAMEL\_MT\_GMSC\_DISC4 and CAMEL\_MT\_GMSC\_DISC6 are specific to CAMEL; they are specified in GSM 03.78 for CAMEL Phase 1 [**Error! Reference source not found.**] (CAMEL\_MT\_GMSC\_DISC3) and GSM 03.78 for CAMEL Phase 2 [**Error! Reference source not found.**] (CAMEL\_MT\_GMSC\_DISC4 and CAMEL\_MT\_GMSC\_DISC6)..

Sheet 6: the procedure CCBS\_Set\_Diagnostic\_For\_Release is specific to CCBS; it is specified in GSM 03.93 [**Error! Reference source not found.**].

Sheet 5: the procedures CAMEL\_MT\_GMSC\_DISC1 and CAMEL\_MT\_GMSC\_DISC2 are specific to CAMEL; they are specified in GSM 03.78 [**Error! Reference source not found.**]. If the GMSC does not support CAMEL, processing continues from the "No" exit of the test "Result=CAMEL handling?".

Sheet 6: the processing in the branch beginning with the Int\_Release\_Call input will occur only if the MSC supports CAMEL.

Sheet 7: the procedure CAMEL\_MT\_GMSC\_DISC1 is specific to CAMEL; it is specified in GSM 03.78 for CAMEL Phase 1 [**Error! Reference source not found.**] and GSM 03.78 for CAMEL Phase 2 [**Error! Reference source not found.**]. If the GMSC does not support CAMEL, processing continues from the "No" exit of the test "Result=CAMEL handling?".

Sheet 7: the procedure CAMEL\_MT\_GMSC\_DISC2 is specific to CAMEL; it is specified in GSM 03.78 for CAMEL Phase 1 [**Error! Reference source not found.**] and GSM 03.78 for CAMEL Phase 2 [**Error! Reference source not found.**]. If the GMSC does not support CAMEL, processing continues from the "Normal handling" exit of the test "Result?".

Sheet 7: in the upper subtree, the processing in the branch beginning with the Int\_Release\_Call input will occur only if the GMSC supports CAMEL.

Sheet 7: after the GMSC has sent an IAM to the destination VMSC or the forwarded-to exchange (via the process MT\_CF\_MSC), it acts as a relay for messages received from the originating exchange and the destination VMSC or the process MT\_CF\_MSC. Any message other than Address Complete, Connect, Answer or Release causes no change of state in the process MT\_GMSC.

### 7.2.1.2 Procedure Obtain\_Routeing\_Address

Sheet 1: the procedure MOBILE\_NUMBER\_PORTABILITY\_IN\_TQoD is specific to Mobile Number Portability; it is specified in GSM 03.66 [**Error! Reference source not found.**].

Sheet 1: the procedure CCBS\_MT\_GMSC\_Check\_CCBS\_Call is specific to CCBS; it is specified in GSM 03.93 [**Error! Reference source not found.**].

Sheet 1: the procedure CLI\_MT\_GMSC is specific to Enhanced CLI Handling. It is specified in GSM 03.81 [**Error! Reference source not found.**].

Sheet 2: the procedure OR\_Handle\_SRI\_Negative\_Response is specific to Support of Optimal Routeing. It is specified in GSM 03.79 [**Error! Reference source not found.**]. If the GMSC does not support Optimal Routeing, processing continues from the "No" exit of the test "Result=Pass?".

Sheet 2: the test "Error=Unknown subscriber" refers to the negative response value received from the HLR.

Sheet 2: the procedure MOBILE\_NUMBER\_PORTABILITY\_IN\_QoHR is specific to Mobile Number Portability; it is specified in GSM 03.66 [**Error! Reference source not found.**].

Sheet 3: the procedure CAMEL\_MT\_GMSC\_INIT is specific to CAMEL; it is specified in GSM 03.78 for CAMEL Phase 1 [**Error! Reference source not found.**] and GSM 03.78 for CAMEL Phase 2 [**Error! Reference source not found.**].

Sheet 3: the procedure CCBS\_MT\_GMSC\_Check\_CCBS\_Indicators is specific to CCBS; it is specified in GSM 03.93 [**Error! Reference source not found.**].

Sheet 2: the task "Store Forwarding Interrogation Required indicator" is executed only if the GMSC supports Optimal Routeing.

Sheet 2: The decision "MSRN contains a Routeing Number" is executed only if the SRF solution for call related MNP is used. If the SRF solution for call related MNP is not used, processing continues from the "No" exit of the test "MSRN contains a Routeing Number".

[Sheet 3: the procedure MNP\\_MT\\_GMSC\\_Check\\_MNP\\_Indicators is specific to Mobile Number Portability; it is specified in TS 23.066](#) [**Error! Reference source not found.**].

Sheet 3: the procedure CAMEL\_MT\_GMSC\_Notify\_CF is specific to CAMEL phase 2; it is specified in GSM 03.78 for CAMEL Phase 2 [**Error! Reference source not found.**]. If the GMSC does not support CAMEL, processing continues from the "Continue" exit of the test "Result".

Sheet 4: the task "BOR:=OR" is executed only if the GMSC supports Optimal Routeing of mobile-to-mobile calls.

Sheet 4: the procedures CCBS\_MT\_GMSC\_Remove\_Indicators\_Store\_FWT is specific to CCBS; it is specified in GSM 03.93 [**Error! Reference source not found.**].

Sheet 4: the procedure Route\_Permitted is specific to Support of Optimal Routeing. It is specified in GSM 03.79 [**Error! Reference source not found.**]. If the GMSC does not support Optimal Routeing, processing continues from the "True" exit of the test "Route permitted".

Sheet 4: the procedures CAMEL\_MT\_MSC\_DISC3 and CAMEL\_MT\_MSC\_DISC4 are specific to CAMEL; they are specified in GSM 03.78 for CAMEL Phase 1 [**Error! Reference source not found.**] and GSM 03.78 for CAMEL Phase 2 [**Error! Reference source not found.**] respectively.

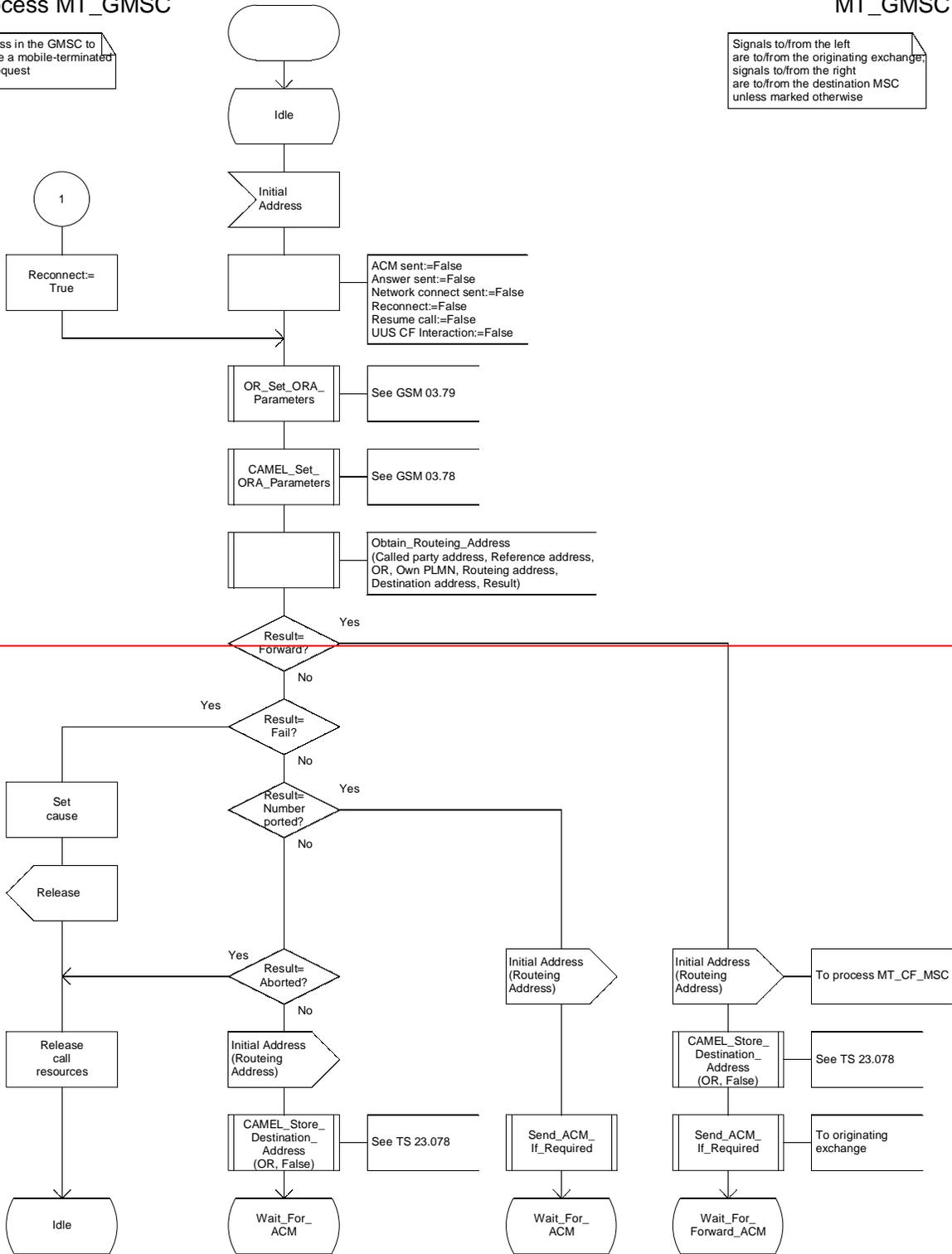
Sheet 4: the task "OR:= True" is executed only if the GMSC supports Optimal Routeing of mobile-to-mobile calls.

### Process MT\_GMSC

### MT\_GMSC1(7)

Process in the GMSC to handle a mobile-terminated call request

Signals to/from the left are to/from the originating exchange; signals to/from the right are to/from the destination MSC unless marked otherwise



### Process MT\_GMSC

### MT\_GMSC1(7)

Process in the GMSC to handle a mobile-terminated call request

Signals to/from the left are to/from the originating exchange; signals to/from the right are to/from the destination MSC unless marked otherwise

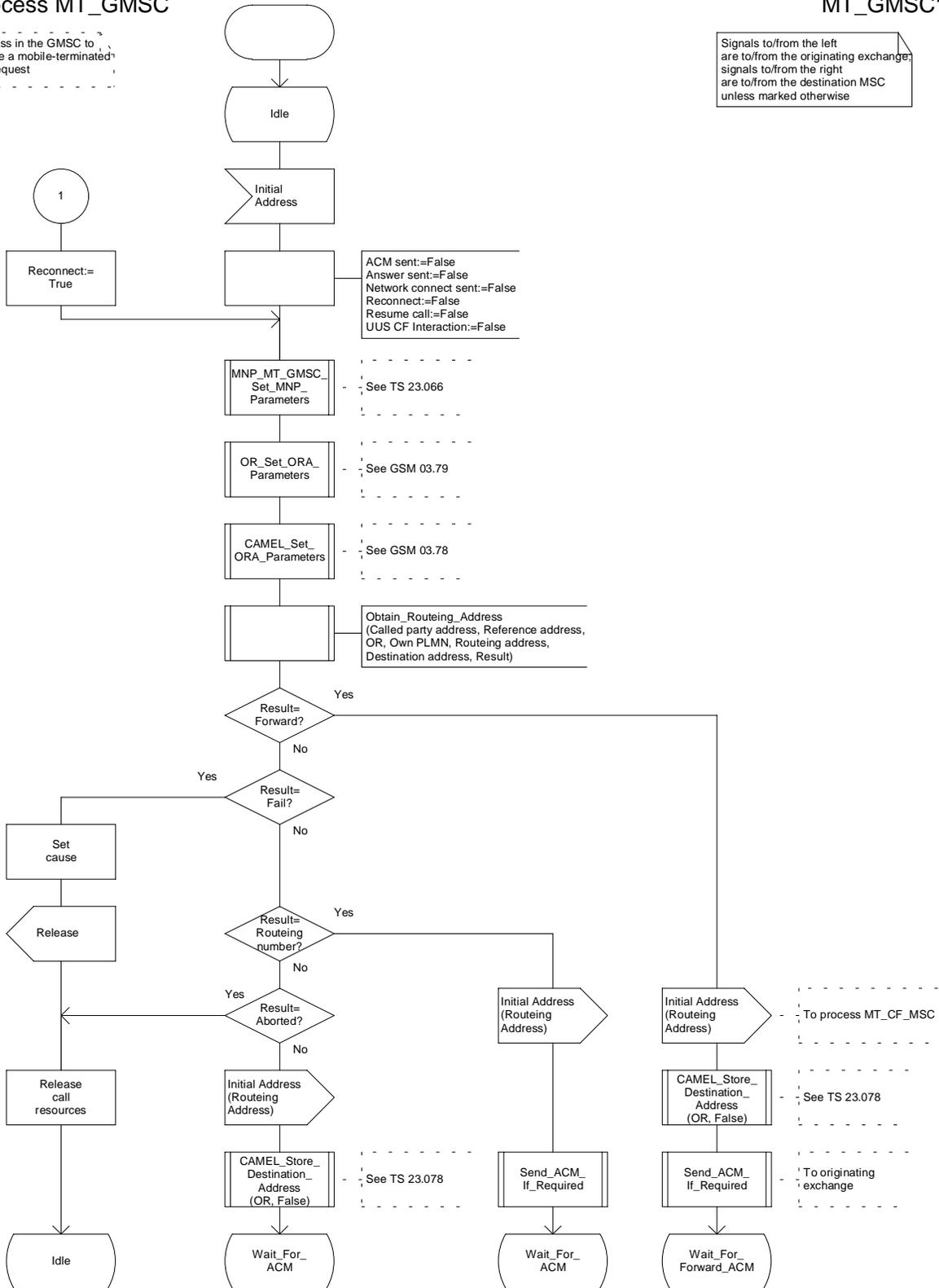


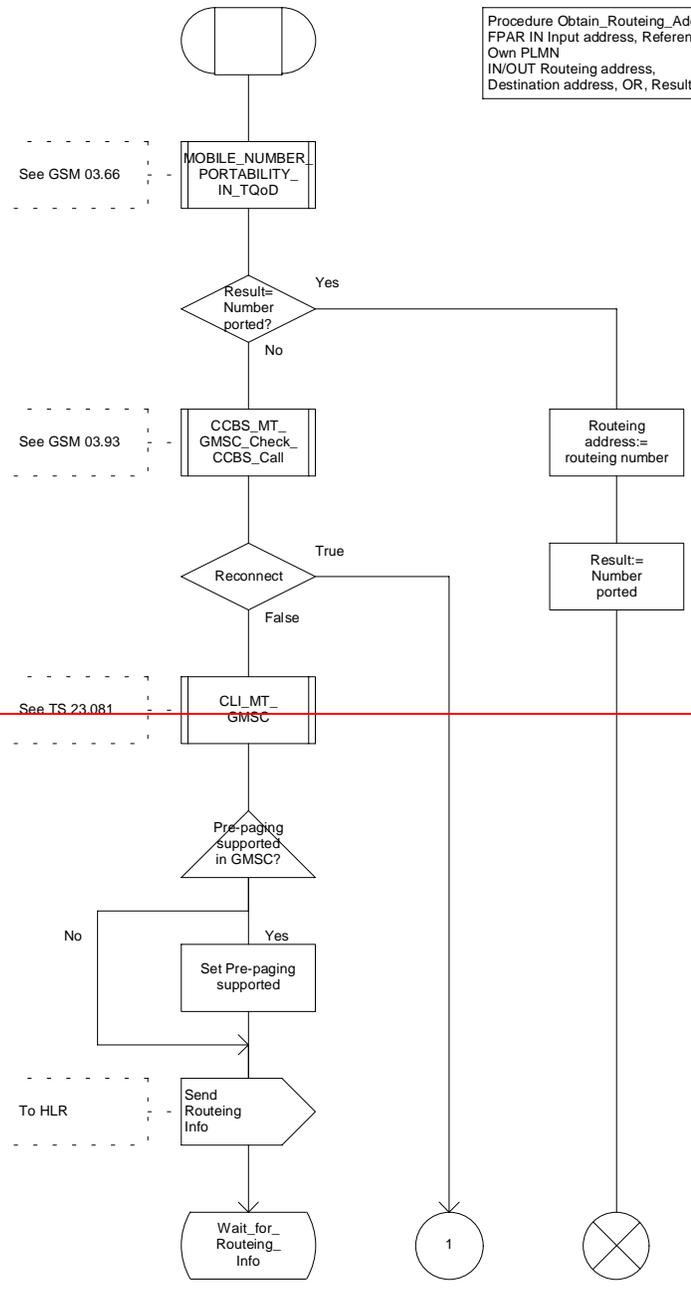
Figure 1a: Process MT\_GMSC (sheet 1)

### Procedure Obtain\_Routeing\_Address

ORA1(4)

Procedure in a GMSC to determine the address to which a call should be routed.

Procedure Obtain\_Routeing\_Address  
FPAR IN Input address, Reference address, Own PLMN  
IN/OUT Routeing address, Destination address, OR, Result



### Procedure Obtain\_Routeing\_Address

ORA1(4)

Procedure in a GMSC to determine the address to which a call should be routed

Procedure Obtain\_Routeing\_Address  
FPAR IN Input address, Reference address, Own PLMN  
IN/OUT Routeing address, Destination address, OR, Result

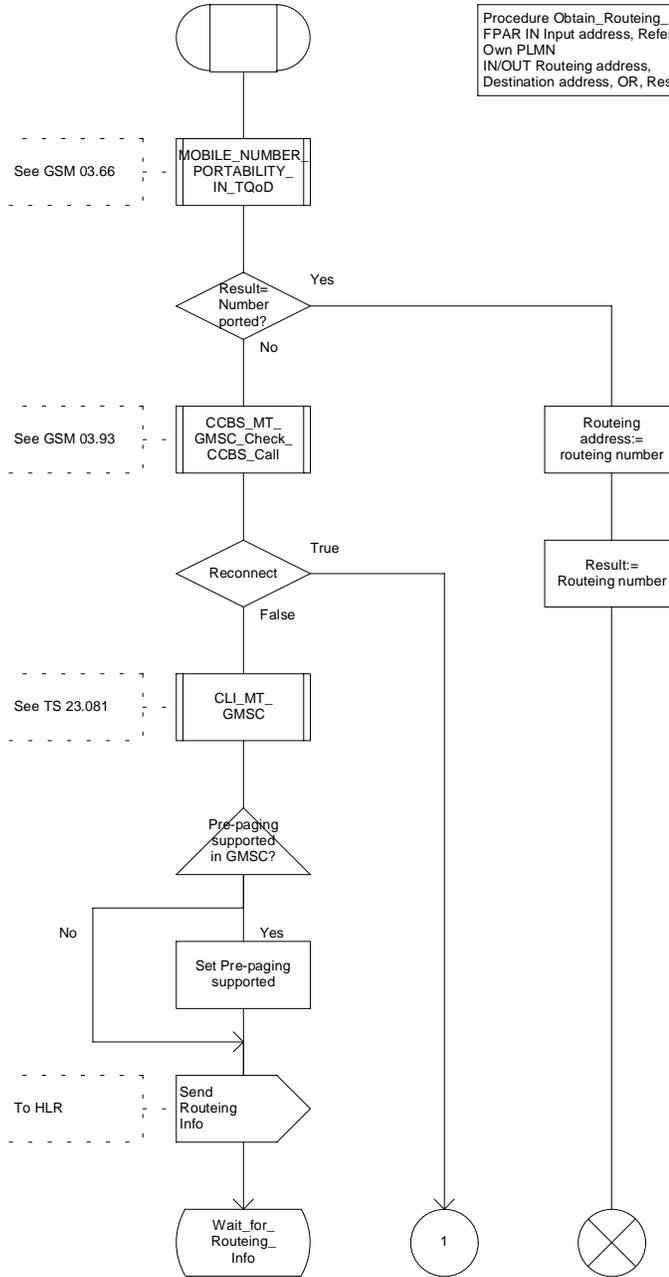


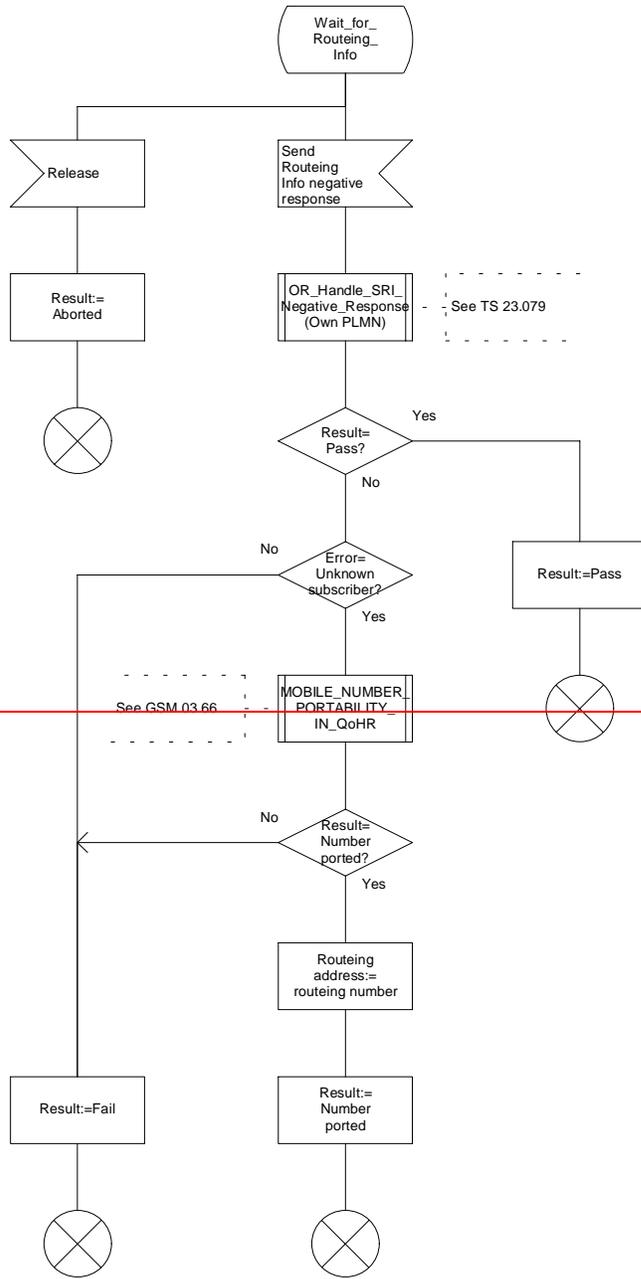
Figure 2a: Procedure Obtain\_Routeing\_Address (sheet 1)

### Procedure Obtain\_Routeing\_Address

ORA2(4)

Procedure in a GMSC to determine the address to which a call should be routed.

Signals to/from the left are to/from the originating exchange, signals to/from the right are to/from the HLR



See GSM 03.66

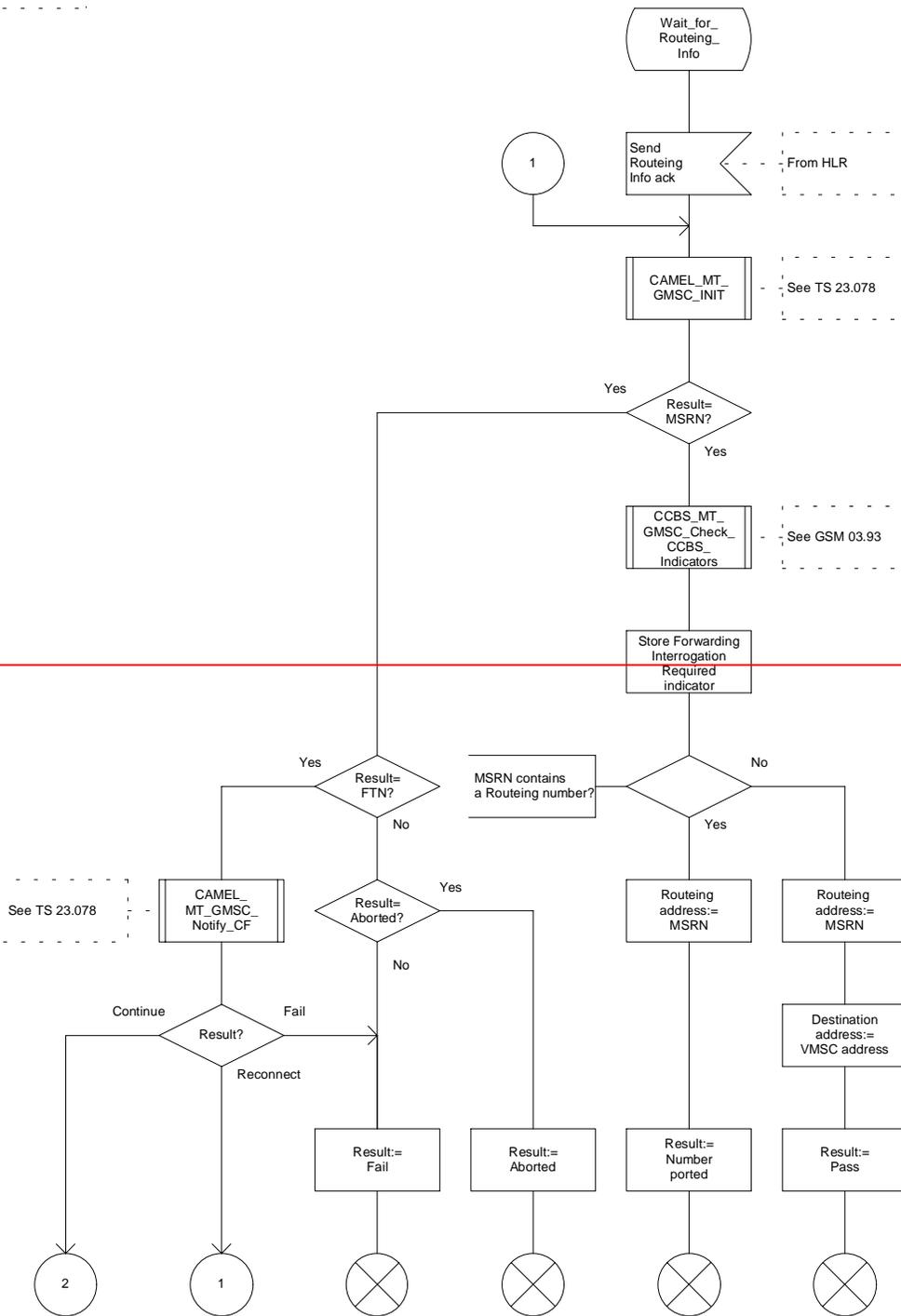
See TS 23.079



### Procedure Obtain\_Routeing\_Address

ORA3(4)

Procedure in a GMSC to determine the address to which a call should be routed.



### Procedure Obtain\_Routeing\_Address

ORA3(4)

Procedure in a GMSC to determine the address to which a call should be routed

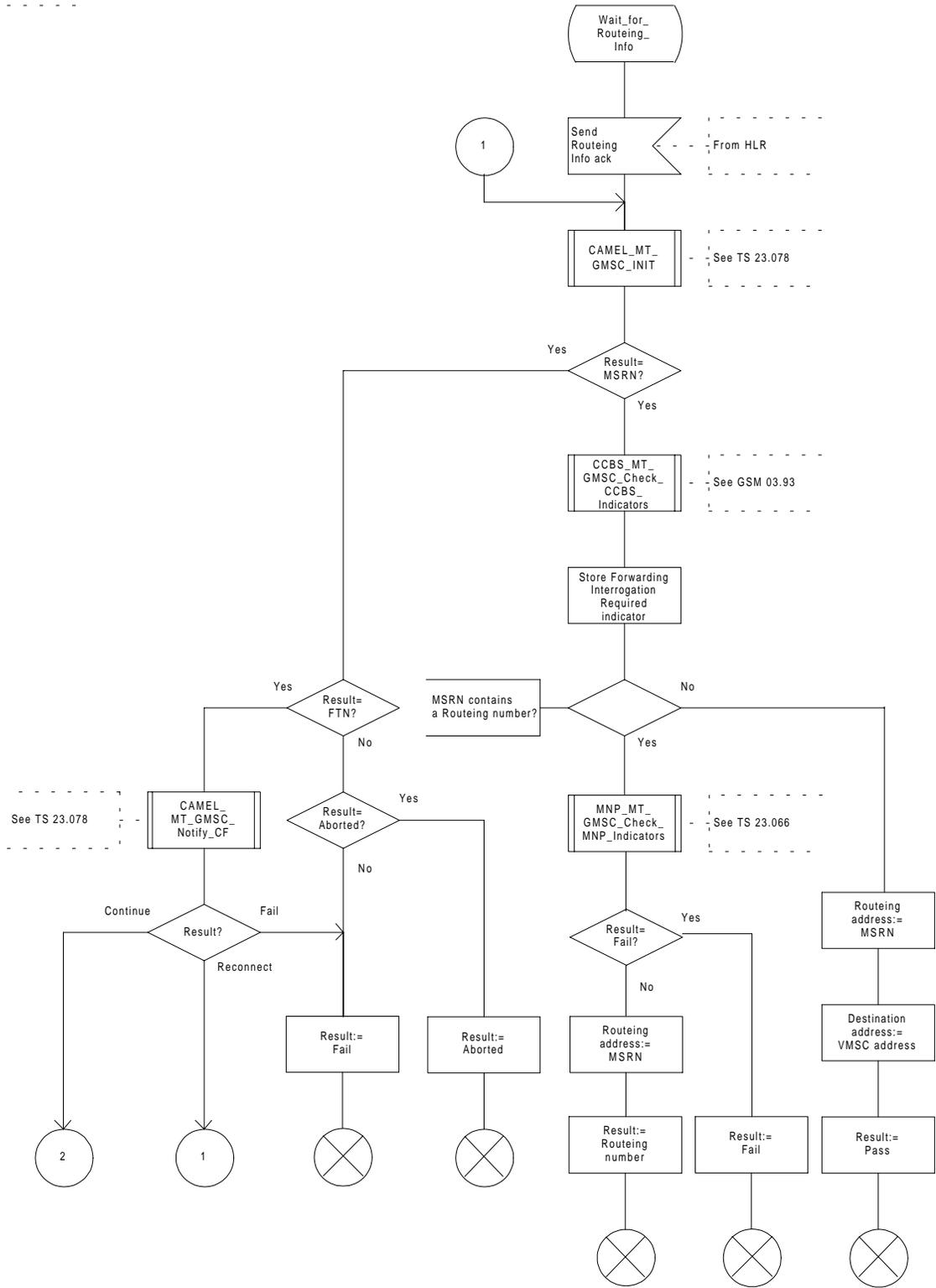


Figure 2c: Procedure Obtain\_Routeing\_Address (sheet 3)

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## Annex A (informative): Handling of an IAM at an MSC

An MSC which receives an IAM from an originating exchange may react in three different ways:

- It acts as a transit exchange, i.e. it relays the IAM to a destination exchange determined by analysis of the called party address, and thereafter relays other telephony signalling between the originating and destination exchange until the connection is released. This behaviour is not specific to GSM;
- It acts as a terminating exchange, i.e. it attempts to connect the call to an MS currently registered in the service area of the MSC;
- It acts as a GMSC, i.e. it interrogates an HLR for information to route the call. If the HLR returns routing information, the MSC uses the routing information from the HLR to construct an IAM, which it sends to a destination exchange determined by analysis of the routing information from the HLR.

Sheet 1: when the MSC co-ordinating process has decided whether the MSC is to act as a terminating VMSC, a GMSC or a transit exchange, it forwards the IAM to an idle instance of the appropriate process.

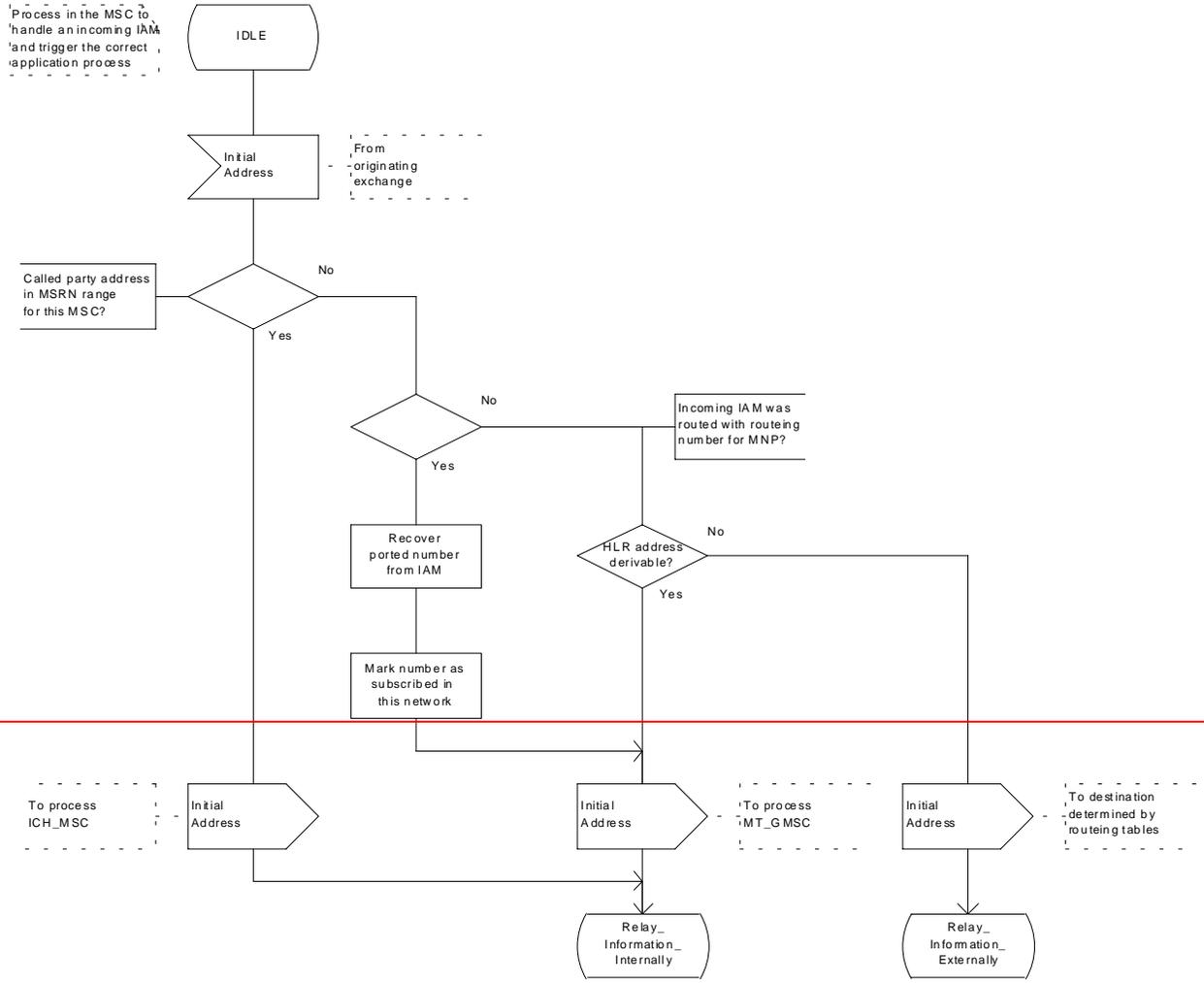
Sheet 2: after the MSC co-ordinating process has sent an IAM to an instance of the process MT\_GMSC or ICH\_MSC, it acts as a transparent relay for messages received from the originating exchange and the process instance (denoted by "offspring"). After the MSC co-ordinating process has relayed a Release message, it returns to the idle state.

Sheet 2: after the MSC co-ordinating process has sent an IAM to a destination exchange, it acts as a transparent relay for messages received from the originating exchange and the destination exchange. After the MSC co-ordinating process has relayed a Release message, it returns to the idle state.

### Process MSC\_Coord

Coord\_M1(2)

'Process in the MSC to  
'handle an incoming IAM  
'and trigger the correct  
'application process



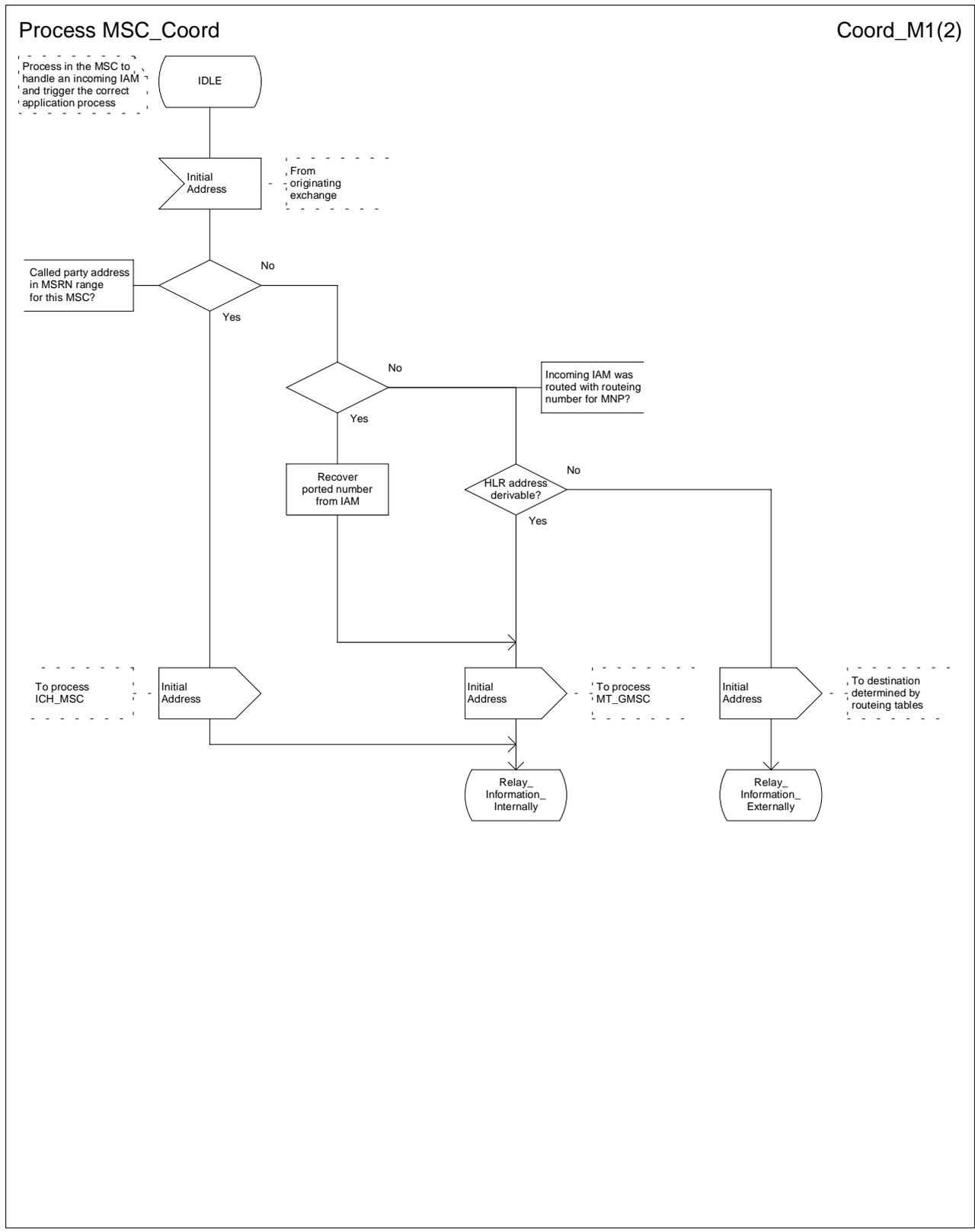


Figure 3a: Process MSC\_Coord (sheet 1)

3GPP TSN CN WG2-B  
Kista, Sweden  
2-3 March, 2000

Tdoc N2B000462

CHANGE REQUEST No :

050r3

*Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.*

Technical Specification GSM

23.018

Version:

3.3.0

Submitted to TSG

CN#07

for approval

without presentation ("non-strategic")

*list SMG plenary meeting no. here* ↑

for information

with presentation ("strategic")

*PT SMG CR cover form is available from: [http://docbox.etsi.org/tech-org/smg/Document/smg/tools/CR\\_form/crf28\\_1.zip](http://docbox.etsi.org/tech-org/smg/Document/smg/tools/CR_form/crf28_1.zip)*

**Proposed change affects:**

SIM

ME

Network

*(at least one should be marked with an X)*

**Work item:** Mobile Number Portability (MNP)

**Source:** N2

**Date:** 29<sup>th</sup> March 2000

**Subject:** ISUP release cause value

<b><u>Category:</u></b> <i>(one category and one release only shall be marked with an X)</i>	Correction	<input type="checkbox"/>	<b><u>Release:</u></b> Phase 2	<input type="checkbox"/>
	Corresponds to a correction in an earlier release	<input type="checkbox"/>	Release 96	<input type="checkbox"/>
	Addition of feature	<input type="checkbox"/>	Release 97	<input type="checkbox"/>
	Functional modification of feature	<input checked="" type="checkbox"/>	Release 98	<input type="checkbox"/>
	Editorial modification	<input type="checkbox"/>	Release 99	<input checked="" type="checkbox"/>

**Reason for change:** Other ISUP release cause values than 26 for "Misrouted call to a ported number" are required, depending on national regulations.

An addition to the text proposed på T1P1.5 is therefore proposed.

**Clauses affected:** 7.2.1.1

<b><u>Other specs affected:</u></b>	Other releases of same spec	<input type="checkbox"/>	→ List of CRs:	
	Other core specifications	<input type="checkbox"/>	→ List of CRs:	
	MS test specifications / TBRs	<input type="checkbox"/>	→ List of CRs:	
	BSS test specifications	<input type="checkbox"/>	→ List of CRs:	
	O&M specifications	<input type="checkbox"/>	→ List of CRs:	

**Other comments:**

# 3G TS 23.018 V3.3.0 (2000-01)

---

*Technical Specification*

**3rd Generation Partnership Project;  
Technical Specification Group Core Network;  
Basic call handling;  
Technical realization  
(3G TS 23.018 version 3.3.0 Release 99)**



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Reference

DTS/TSGN-02223018U

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Keywords

3GPP, CN

**3GPP**

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### 7.2.1.1 Process MT\_GMSC

Sheet 1: the variables ACM sent, Answer sent, Network connect sent, Reconnect and Resume call are global data, accessible to the procedures CCBS\_MT\_GMSC\_Check\_CCBS Possible, CCBS\_Set\_Diagnostic\_For\_Release, Obtain\_Routeing\_Address, Send\_ACM\_If\_Required, Send\_Answer\_If\_Required and Send\_Network\_Connect\_If\_Required.

Sheet 1: the variable UUS CF interaction is specific to UUS; it is accessible to all UUS specific procedures in the GMSC.

Sheet 1: the procedure OR\_Set\_ORA\_Parameters is specific to Support of Optimal Routeing; it is specified in GSM 03.79 [[Error! Reference source not found.](#) **Fel! Hittar inte referensskälla.**].

Sheet 1: the procedure CAMEL\_Set\_ORA\_Parameters is specific to CAMEL; it is specified in GSM 03.78 for CAMEL Phase 1 [[Error! Reference source not found.](#) **Fel! Hittar inte referensskälla.**] and GSM 03.78 for CAMEL Phase 2 [[Error! Reference source not found.](#) **Fel! Hittar inte referensskälla.**].

Sheet 1: the parameters "Reference address", "OR" and "Own PLMN" are passed to the procedure Obtain\_Routeing\_Address only if the GMSC supports Optimal Routeing. The parameter "Destination address" is returned by the procedure Obtain\_Routeing\_Address only if the GMSC supports Optimal Routeing of mobile-to-mobile calls. The Send Routeing Info negative response information element received in the execution of the procedure Obtain\_Routeing\_Address is global data, available to the parent process.

Sheet 1: the suggested mapping from values of the Send Routeing Info negative response information element to values of the ISUP release cause (see ITU-T Recommendation Q.850 [[Error! Reference source not found.](#) **Fel! Hittar inte referensskälla.**]) is shown in table 1. The mapping used is a matter for the network operator, depending on the telephony signalling system used.

**Table 1: Suggested mapping of Send Routeing Info (SRI) negative responses to ISUP release causes**

SRI negative response	ISUP release cause number	ISUP release cause name
Absent subscriber	20	Subscriber absent
Bearer service not provisioned	57	Bearer capability not authorised
Call barred (ODB)	21	Call rejected
Call barred (SS barring)	21	Call rejected
CUG reject (Called party SS interaction violation)	21	Call rejected
CUG reject (Incoming calls barred within CUG)	55	Incoming calls barred within CUG
CUG reject (Subscriber not member of CUG)	87	User not member of CUG
CUG reject (Requested basic service violates CUG constraints)	87	User not member of CUG
Data missing	111	Protocol error, unspecified
Facility not supported	69	Requested facility not implemented
Forwarding violation	21	Call rejected
Number changed	22	Number changed
System failure	111	Protocol error, unspecified
Teleservice not provisioned	57	Bearer capability not authorised
Unexpected data value	111	Protocol error, unspecified
Unknown subscriber	1	Unallocated (unassigned) number <a href="#">Misrouted call to a ported number NOTE</a>

**NOTE:** [If the Diagnostic parameter indicates “NPDB mismatch”, MNP can require a specific ISUP release cause value, according to National Coding Standard, to indicate “Misrouted call to a ported number”, depending on national regulations.](#)

Sheet 1: it is an operator option whether to send an Address Complete message if the Number Portability Database returns a routeing number. If the GMSC sends an Address Complete message, it shall include the called party's status field of the Backward call indicator set to "no indication".

Sheet 1: the called party address sent in the IAM to the process MT\_CF\_MSC is the Forwarded-to number received in the Perform Call Forwarding ack.

Sheet 1: the procedure CAMEL\_Store\_Destination\_Address is specific to CAMEL phase 3; it is specified in TS 23.078 for CAMEL Phase 3 [[Error! Reference source not found.](#) ~~Fel! Hittar inte referenskölla.~~].

Sheet 1: it is an operator option whether to send an Address Complete message if the HLR returns forwarding information. If the GMSC sends an Address Complete message, it shall include the called party's status field of the Backward call indicator set to "no indication".

Sheet 2: the procedures CAMEL\_Start\_TNRy and CAMEL\_Stop\_TNRy are specific to CAMEL phase 2; they are specified in GSM 03.78 for CAMEL Phase 2 [[Error! Reference source not found.](#) ~~Fel! Hittar inte referenskölla.~~].

Sheet 2, sheet 3: the procedure CAMEL\_MT\_GMSC\_ANSWER is specific to CAMEL; it is specified in GSM 03.78 for CAMEL Phase 1 [[Error! Reference source not found.](#) ~~Fel! Hittar inte referenskölla.~~] and GSM 03.78 for CAMEL Phase 2 [[Error! Reference source not found.](#) ~~Fel! Hittar inte referenskölla.~~]. If the GMSC does not support CAMEL, processing continues from the "Pass" exit of the test "Result".

Sheet 2, sheet 3: the task "Set destination address parameter" is executed only if the GMSC supports Optimal Routing of mobile-to-mobile calls.

Sheet 3: the procedure Handle\_COLP\_Forwarding\_Interaction is specific to COLP.

Sheet 4: the input signal Resume Call Handling and all the subsequent processing on this sheet are specific to Support of Optimal Routing, and will occur only if the GMSC supports Optimal Routing. The procedure OR\_Handle\_RCH is specified in GSM 03.79 [[Error! Reference source not found.](#) ~~Fel! Hittar inte referenskölla.~~].

Sheet 4, sheet 6: the procedure CCBS\_MT\_GMSC\_Check\_CCBS\_Possible is specific to CCBS; it is specified in GSM 03.93 [[Error! Reference source not found.](#) ~~Fel! Hittar inte referenskölla.~~].

Sheet 5: the input signal TNRy expired and all the subsequent processing are specific to CAMEL phase 2, and will occur only if the GMSC supports CAMEL phase 2. The procedure CAMEL\_MT\_GMSC\_DISC5 is specified in GSM 03.78 for CAMEL phase 2 [[Error! Reference source not found.](#) ~~Fel! Hittar inte referenskölla.~~].

Sheet 6: the procedures CAMEL\_MT\_GMSC\_DISC3, CAMEL\_MT\_GMSC\_DISC4 and CAMEL\_MT\_GMSC\_DISC6 are specific to CAMEL; they are specified in GSM 03.78 for CAMEL Phase 1 [[Error! Reference source not found.](#) ~~Fel! Hittar inte referenskölla.~~] (CAMEL\_MT\_GMSC\_DISC3) and GSM 03.78 for CAMEL Phase 2 [[Error! Reference source not found.](#) ~~Fel! Hittar inte referenskölla.~~] (CAMEL\_MT\_GMSC\_DISC4 and CAMEL\_MT\_GMSC\_DISC6)..

Sheet 6: the procedure CCBS\_Set\_Diagnostic\_For\_Release is specific to CCBS; it is specified in GSM 03.93 [[Error! Reference source not found.](#) ~~Fel! Hittar inte referenskölla.~~].

Sheet 5: the procedures CAMEL\_MT\_GMSC\_DISC1 and CAMEL\_MT\_GMSC\_DISC2 are specific to CAMEL; they are specified in GSM 03.78 [[Error! Reference source not found.](#) ~~Fel! Hittar inte referenskölla.~~]. If the GMSC does not support CAMEL, processing continues from the "No" exit of the test "Result=CAMEL handling?".

Sheet 6: the processing in the branch beginning with the Int\_Release\_Call input will occur only if the MSC supports CAMEL.

Sheet 7: the procedure CAMEL\_MT\_GMSC\_DISC1 is specific to CAMEL; it is specified in GSM 03.78 for CAMEL Phase 1 [[Error! Reference source not found.](#) ~~Fel! Hittar inte referenskölla.~~] and GSM 03.78 for CAMEL Phase 2 [[Error! Reference source not found.](#) ~~Fel! Hittar inte referenskölla.~~]. If the GMSC does not support CAMEL, processing continues from the "No" exit of the test "Result=CAMEL handling?".

Sheet 7: the procedure CAMEL\_MT\_GMSC\_DISC2 is specific to CAMEL; it is specified in GSM 03.78 for CAMEL Phase 1 [[Error! Reference source not found.](#) ~~Fel! Hittar inte referenskölla.~~] and GSM 03.78 for CAMEL Phase 2 [[Error! Reference source not found.](#) ~~Fel! Hittar inte referenskölla.~~]. If the GMSC does not support CAMEL, processing continues from the "Normal handling" exit of the test "Result?".

Sheet 7: in the upper subtree, the processing in the branch beginning with the Int\_Release\_Call input will occur only if the GMSC supports CAMEL.

Sheet 7: after the GMSC has sent an IAM to the destination VMSC or the forwarded-to exchange (via the process MT\_CF\_MSC), it acts as a relay for messages received from the originating exchange and the destination VMSC or the process MT\_CF\_MSC. Any message other than Address Complete, Connect, Answer or Release causes no change of state in the process MT\_GMSC.

# CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

**23.066 CR 012r2**

Current Version: **3.1.0**

GSM (AA.BB) or 3G (AA.BBB) specification number ↑

↑ CR number as allocated by MCC support team

For submission to: **CN #07**  
list expected approval meeting # here ↑

for approval   
for information

strategic   
non-strategic  (for SMG use only)

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: <ftp://ftp.3gpp.org/Information/CR-Form-v2.doc>

**Proposed change affects:**  
(at least one should be marked with an X)

(U)SIM  ME  UTRAN / Radio  Core Network

**Source:**

**N2**

**Date:**

**2000-02-29**

**Subject:**

**Result of Public Enquiry 9953**

**Work item:**

**Mobile Number Portability**

**Category:**

(only one category shall be marked with an X)

F Correction   
A Corresponds to a correction in an earlier release   
B Addition of feature   
C Functional modification of feature   
D Editorial modification

**Release:**

Phase 2   
Release 96   
Release 97   
Release 98   
Release 99   
Release 00

**Reason for change:**

**Mirror CR to Tdoc N2B000432, CR 03.66-A014r2 on Results of Public Enquiry 9953**

**Clauses affected:**

**2, 3, 4, 5, A.1.2 to A.1.4, A.2, B.4.2 to B.4.9, C.3, C4, C.6**

**Other specs affected:**

Other 3G core specifications  → List of CRs:  
Other GSM core specifications  → List of CRs:  
MS test specifications  → List of CRs:  
BSS test specifications  → List of CRs:  
O&M specifications  → List of CRs:

**Other comments:**



help.doc

<----- double-click here for help and instructions on how to create a CR.

---

## 2 References

### 2.1 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.
- For this Release 1998 document, references to GSM documents are for Release 1998 versions (version 7.x.y).

- [1] GSM 01.04: (ETR 350) "Digital cellular telecommunications system (Phase 2+); Abbreviations and acronyms".
- [2] ETS 300 009 (December 1991): "Integrated Services Digital Network (ISDN); CCITT Signalling System No. 7 – Signalling Connection Control Part (SCCP) [connectionless services] to support international interconnection".
- [3] GSM 02.66: "Digital cellular telecommunications system (Phase 2+); Support of Mobile Number Portability (MNP); Service description. Stage 1".
- [4] GSM 03.18: "Digital cellular telecommunications system (Phase 2+); Basic call handling ; Technical realisation".
- [5] GSM 09.02 (ETS 300 974): "Digital cellular telecommunications system (Phase 2+); Mobile Application Part (MAP) specification".
- [6] ETS 300 374-1: "Intelligent Network (IN); Intelligent Network Capability Set 1 (CS1); Core Intelligent Network Application Protocol (INAP); Part 1: protocol specification".
- [7] draft EN 302 097 V1.1.2 (1999-01): "Integrated Services Digital Network (ISDN); Signalling System No.7; ISDN User Part (ISUP); Enhancements for support of Number Portability (NP)".
- [8] draft EN 300 356-2 V4.0.0: "Integrated Services Digital Network (ISDN); Signalling System No.7; ISDN User Part (ISUP) version 4 for the international interface; Part 2: ISDN supplementary services [ITU-T Recommendation Q.730 modified]"
- 

## 3 Definitions and abbreviations

### 3.1 Definitions

For the purposes of the present document, the following definitions apply:

**donor network:** the subscription network from which a number is ported in the porting process. This may or may not be the number range ~~owner~~holder network.

**interrogating network entity:** the entity that submits a non-call related signalling message to interrogate the HLR;

**interrogating network:** the network in which the interrogating network entity resides;

**mobile number portability:** the ability for a mobile subscriber to change GSM subscription network within the same country whilst retaining their original MSISDN(s).

**network operator:** a GSM PLMN operator.

**non-call related signalling message:** all signalling messages where the MSISDN is used to route the message on SCCP level except MAP SRI without OR parameter set (i.e. SRI\_SMS, SRI for SOR, Send\_IMSI, CCBS\_Request etc);

**number portability database:** an Operational database (used in real time at call set-up) which provides portability information.

**number portability location register:** an internal MAP application terminating function (MATF) in the MNP-SRF network entity with an (unspecified) interface with a NPDB.

**number range ownerholder network:** the network to which the number range containing the ported number has been allocated.

**originating network:** the network where the calling party is located.

**portability clusterdomain:** a set of GSM PLMNs in a country between which MSISDNs may be ported.

**portable number:** an E.164 number that can be ported between networks in one nation.

**ported number:** a portable number that has undergone the porting process.

**ported subscriber:** the subscriber of a ported number.

**porting process:** a description of the transfer of a number between network operators.

**recipient network:** the network which receives the number in the porting process. This network becomes the subscription network when the porting process is complete.

**routeing number:** the routeing number is the data stored against the ported number in the Number Portability Database.

**service key:** the Service Key can identify to the entity holding the Number Portability Database that the service logic for Mobile Number Portability should apply. The Service Key value for Mobile Number Portability is administered in the MSC, and is passed transparently to the entity holding the Number Portability Database.

**service provider:** an entity which offers service subscriptions to individual subscribers and contracts with a network operator to implement services for a specific MSISDN. A service provider may contract with more than one network operator.

**service provider portability:** the transfer of numbers between two unique Service Providers.

**subscription network:** the network with which the customer's Service Provider has a contract to implement the customer's services for a specific MSISDN.

NOTE: The term "recipient network" is used during the porting process. The recipient network becomes the "subscription network" after the completion of the porting process.

## 3.2 Abbreviations

Abbreviations used in the present document are listed in GSM 01.04 ([1]).

For the purposes of the present document, the following abbreviations apply:

GMSC	Gateway MSC
GMSCB	The GMSC in HPLMNB
HLR	Home Location Register
HPLMNB	The subscription network of the B subscriber
IDP	Initial Detection Point
IE	Information Element
INE	Interrogating Network Entity
IF	Information Flow

IPLMN	Interrogating PLMN
MATF	MAP application Terminating Function
MNP	Mobile Number Portability
MNP-SRF	Signalling Relay Function for support of MNP
MSA	Mobile Station of the A subscriber
MSB	Mobile Station of the B subscriber
MSC	Mobile service Switching Centre
NPDB	Number Portability Database
NPLMN	The number range <u>ownerholder</u> network of the B subscriber
<u>NPLR</u>	<u>Number Portability Location Register</u>
OQoD	Originating call Query on Digit Analysis
PLMN	Public Land Mobile Network
QoHR	Query on HLR Release
RN	Routing Number
SMS	Short Message Service
SOR	Support of Optimal Routeing
SRI	Send Routeing Information
TQoD	Terminating call Query on Digit Analysis
TT	Translation Type
VMSC	The Visited MSC
VMSCB	The VMSC of the B subscriber

Further GSM related abbreviations are given in GSM 01.04.

## 4 General

### 4.1 Overview

Mobile Number Portability (MNP) is the ability for a mobile subscriber to change the GSM subscription network within a portability clusterdomain whilst retaining her original MSISDN or MSISDNs.

As part of the porting process administrative actions have to be performed by the GSM network operators of the number range ownerholder network, donor network, recipient network and, as an option, by operators of other national GSM networks as follows:

a) if the number range ownerholder network is identical with the donor network:

Recipient network:	add an entry in the HLR; add an entry in the Number Portability Database.
Donor network:	add an entry in the Number Portability Database; delete the entry related to the ported MSISDNs in the HLR.
Other networks in the portability <u>clusterdomain</u> :	add an entry in the Number Portability Database (if direct routeing is used).

b) if the number range ownerholder network is identical with the recipient network:

Recipient network:	add an entry in the HLR; delete any entry related to the ported MSISDN in the Number Portability Database.
Donor network:	delete any entry related to the ported MSISDN in the Number Portability Database; delete the entry related to the ported MSISDNs in the HLR.
Other networks in the portability <u>clusterdomain</u> :	delete any entry related to the ported MSISDN in the Number Portability Database.

c) if the number range ~~owner~~holder network is different from both the recipient and the donor network:

Recipient network:	add an entry in the HLR; add an entry in the Number Portability Database.
Number range <del>owner</del> <u>holder</u> network:	update the Number Portability Database
Donor network:	delete (or update) the entry in the Number Portability Database; delete the entry related to the ported MSISDNs in the HLR.
Other networks in the portability <del>cluster</del> <u>domain</u> :	update the Number Portability Database (if an entry for the ported MSISDN exists ).

Note that the order of sequence for the administrative actions to be performed both within a network and by different network operators is significant with respect to prevention of disruption in service to the mobile subscriber and prevention of looping calls between networks during the porting process.

Termination of a subscription for a ported number results in the deletion of any entry in an HLR and NPDB of that number.

If a call fails because databases are not correctly synchronised, the network entity which detects the inconsistency will raise an MNP specific alarm to the operation and maintenance subsystem.

The present document does not specify the porting process; it specifies the functionality needed to set-up calls to both ported and non ported subscribers (Normative Annex A and Normative Annex C) and the functionality needed to relay non-call related signalling messages to the HLR in the subscription network (Normative Annex B).

## 4.2 Compatibility

The IAM sent to the subscription network may contain additional routing information. Within a portability ~~cluster~~domain the method how to convey the Routing Number in the IAM between 2 PLMNs shall be agreed upon by the 2 network operators involved (see also [7]).

In general, IN-based and MNP-SRF (call-related) solutions are compatible and may coexist in the same portability ~~cluster~~domain. The only restriction refers to the case where the number range ~~owner~~holder network relays call-related MAP messages (i.e. SRI for national calls) to the subscription network. If this solution is selected by at least one network operator within a portability ~~cluster~~domain, all the PLMNs and transit networks affected must fulfil the following requirements:

1. The SCCP interfaces between networks in a portability ~~cluster~~domain must be agreed. This refers to the SCCP addressing mechanism being used (e.g. number lengths, natures of address and translation types for call-related MAP messages).  
For messages which do not cross network boundaries the SCCP addressing mechanism is a choice of the network operator.
2. The subscription network must be able to generate the SRI ack to allow the onward routing of the call from the number range ~~owner~~holder network to the subscription network.

In the rest of the possible architectures for MNP, no interworking problems have been identified. In these cases, network architectures used within one PLMN (e.g. IN, MNP-SRF) are regarded as operator dependent.

In order to avoid loops and incompatibility situations, all the networks within a portability ~~cluster~~domain shall use the same routing convention either direct routing, indirect routing or indirect routing with reference to the Subscription network. As an alternative, indirect routing can interwork successfully with direct routing if the routing number is transferred in the IAM or if dedicated traffic connections are used.

## 4.3 Common Functionality of the MNP-SRF

In a PLMN which supports mobile number portability, SCCP messages sent to an HLR may be relayed by an MNP-SRF. Depending on the implemented solution (IN-based or MNP-SRF-based), on the type of message (call-related or non-call-related) and on the porting status of the called subscriber the MNP-SRF may modify the SCCP called party

address and route the message to a different HLR or to the subscription network, or terminate the dialogue and response to the INE.

Figure 1 shows the general steering functionality for SCCP message routing. It shows the SCCP routing principle for mobile number portability within a network.

Note that call related messages in the IN-based solution are not routed to the MNP-SRF. Therefore Normative Annex A of the present document does not mention the MNP-SRF.

However, the usage of the IN-based solution for the call-related messages should allow operators to have the routing of the non call-related messages determined in the same database. ~~See [8] for the description of the access of the MNP-SRF (node with relay capability) to the NPDB (external database).~~

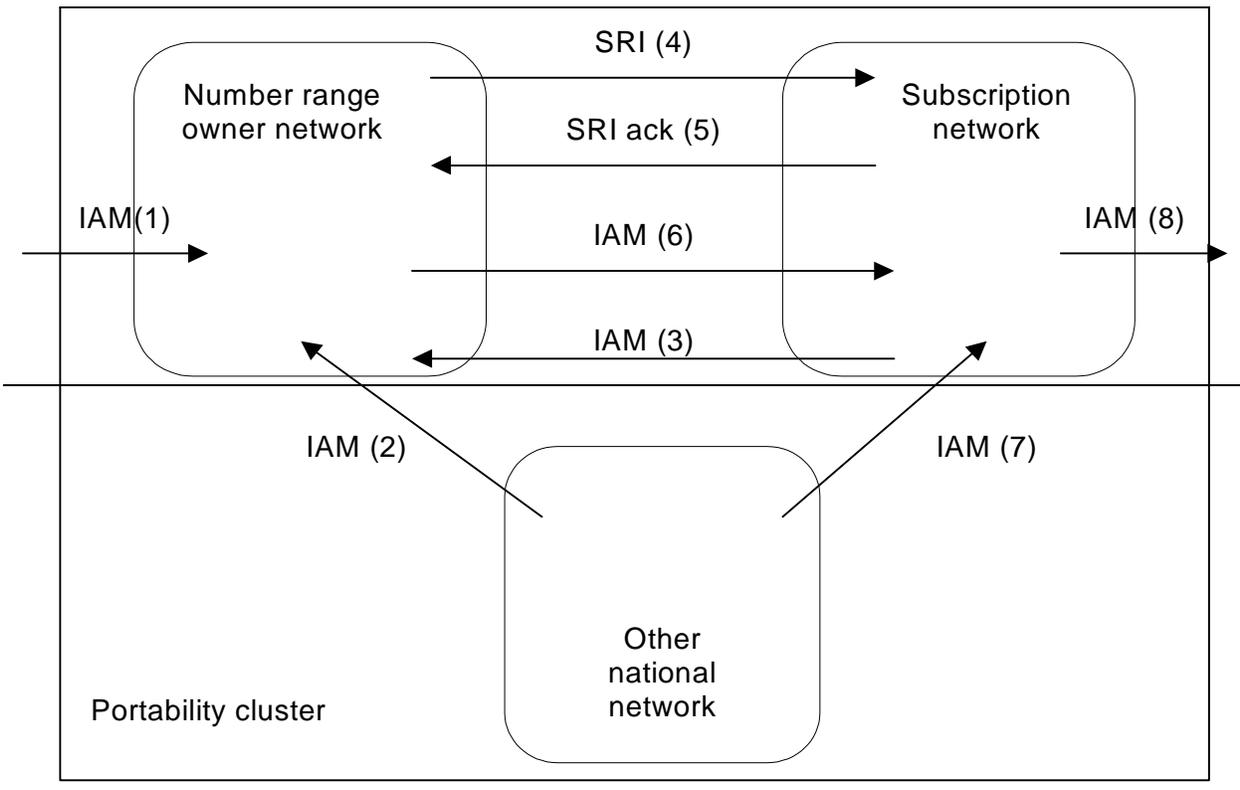
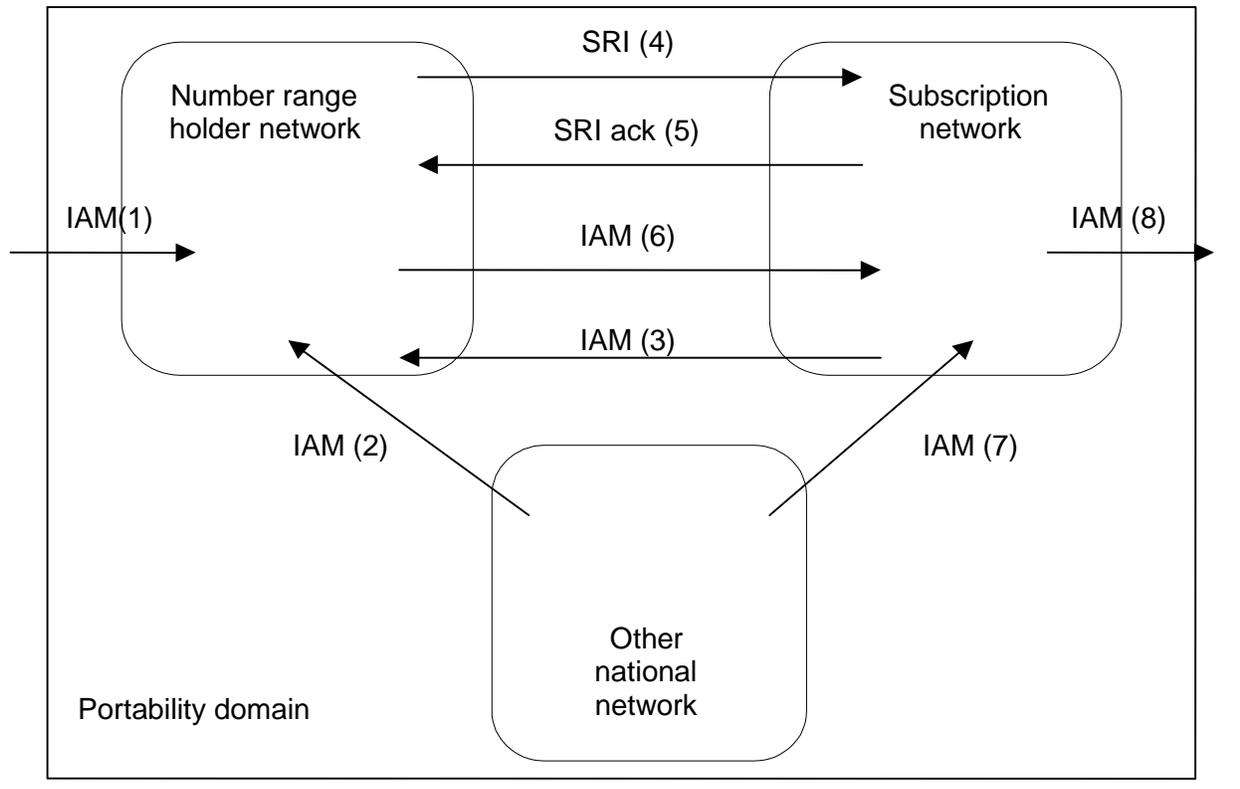
In order to guard against the possibility that the porting data for an MSISDN is inconsistent between PLMNs in a porting ~~cluster~~domain, the SCCP hop counter may be used to prevent indefinite looping of messages between PLMNs. The MNP-SRF would then decrement the SCCP hop counter for every message that is relayed. It should be noted that the use of the SCCP hop counter requires the use of unsegmented SCCP XUDT messages as defined in ITU-T 1996 SCCP recommendations.

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## 5 Common Architecture for call setup

Figure 3 shows the general architecture of a portability cluster domain for routing of calls. The more detailed architecture within the networks depends on the chosen solution (IN-based or MNP/SRF-based) and options and is described in Normative Annex A and Normative Annex C of the present document.

The architecture for non-call related signalling is described in Normative Annex B of the present document.



**Figure 3 General architecture of a portability cluster domain for routing of calls**

The following routing conventions are identified:

1. Direct Routing of calls is a PLMN option which allows to route calls directly from the PLMN supporting this option to the ported subscriber's subscription network.

2. Indirect Routing of calls is a PLMN option which allows to route calls from the PLMN supporting this option via the number range ownerholder network to the ported subscriber's subscription network.
3. Indirect Routing of calls with reference to the subscription network is a PLMN option for PLMN operators having chosen the MNP-SRF solution for call related signalling described in Normative Annex C. If all PLMNs within a portability clusterdomain support this option, calls are routed from the originating network to the number range ownerholder network. The number range ownerholder network obtains onward routing information from the subscription network and routes the call onward to the ported subscriber's subscription network.

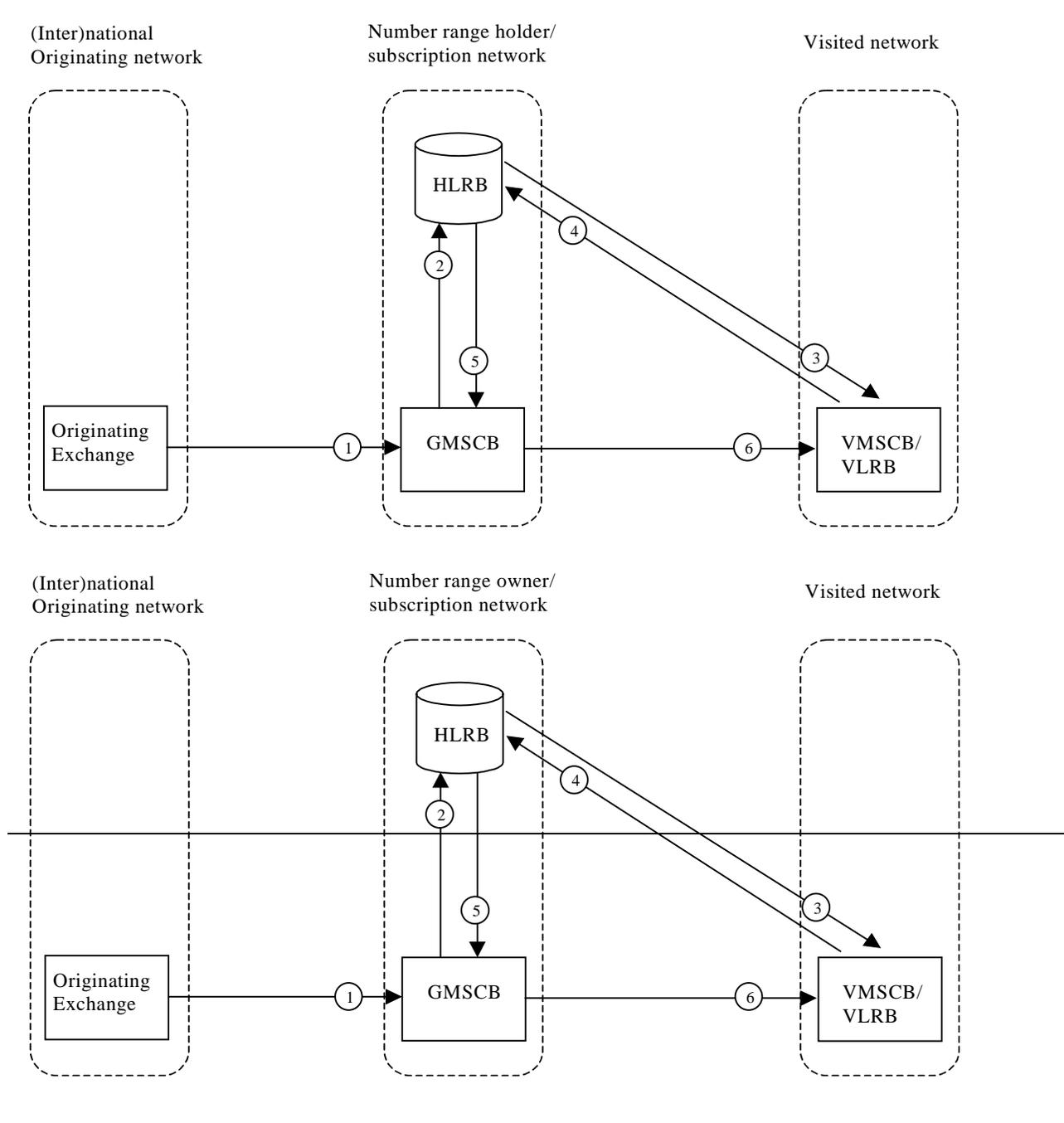
The following action in the different networks can be identified:

1. If the call is originated outside the portability clusterdomain, the IAM(1) is received by the number range ownerholder network.
- 2a. If the call is originated in another national network and the other national network does not support originating call query (i.e. Indirect Routing of calls is applicable), the IAM(2) is received by the number range ownerholder network.
- 2b. If the call is originated in another national network and the other national network supports originating call query (i.e. Direct Routing of calls is applicable), the IAM(7) containing the routing number is sent to the subscription network. If the routing number is not used in the IAM sent from the national originating network to the subscription network, all transit networks involved are required to look up an NPDB in order to retrieve routing information to route the call to the subscription network without looping.
- 3a. If the call is originated in the subscription network and the subscription network does not support originating call query (i.e. Indirect Routing of calls is applicable), the IAM(3) is received by the number range ownerholder network.
- 3b. If the call is originated in the subscription network and the subscription network supports originating call query (i.e. Direct Routing of calls is applicable), it sends an IAM(8) containing the MSRN to the visited network of the called subscriber.
- 3c. If the subscription network receives IAM(6 or 7) containing the routing number, it sends an IAM(8) containing the MSRN to the visited network of the called subscriber.
- 4a. If the call is routed via the number range ownerholder network, and the number range ownerholder network supports the MNP-SRF/MATF solution with the option 'MATF in subscription network' described in Normative Annex C of the present document (i.e. Indirect Routing of calls with reference to the subscription network is applicable), the number range ownerholder network sends SRI(4) to the subscription network. The subscription network returns SRI ack (5) containing the routing number. The number range ownerholder network then sends IAM(6) containing the routing number to the subscription network. If the routing number is not used in the IAM sent from the number range ownerholder network to the subscription network, all transit networks involved are required to look up an NPDB in order to retrieve routing information to route the call to the subscription network without looping.
- 4b. If the call is routed via the number range ownerholder network, and the number range ownerholder network supports the IN solution described in Normative Annex A of the present document or the MNP-SRF/MATF solution with the option 'MATF inside number range ownerholder network' described in Normative Annex C of the present document, the number range ownerholder network sends IAM(6) containing the routing number to the subscription network.

### A.1.2 No NP Query required – Number is not subject for portability

Figure A.1.2 shows the architecture for a call to a number that is not subject for portability. This can be for several reasons like for example:

- the national regulator has stipulated some number series as being non-portable or;
- in an initial phase only a limited amount of subscribers might port in certain number blocks and some operators might want to treat the call routing according to traditional routing plans without any change.



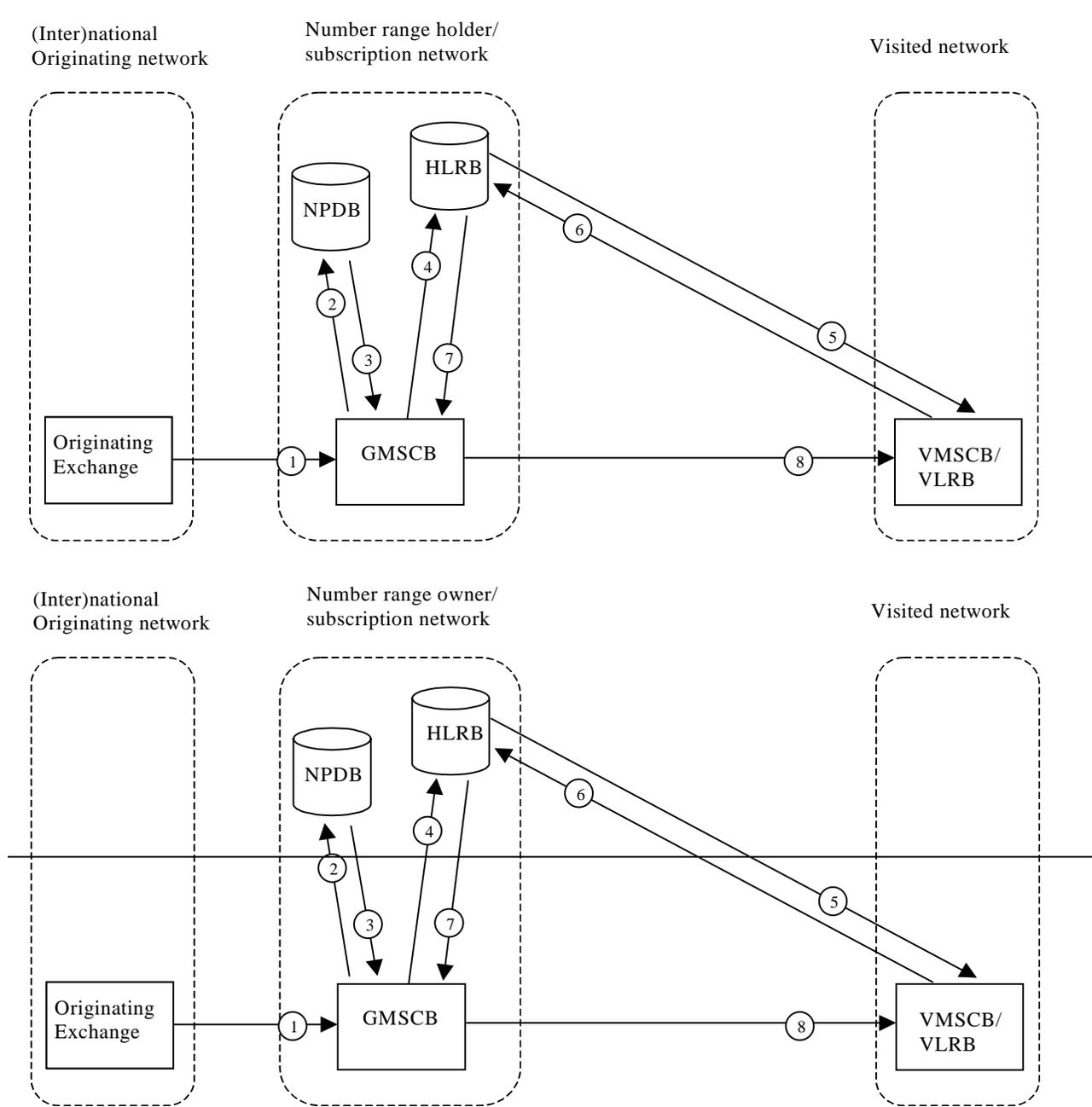
**Figure A.1.2: Call to a non-ported number, no NP query required**

- 1 From an Originating Exchange a call is set up to MSISDN. The call is routed to the Number range ~~owner~~holder network being the Subscription network;
- 2 When GMSCB receives the ISUP IAM, it requests routing information by submitting a MAP SRI to the HLRB including the MSISDN in the request;
- 3 The HLRB requests an MSRN from the MSC/VLRB where the mobile subscriber currently is registered;
- 4 The MSC/VLRB returns an MSRN back to the HLRB;
- 5 The HLRB responds to the GMSCB by sending an SRI ack with an MSRN;
- 6 GMSCB uses the MSRN to route the call to VMSCB.

## A.1.3 NP Query in Number Range ~~Owner~~Holder Network

### A.1.3.1 TQoD – Number is not ported

Figure A.1.3.1 shows the architecture for a call where the Originating network has no knowledge whether the MSISDN is ported or not and uses the traditional routing plans for routing the call to the Number range ~~owner~~holder network for further routing decisions.



**Figure A.1.3.1: Call to a non-ported number using TQoD procedure**

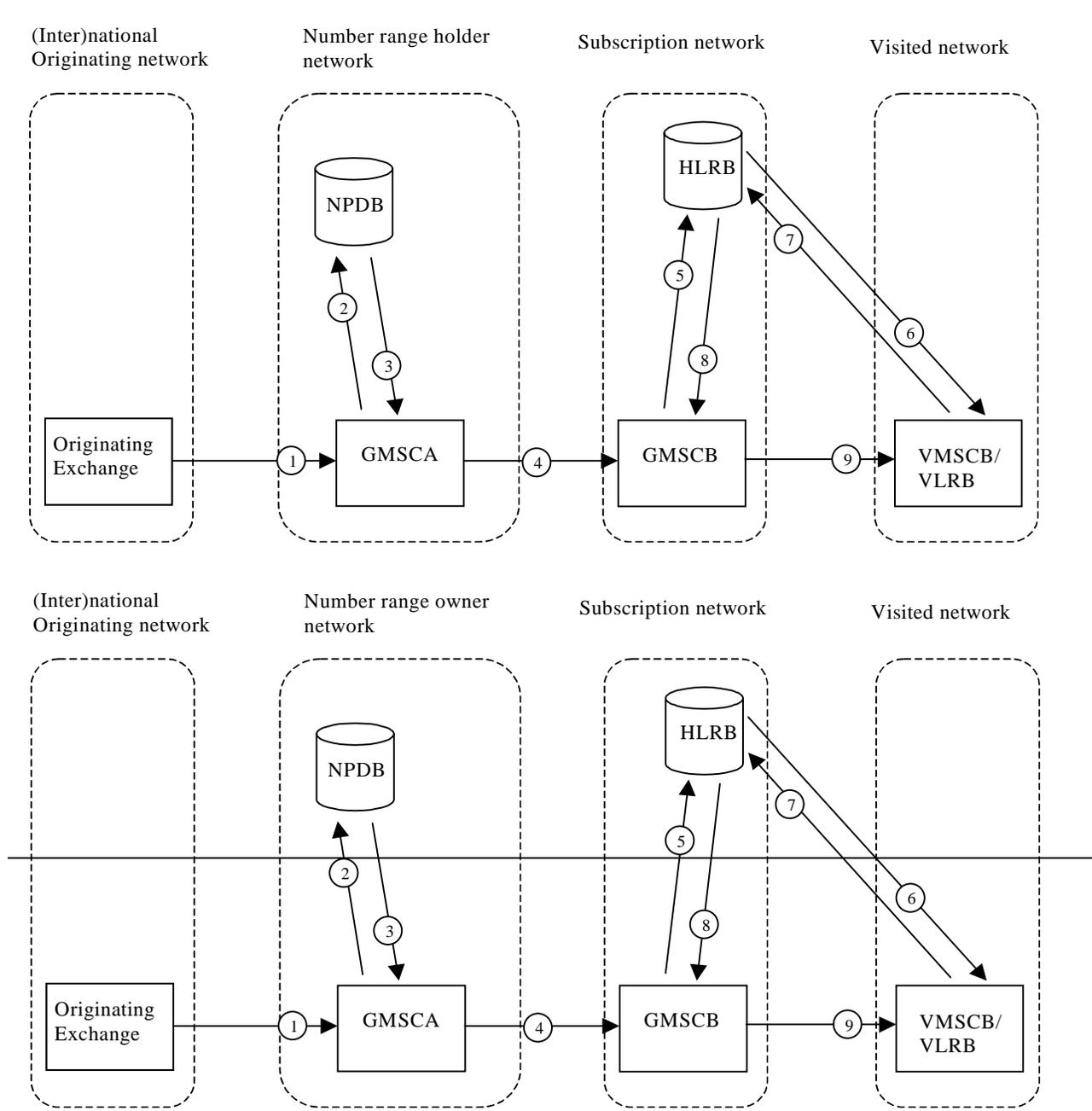
1. From an Originating Exchange a call is set up to MSISDN. The call is routed to the Number range holder network being the Subscription network;
2. When GMSCB receives the ISUP IAM, it will send a database query to the NPDB as a result of analysis of the received MSISDN. The MSISDN is included in the query to the NPDB;
3. The NPDB detects that the MSISDN is not ported and responds back to the GMSCB to continue the normal call setup procedure for MT calls;
4. The GMSCB requests routing information by submitting a MAP SRI to the HLRB, including the MSISDN in the request;
5. The HLRB requests an MSRN from the MSC/VLRB where the mobile subscriber owning the MSISDN currently is registered;
6. The MSC/VLRB returns an MSRN back to the HLRB;

7. The HLRB responds to the GMSCB by sending an SRI ack with an MSRN;
8. GMSCB uses the MSRN to route the call to VMSCB.

Note that the NPDB may be outside the number range owner/holder network if a shared NPDB is used.

### A.1.3.2 TQoD – Number is ported

Figure A.1.3.2 shows the architecture for a call where the Originating network has no knowledge whether the MSISDN is ported or not and uses the traditional routing plans for routing the call to the Number range owner/holder network for further routing decisions.



**Figure A.1.3.2: Call to a ported number using TQoD procedure**

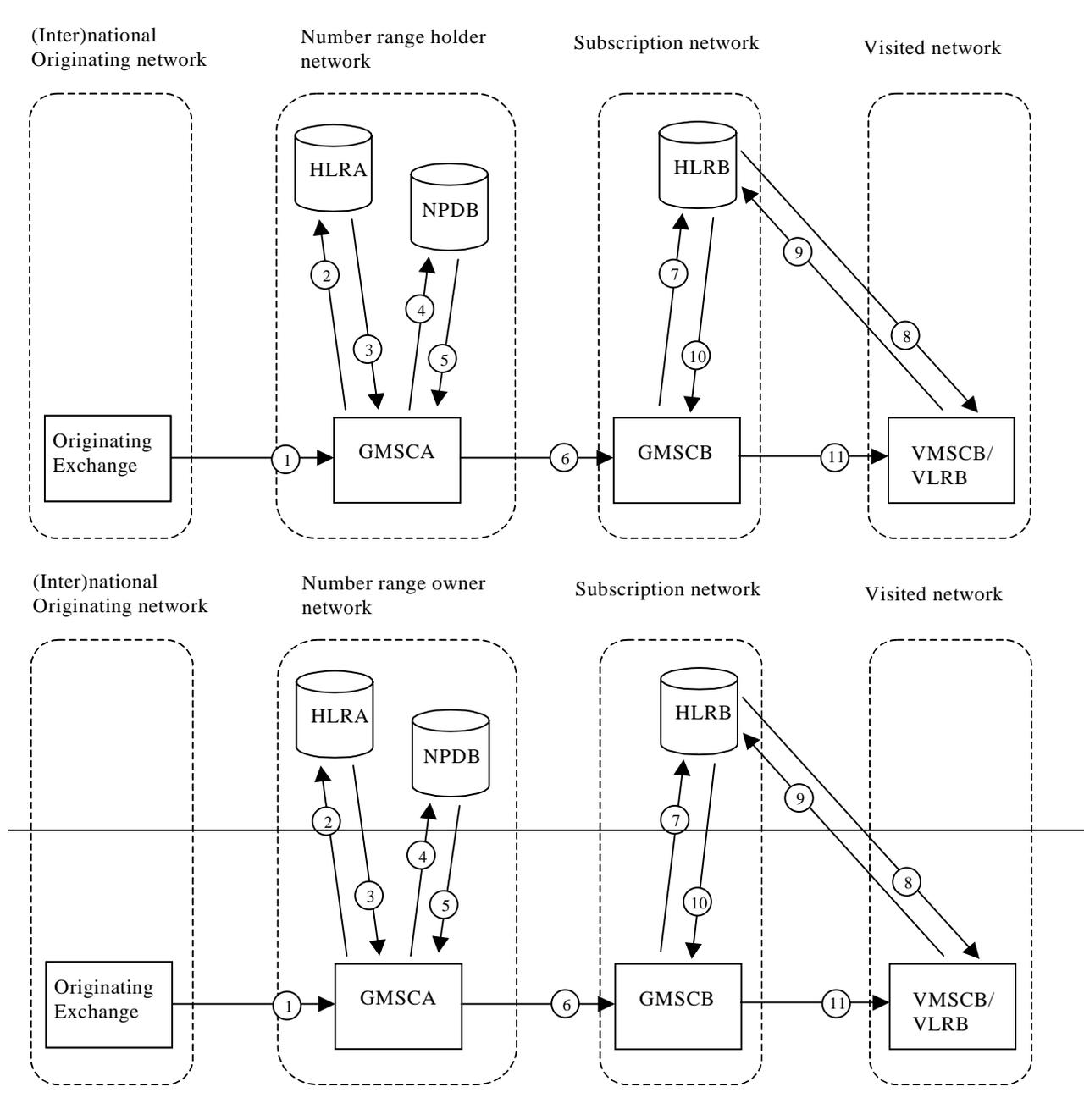
- 1 From an Originating Exchange a call is set up to MSISDN. The call is routed to the Number range owner/holder network;

- 2 When GMSCA receives the ISUP IAM, it will send a database query, including the MSISDN, to the NPDB as a result of analysis of the received MSISDN;
- 3 The NPDB detects that the MSISDN is ported and responds back to the GMSCA with a Routeing Number pointing out the Subscription network;
- 4 The call is routed to the Subscription network based on the Routeing Number carried in ISUP IAM message; also the MSISDN is included in IAM.
- 5 The GMSCB requests routeing information by submitting a MAP SRI to the HLRB, including the MSISDN in the request. The capability to route messages to the correct HLR is required.
- 6 The HLRB requests an MSRN from the MSC/VLRB where the mobile subscriber currently is registered;
- 7 The MSC/VLRB returns an MSRN back to the HLRB;
- 8 The HLRB responds to the GMSCB by sending an SRI ack with an MSRN;
- 9 GMSCB uses the MSRN to route the call to VMSCB.

Note that the NPDB may be outside the number range ~~owner~~holder network if a shared NPDB is used.

### A.1.3.3 QoHR – Number is ported

Figure A.1.3.3 shows the architecture for a call where the Originating network has no knowledge whether the MSISDN is ported or not and uses the traditional routeing plans for routeing the call to the Number range ~~owner~~holder network for further routeing decisions.



**Figure A.1.3.3: Call to a ported number using QoHR procedure**

1. From an Originating Exchange a call is set up to MSISDN. The call is routed to the number range ~~owner~~holder network;
2. When GMSCA receives the ISUP IAM, it requests routing information by submitting a MAP SRI to the HLRA including the MSISDN in the request;
3. The HLRA returns a MAP SRI ack with an “Unknown Subscriber” error since no record was found for the subscriber in the HLRA;
4. When GMSCA receives the error indication form the HLRA, this will trigger the sending of a database query to the NPDB, including the MSISDN in the query;
5. The NPDB detects that the MSISDN is ported and responds back to the GMSCA with a Routing Number pointing out the Subscription network;
6. The call is routed to the Subscription network based on the Routing Number carried in ISUP IAM message; also the MSISDN is included in IAM.

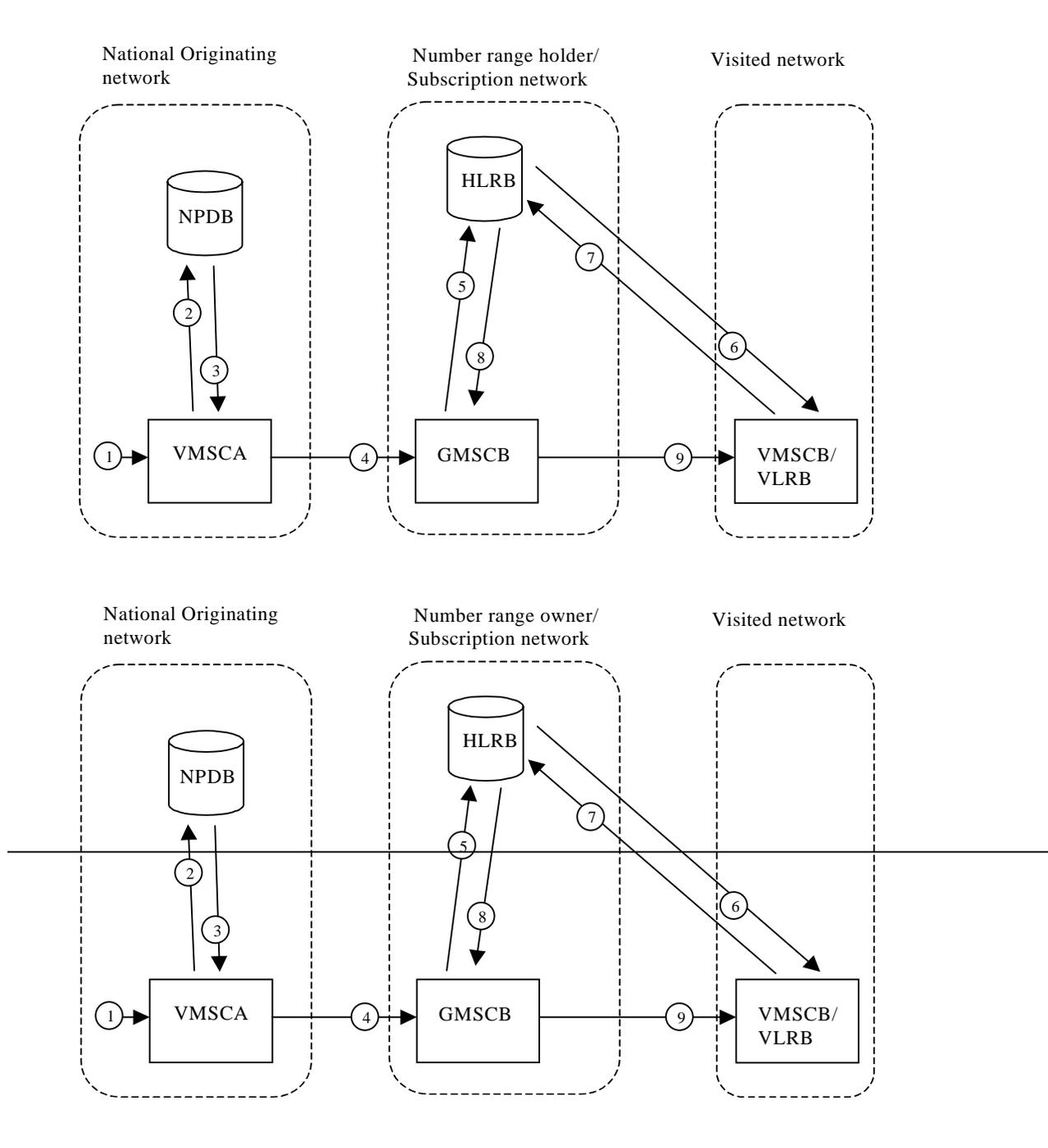
7. The GMSCB requests routing information by submitting a MAP SRI to the HLRB, including the MSISDN in the request. The capability to route messages to the correct HLR is required.
8. The HLRB requests an MSRN from the MSC/VLRB where the mobile subscriber currently is registered;
9. The MSC/VLRB returns an MSRN back to the HLRB;
10. The HLRB responds to the GMSCB by sending an SRI ack with an MSRN;
11. GMSCB uses the MSRN to route the call to VMSCB.

Note that the NPDB may be outside the number range ~~owner~~holder network if a shared NPDB is used.

## A.1.4 NP Query in Originating Network

### A.1.4.1 OQoD – Number is not ported

Figure A.1.4.1 shows the architecture for a call where already the Originating network has the knowledge whether the MSISDN is ported or not and can route the call directly to the Subscription network that in this case is the same as the Number range ~~owner~~holder network.



**Figure A.1.4.1: Call to a non-ported number using OQoD procedure**

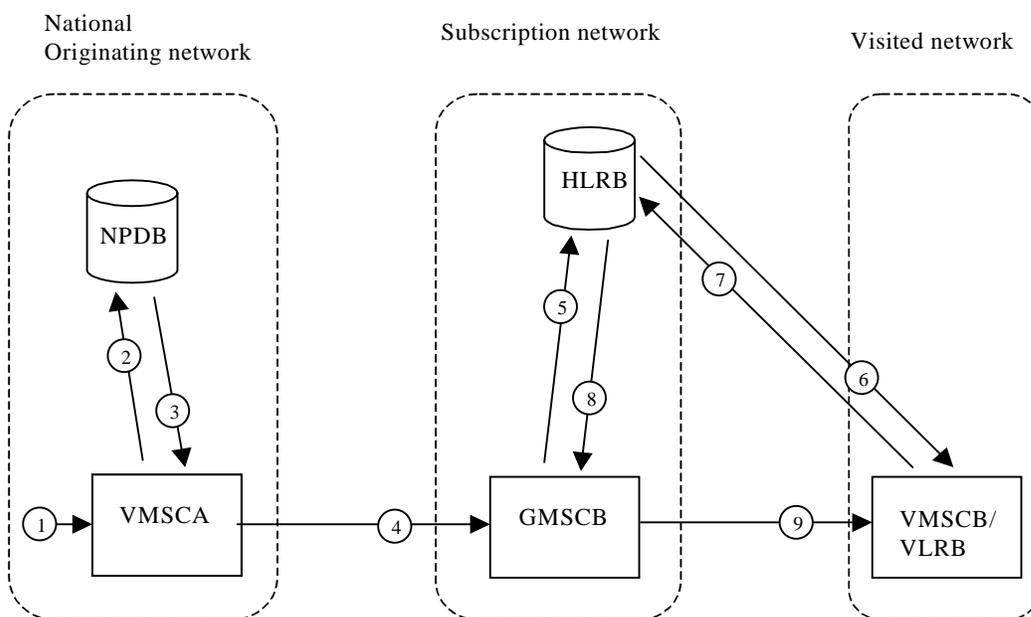
- 1 A call is initiated by Mobile Subscriber A towards Mobile Subscriber B, using MSISDN of the called subscriber;
- 2 When VMSCA receives the call setup indication, it will send a database query to the NPDB as a result of analysis of the received MSISDN, including the MSISDN in the query;
- 3 The NPDB detects that the MSISDN is not ported and responds back to the VMSCA to continue the normal call setup procedure for MO calls. Depending on database configuration option, the NPDB could either return a Routing Number on not ported calls, as done for ported calls, or the call is further routed using the MSISDN number only towards the Number range owner/holder network;
- 4 The call is routed to the Number range owner/holder/Subscription network based on the MSISDN or Routing Number carried in ISUP IAM message;

- 5 The GMSCB requests routing information by submitting a MAP SRI to the HLRB, including the MSISDN in the request;
- 6 The HLRB requests an MSRN from the MSC/VLRB where the mobile subscriber currently is registered;
- 7 The MSC/VLRB returns an MSRN back to the HLRB;
- 8 The HLRB responds to the GMSCB by sending an SRI ack with an MSRN;
- 9 GMSCB uses the MSRN to route the call to VMSCB.

Note that the NPDB may be outside the national originating network if a shared NPDB is used.

#### A.1.4.2 OQoD – Number is ported

Figure A.1.4.2 shows the architecture for a call where already the Originating network has the knowledge that the MSISDN is ported and can route the call directly to the Subscription network without involving the Number range owner/holder network.



**Figure A.1.4.2: Call to a ported number using OQoD procedure**

- 1 A call is initiated by Mobile Subscriber A towards Mobile Subscriber B, using MSISDN of the called subscriber;
- 2 When VMSCA receives the call setup indication, it will send a database query to the NPDB as a result of analysis of the received MSISDN including the MSISDN in the query;
- 3 The NPDB detects that the MSISDN is ported and responds back to the VMSCA with a Routing Number pointing out the Subscription network;
- 4 The call is routed to the Subscription network based on the Routing Number carried in ISUP IAM message; also the MSISDN is included in IAM.
- 5 The GMSCB requests routing information by submitting a MAP SRI to the HLRB, including the MSISDN in the request. The capability to route messages to the correct HLR is required.
- 6 The HLRB requests an MSRN from the MSC/VLRB where the mobile subscriber currently is registered;
- 7 The MSC/VLRB returns an MSRN back to the HLRB;
- 8 The HLRB responds to the GMSCB by sending an SRI ack with an MSRN;

9 GMSCB uses the MSRN to route the call to VMSCB.

Note that the NPDB may be outside the national originating network if a shared NPDB is used.

## A.2 Information flows

In the following figures the NPDB is shown as belonging to the number range ownerholder network or to the national originating network. However, the NPDB may be shared within one portability clusterdomain i.e. nation-wide.

Figure A.2.1 shows the information flow for successful QoHR.

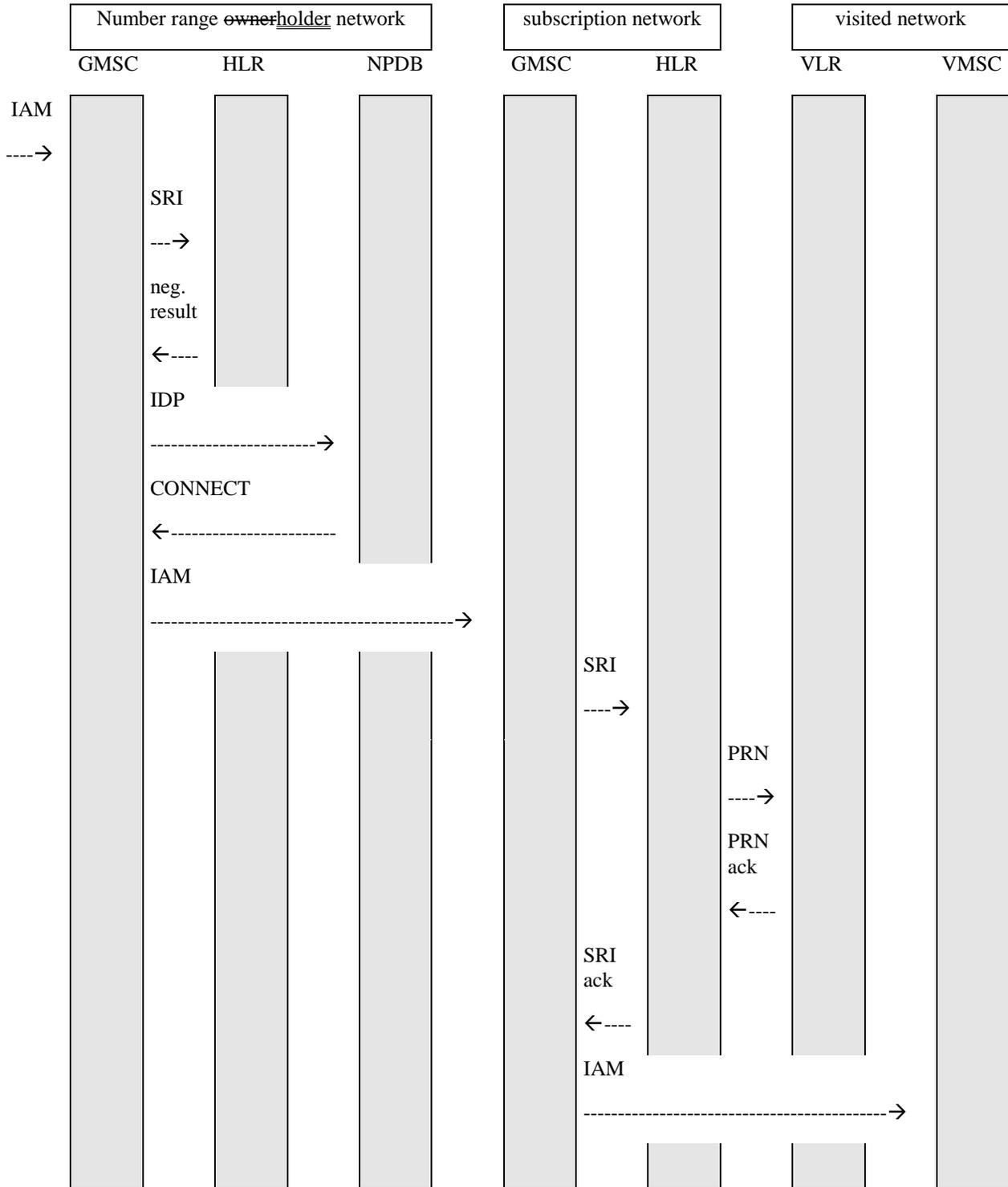


Figure A.2.1

Figure A.2.2 shows the information flow for unsuccessful QoHR (misdialed unallocated number).

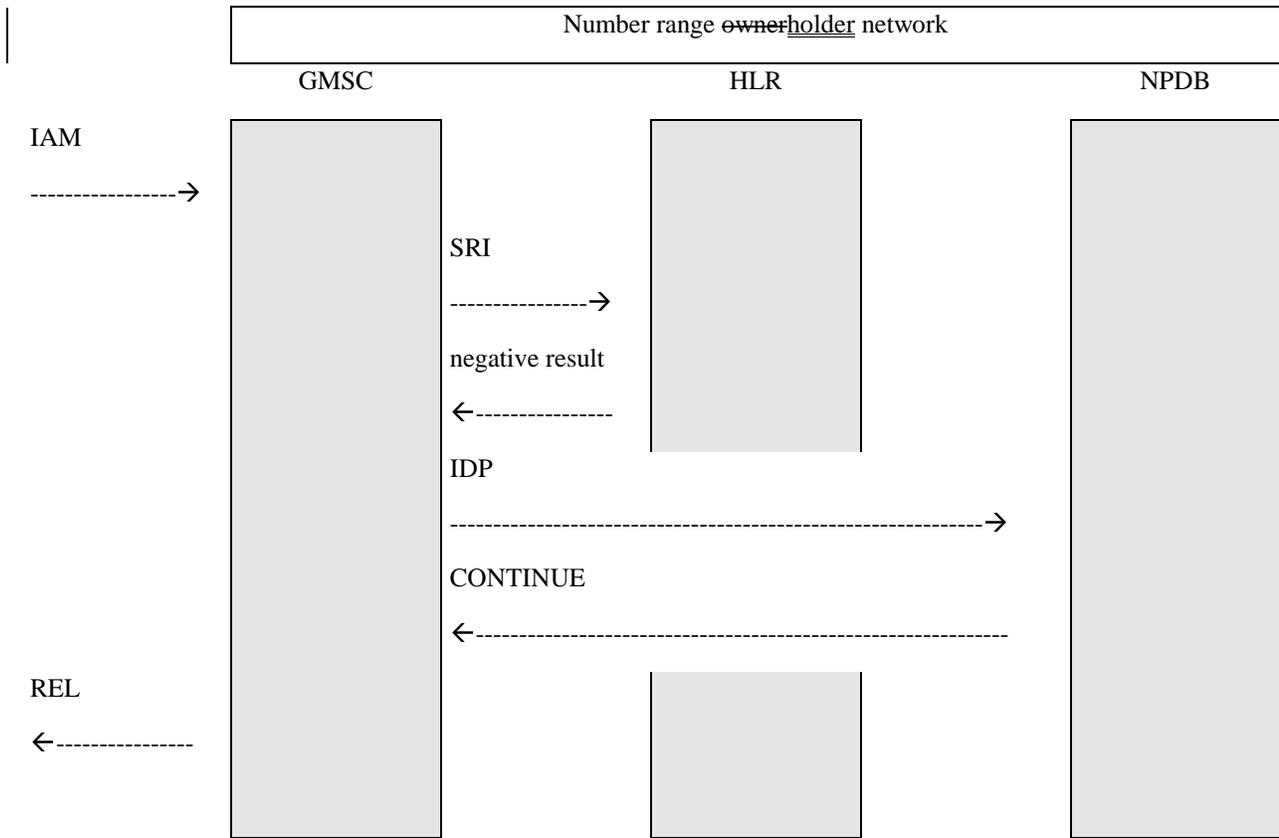


Figure A.2.2

Figure A.2.3 shows the information flow for successful TQoD.

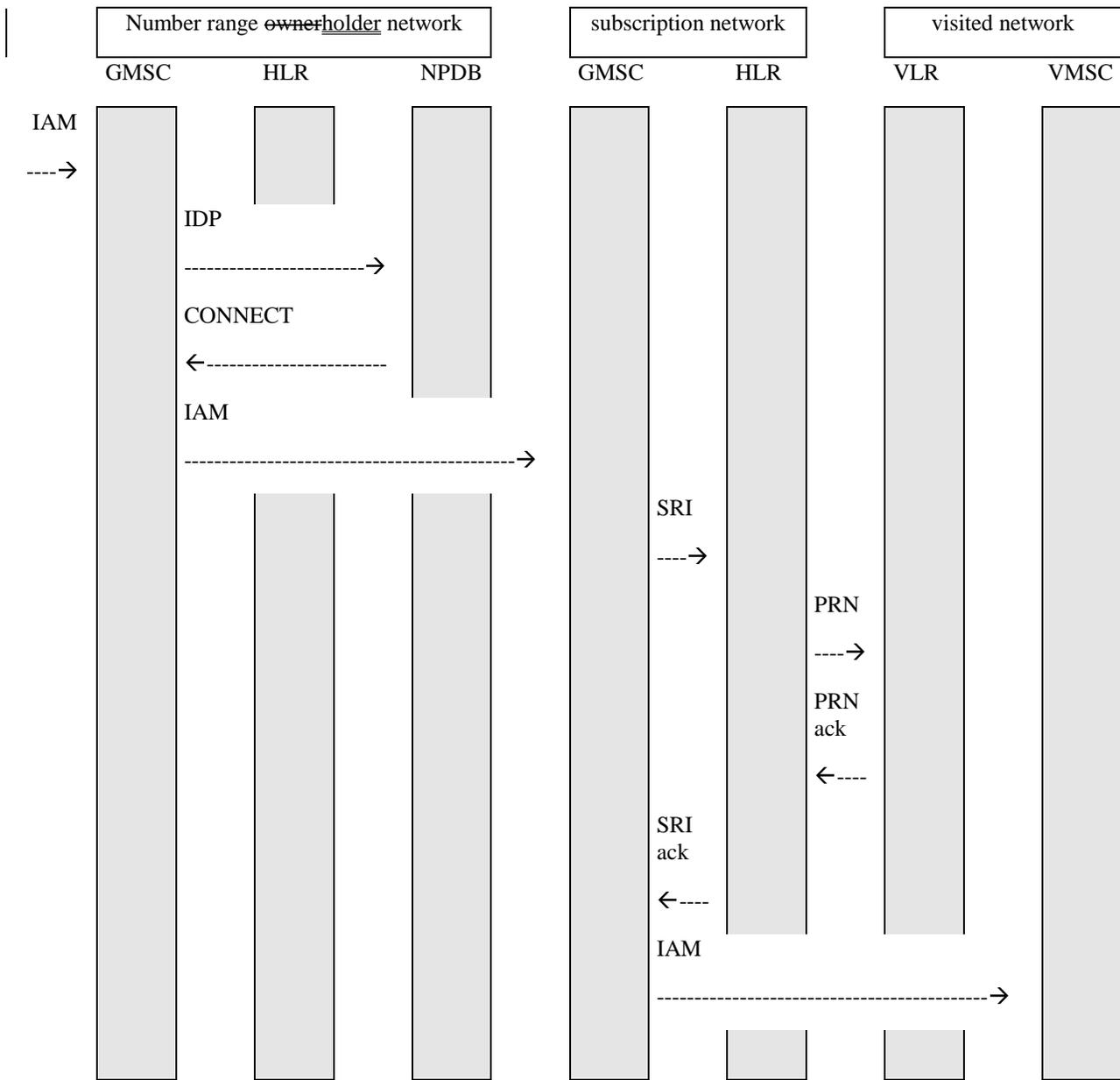


Figure A.2.3

Figure A.2.4 shows the information flow for unsuccessful TQoD (number not ported).

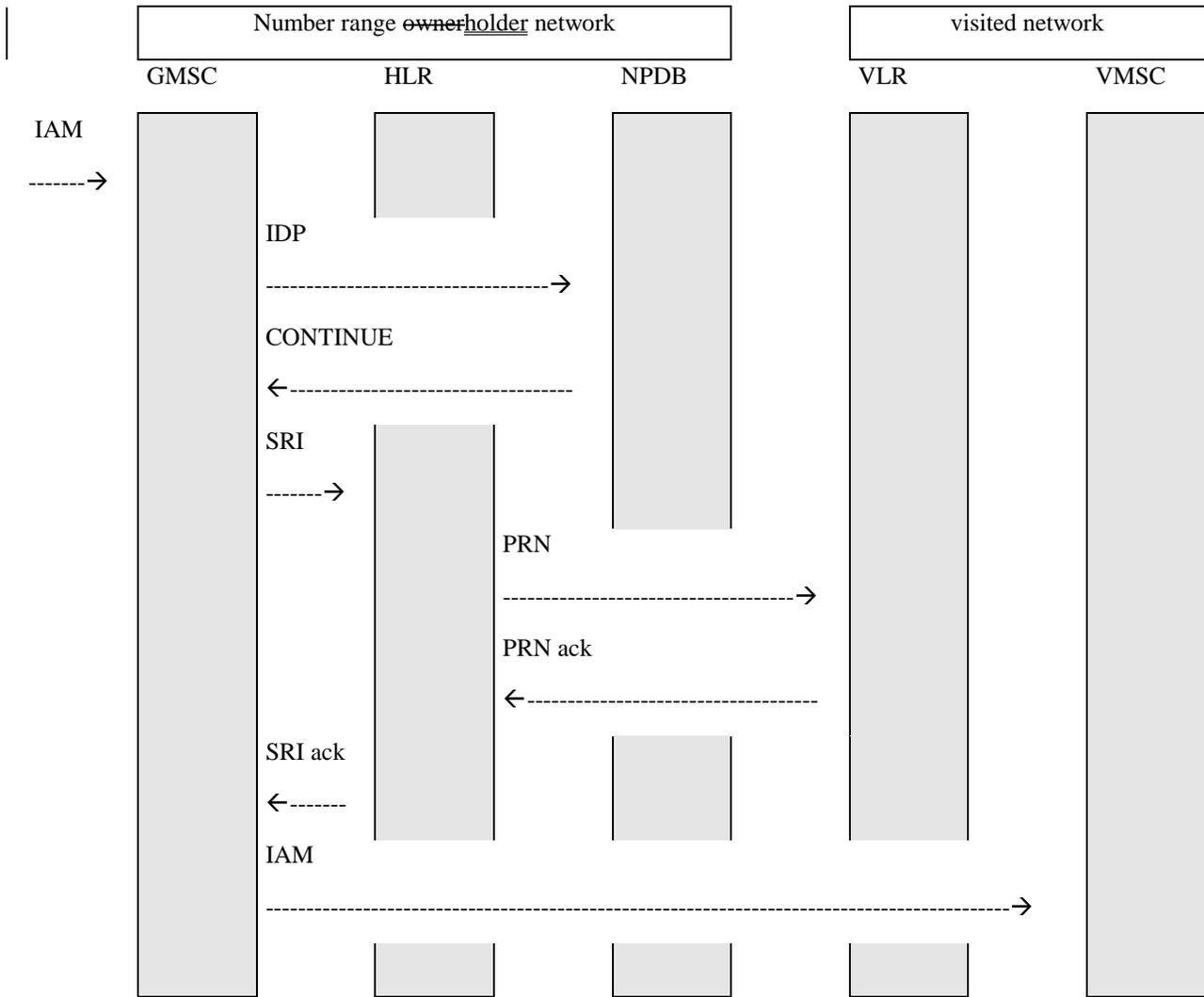


Figure A.2.4

Figure A.2.5 shows the information flow for successful OQoD (number ported ).

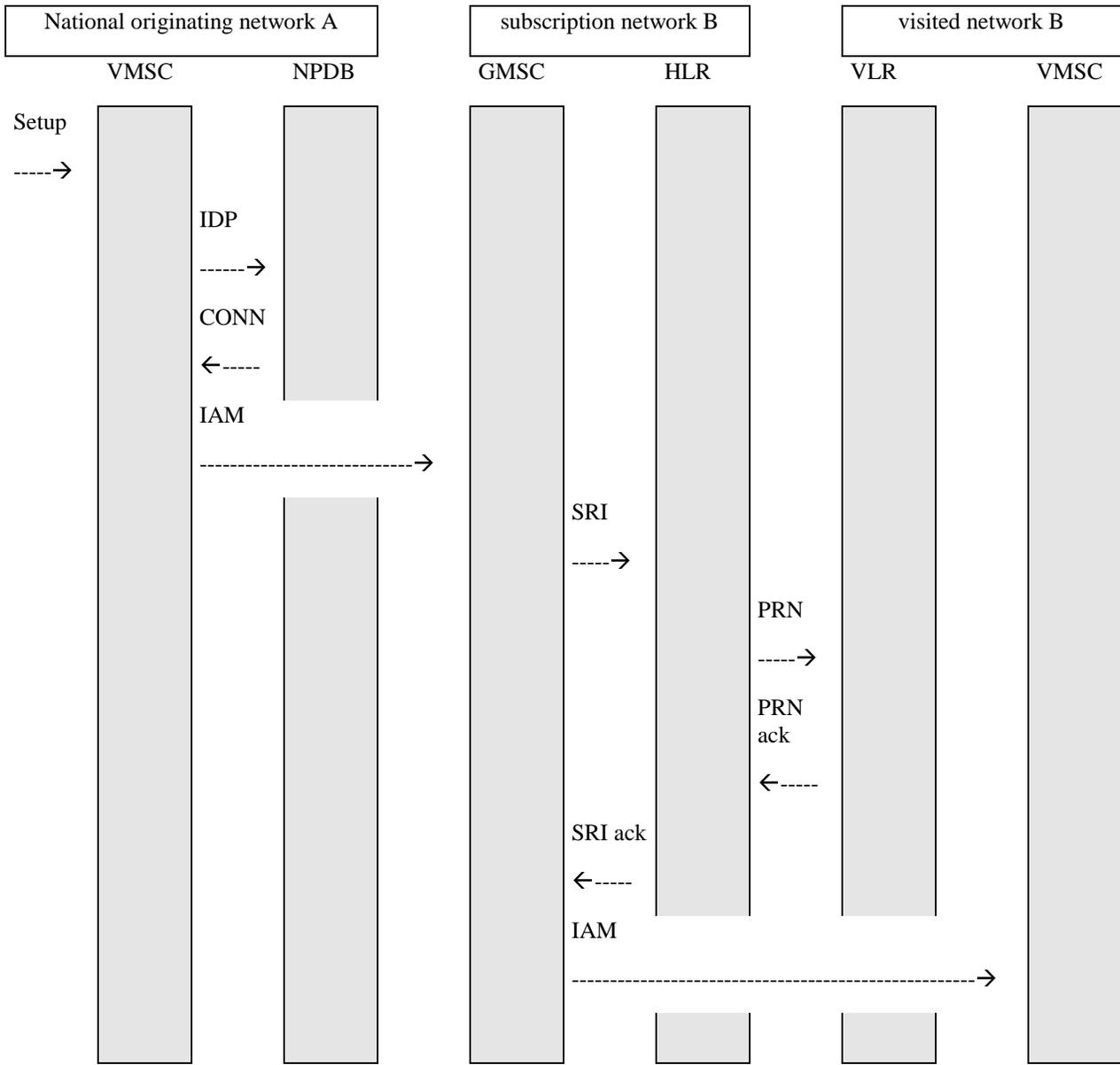


Figure A.2.5

Figure A.2.6 shows the information flow for unsuccessful OQoD (number not ported in).

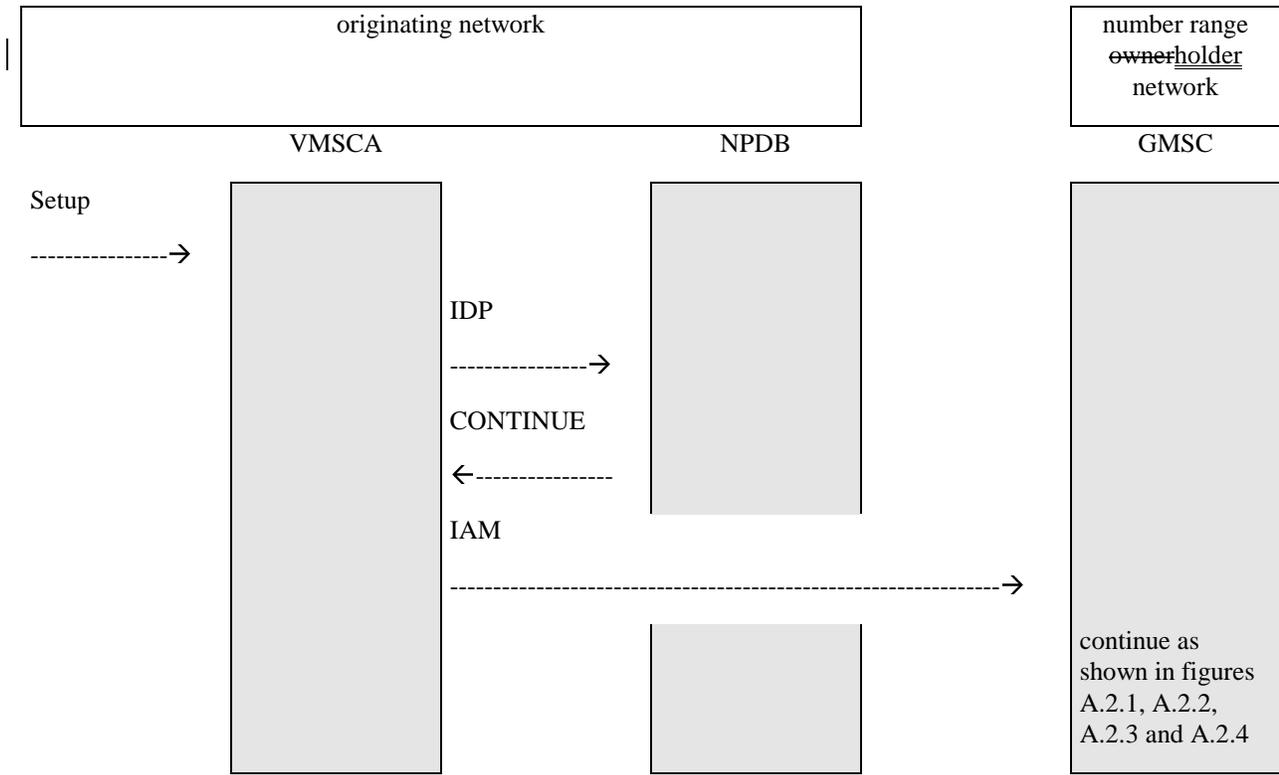


Figure A.2.6

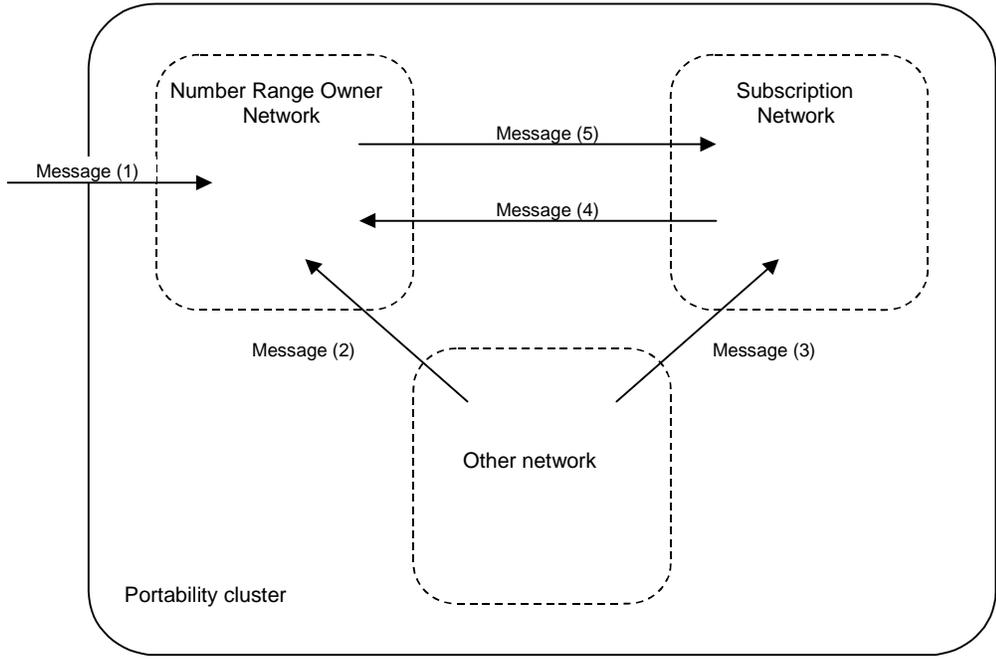
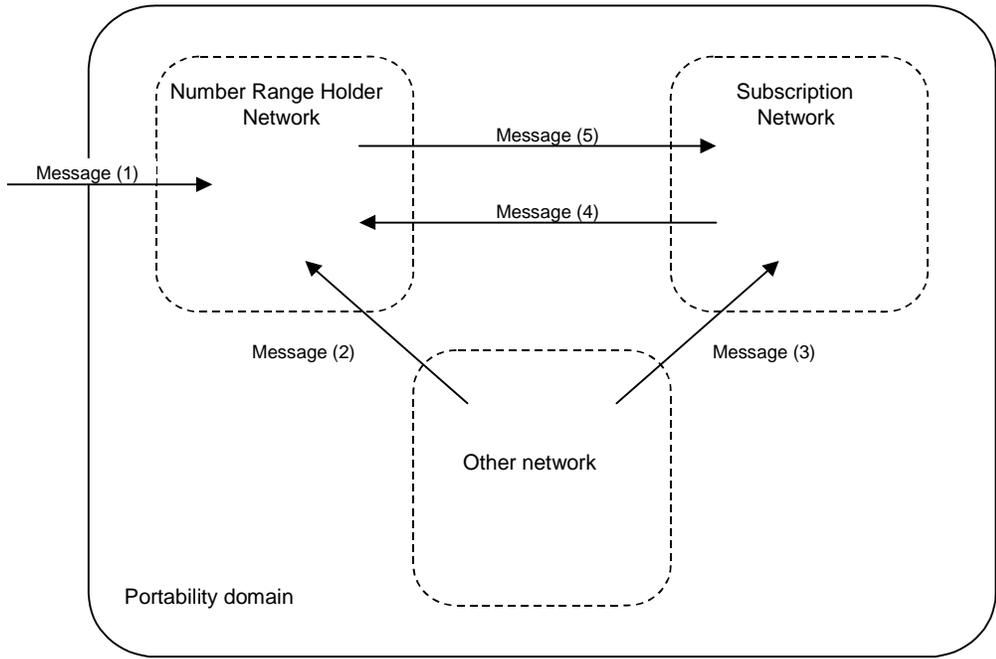
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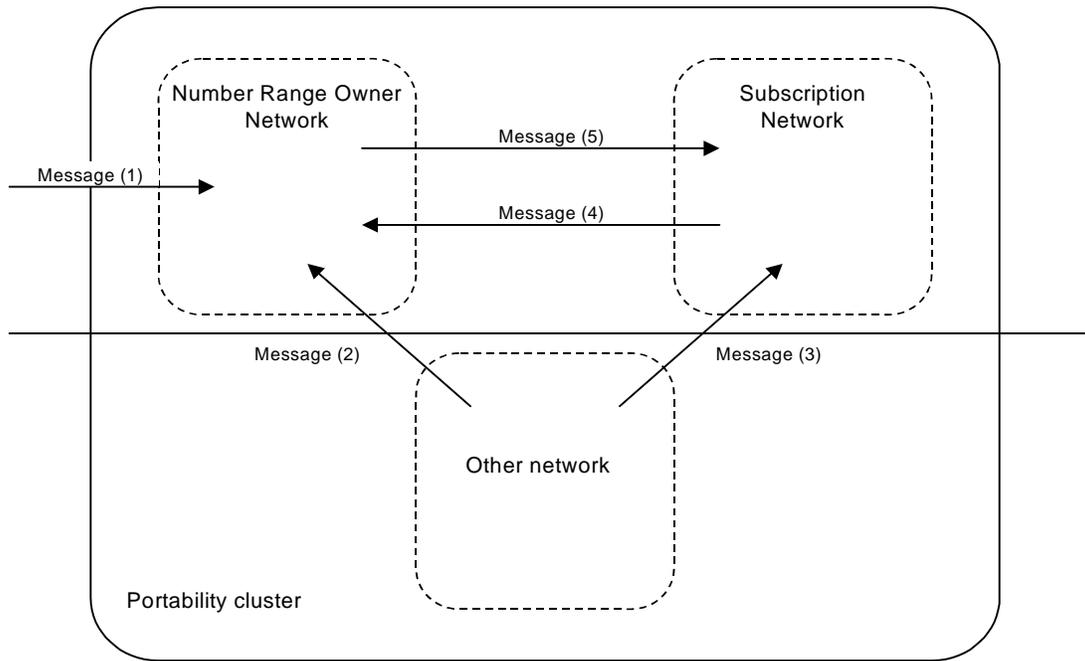
## Annex B (normative): Handling of Non-Call Related Signalling

### B.1 Handling of Non-call Related Signalling

#### B.1.1 Routeing Conventions

Figure B.1.1 illustrates the routeing of non-call related signalling messages between networks in a number portability environment.





**Figure B.1.1: Routing of non-call related signalling messages in a number portability environment**

If a non-call related signalling message is originated outside the portability cluster domain, this message (1) is received by the number range ownerholder network. The number range ownerholder network routes the message (5) onward to the subscription network.

If a non-call related signalling message is originated in a network inside the portability cluster domain and this network supports direct routing, this message (3) is routed to the subscription network.

If a non-call related signalling message is originated in a network inside the portability cluster domain and this network does not support direct routing, the message (2, 4) is routed to the number range ownerholder network. The number range ownerholder network routes the message (5) onward to the subscription network. This is referred to as indirect routing.

## B.1.2 Network Architecture

In a PLMN which supports MNP, non-call related signalling messages as mentioned in section B.1.1 are relayed by an MNP-Signalling Relay Function (MNP-SRF). The MNP-SRF provides re-routing capability for signalling messages addressed using the MSISDN. The MNP-SRF obtains routing information from the NP database to identify the subscription network associated with a particular national MSISDN. The interface between the MNP-SRF and the NP database is considered implementation dependent and is not detailed further. For further details see clause 4.3. ~~For further details of the signalling relay function, the reader is referred to [9].~~

From the perspective of the PLMN in which the MNP-SRF resides, the MSISDN in the CdPA represents either:

- 1 An own number ported out;
- 2 An own number not ported out;
- 3 A foreign number ported in;
- 4 A foreign number ported to a foreign network;
- 5 A foreign number not known to be ported.

When a PLMN supports direct routing (clause B.1.1), all non-call related signalling messages where the MSISDN in the CdPA belongs to a number range owned by a PLMN in the portability cluster domain and all non-call related

signalling messages which are relayed towards the network, are routed to the PLMN's MNP-SRF for treatment.

In case 2 and 3 the MNP-SRF relays the message to the HLR.

In case 1, 4 and 5 the MNP-SRF relays the message to subscription network.

When a PLMN does not support direct routing, only non-call related signalling messages where the MSISDN in the CdPA belongs to a number range owned by the PLMN itself and all non-call related signalling messages which are relayed towards the network are routed to the PLMN's MNP-SRF for treatment. All other messages are routed to the number range ~~owner~~holder network.

For this routing convention, only cases 1, 2 and 3 are applicable:

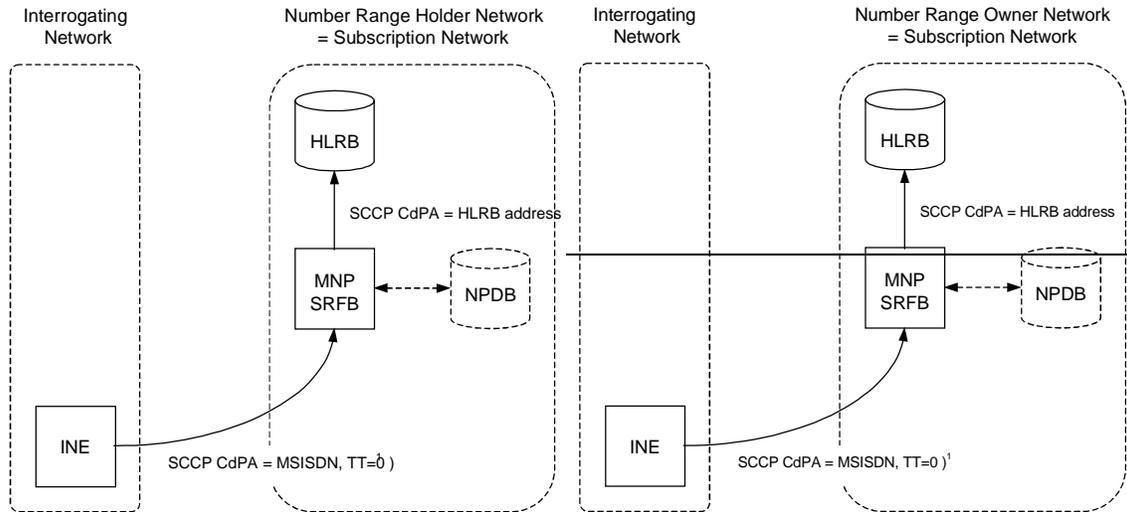
In case 2 and 3 the MNP-SRF relays the message to the HLR.

In case 1 the MNP-SRF relays the message to the subscription network.

## B.2 Signalling Scenarios

### B.2.1 Non-call Related Signalling Message for a Non-ported Number – Indirect Routing

Figure B.2.1 shows the MNP-SRF operation for routing a non-call related signalling message for a non-ported number where the interrogating network is inside the portability cluster domain and indirect routing is used or the interrogating network is outside the portability cluster domain.



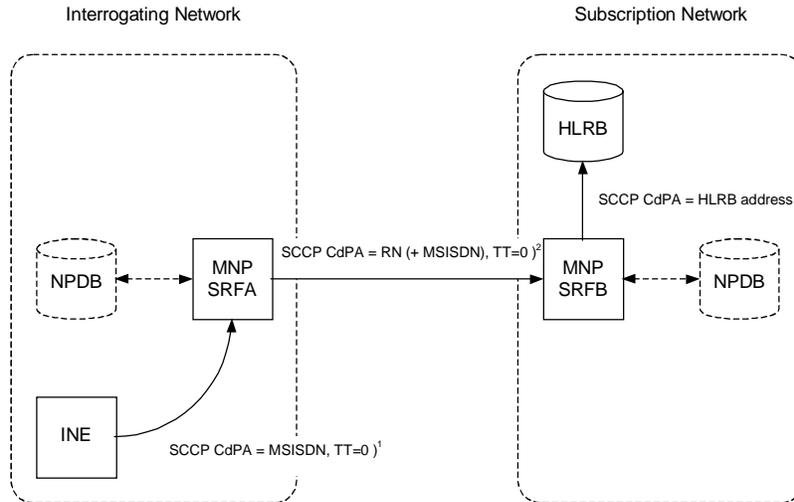
**Figure B.2.1: MNP-SRF operation for routing a non-call related signalling message for a non-ported number where the interrogating network is inside the portability cluster domain and indirect routing is used or the interrogating network is outside the portability cluster domain.**

<sup>1</sup> Note that the TT may have a different value, e.g. TT=17 in the case of CCBS Requests.

The Interrogating Network Entity (INE) submits a non-call related signalling message. When MNP-SRFB receives the message, MNP-SRF operation is triggered. The MNP-SRF functionality analyses the MSISDN in the CdPA and identifies the MSISDN as being non-ported using information which may be retrieved from an NP database. The MNP-SRF function then reroutes the message to HLRB.

## B.2.2 Non-call Related Signalling Message for a Ported or Non-ported Number – Direct Routing

Figure B.2.2 shows the MNP-SRF operation for routing a non-call related signalling message for a ported or non-ported number where the interrogating network supports direct routing. If the interrogating network is the subscription network, MNP-SRFA and MNP-SRFB coincide, i.e. the signalling message passes the MNP-SRF only once.



**Figure B.2.2: MNP-SRF operation for routing a non-call related signalling message for a ported or non-ported number where the interrogating network supports direct routing.**

- 1** Note that the TT may have a different value, e.g. TT=17 in the case of CCBS Requests.
- 2** The CdPA may have different values in the GT address and the nature of address fields.

The Interrogating Network Entity (INE) submits a non-call related signalling message. When MNP-SRFA receives the message, MNP-SRF operation is triggered. The MNP-SRF functionality analyses the MSISDN in the CdPA and identifies the subscription network using information which may be retrieved from an NP database. The MNP-SRF function then modifies the CdPA according to the rules agreed for the portability ~~cluster~~ domain and routes the message to MNP-SRFB in the subscription network.

When MNP-SRFB receives the message, MNP-SRF operation is triggered. The MNP-SRF functionality analyses the MSISDN in the CdPA and identifies the MSISDN as being ported into the network using information which may be retrieved from an NP database. The MNP-SRF function then re-routes the message to HLRB.

### B.2.3 Non-call Related Signalling Message for a Ported Number – Indirect Routeing

Figure B.2.3 shows the MNP-SRF operation for indirectly routeing (i.e. via the number range ownerholder network) a non-call related signalling message for a ported subscriber.

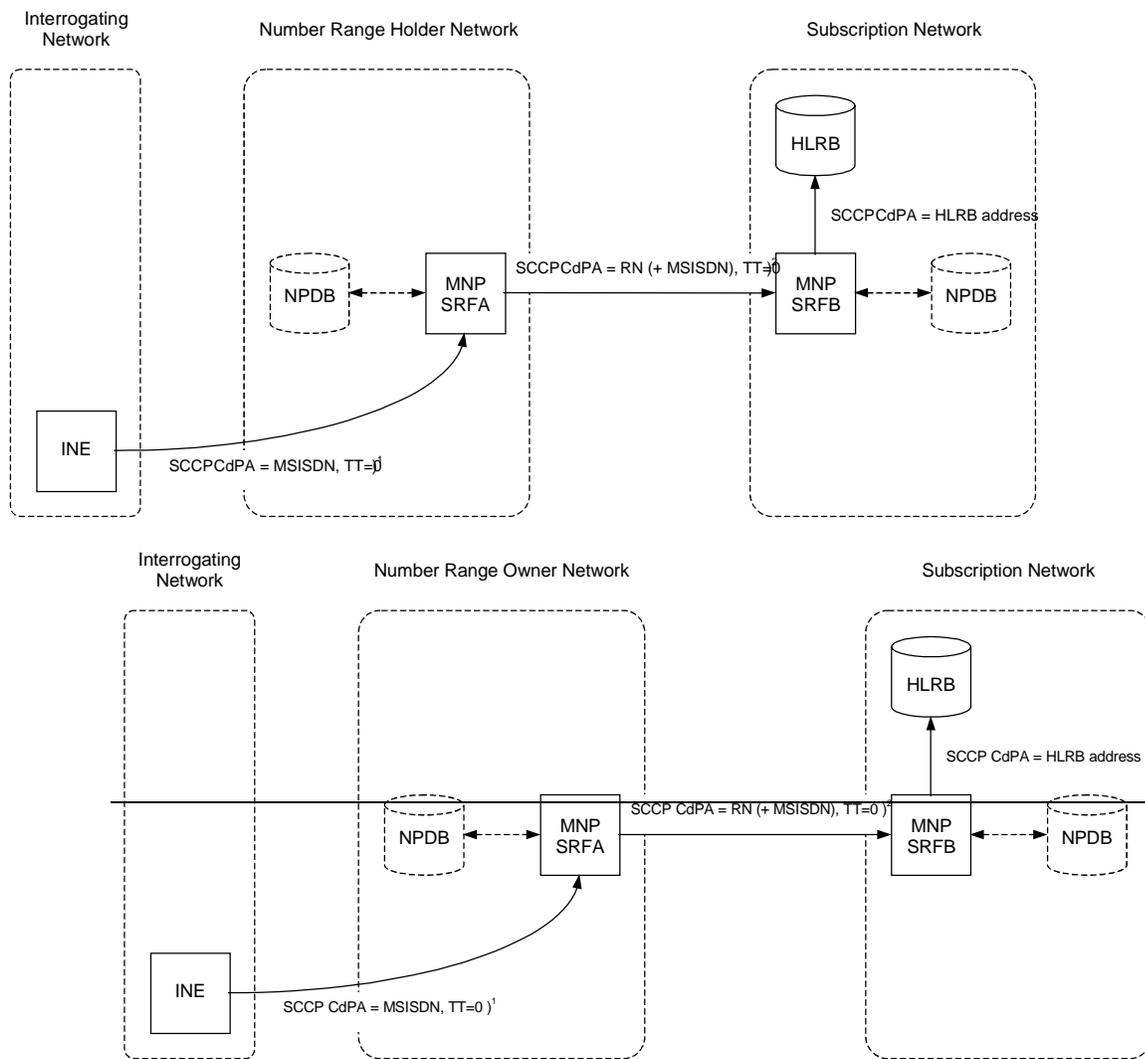


Figure B.2.3: **MNP-SRF operation for indirectly routeing (i.e. via the number range ownerholder network) a non-call related signalling message for a ported subscriber.**

- 1 Note that the TT may have a different value, e.g. TT=17 in the case of CCBS Requests.
- 2 The CdPA may have different values in the GT address and the nature of address fields.

The Interrogating Network Entity (INE) submits a non-call related signalling message. This message is routed on MSISDN global title to MNP-SRFA in the number range ownerholder network.

When MNP-SRFA receives the message, MNP-SRF operation is triggered. The MNP-SRF functionality analyses the MSISDN in the CdPA and identifies the subscription network using information which may be retrieved from an NP database. The MNP-SRF function then modifies the CdPA according to the rules agreed for the portability clusterdomain and routes the message to MNP-SRFB in the subscription network.

When MNP-SRFB receives the message, MNP-SRF operation is triggered. The MNP-SRF functionality analyses the MSISDN in the CdPA and identifies the MSISDN as being ported into the network using information which may be retrieved from an NP database. The MNP-SRF function then reroutes the message to HLRB.

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## B.3 Functional Requirements of Network Entities

### B.3.1 Procedure MNP\_SRF\_Non\_Call\_Related

Figure B.3.1 shows the procedure MNP\_SRF\_Non\_Call\_Related. This procedure handles non-call related signalling messages. It is called from the process MNP\_SRF (see chapter 4.3).

The check “CdPA contains own number ported out?” identifies all mobile numbers from number ranges allocated to the network the MNP-SRF is located in and which are ported to other networks. In this case the message is relayed to the subscription network.

The check “CdPA contains own number not ported out?” identifies all mobile numbers from the number ranges allocated to the network the MNP-SRF is located in and which are still served by the network the MNP-SRF is located in, i.e. the numbers are not ported out. In this case the message is relayed to the HLR in the network.

The check “CdPA contains foreign number ported in?” identifies all mobile numbers from the number ranges not allocated to the network the MNP-SRF is located in and which are served by the network the MNP-SRF is located in, i.e. the numbers are ported in. In this case the message is relayed to the HLR in the network.

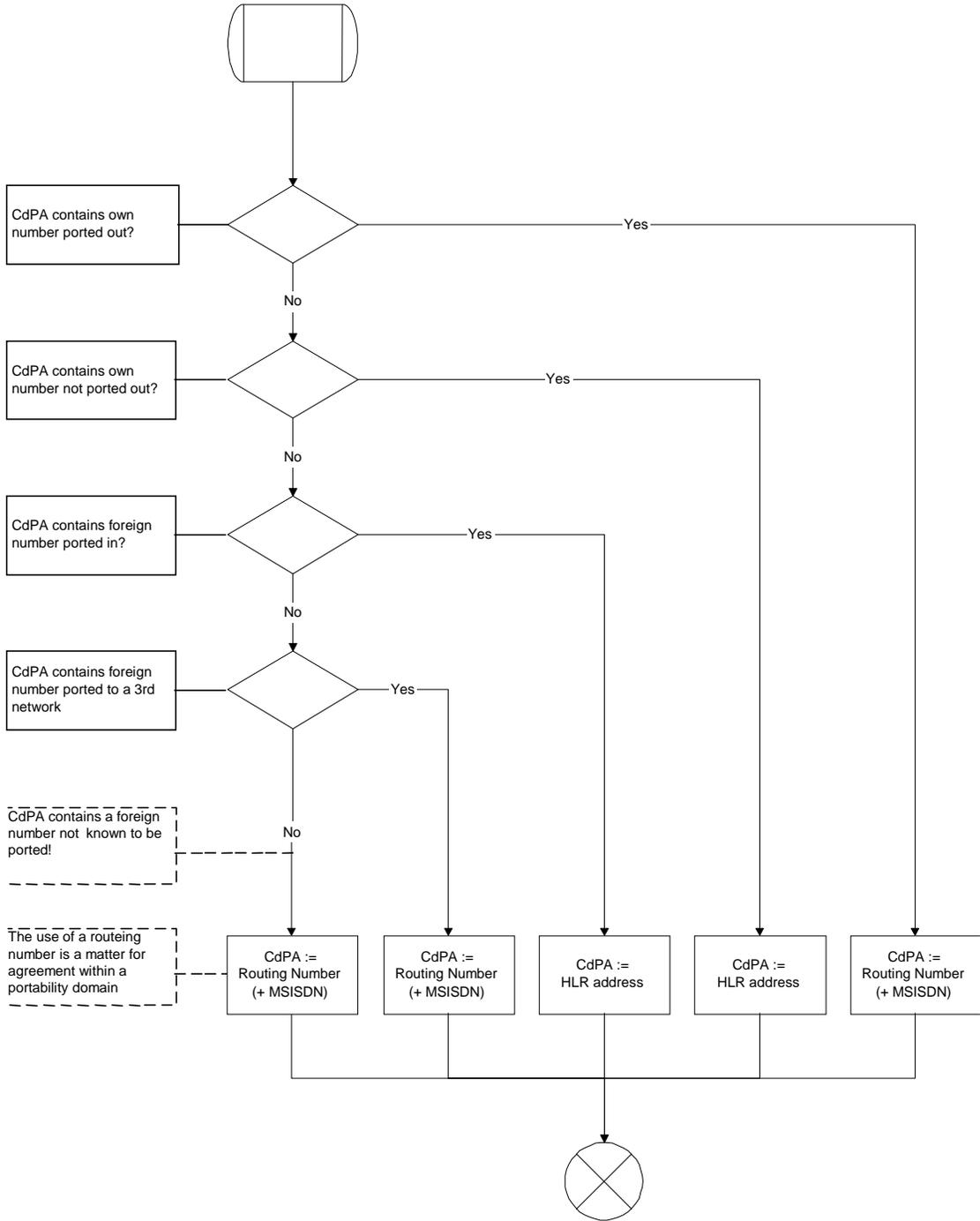
The check “CdPA contains foreign number ported to a foreign network?” identifies all mobile numbers from the number ranges not allocated to the network the MNP-SRF is located in and which are not served by the MNP-SRF is located in and not served by the network the number range is allocated to, i.e. the numbers are ported to a foreign network. In this case the message is relayed to the subscription network.

The remaining numbers “CdPA contains number not known to be ported ?” are mobile numbers from the number ranges not allocated to the network the MNP-SRF is located in and which are also not served by the network the MNP-SRF is located in. In this case the message is relayed to the number range ~~owner~~holder network.

### Procedure MNP\_SRF\_Non\_Call\_Related

Procedure in MNP\_SRF  
to handle the Signalling  
Relation of Mobile  
Portability for Non Call  
Related Messages

Procedure  
MNP\_SRF\_Non\_Call\_Related  
FPAR IN/OUT Called  
Address



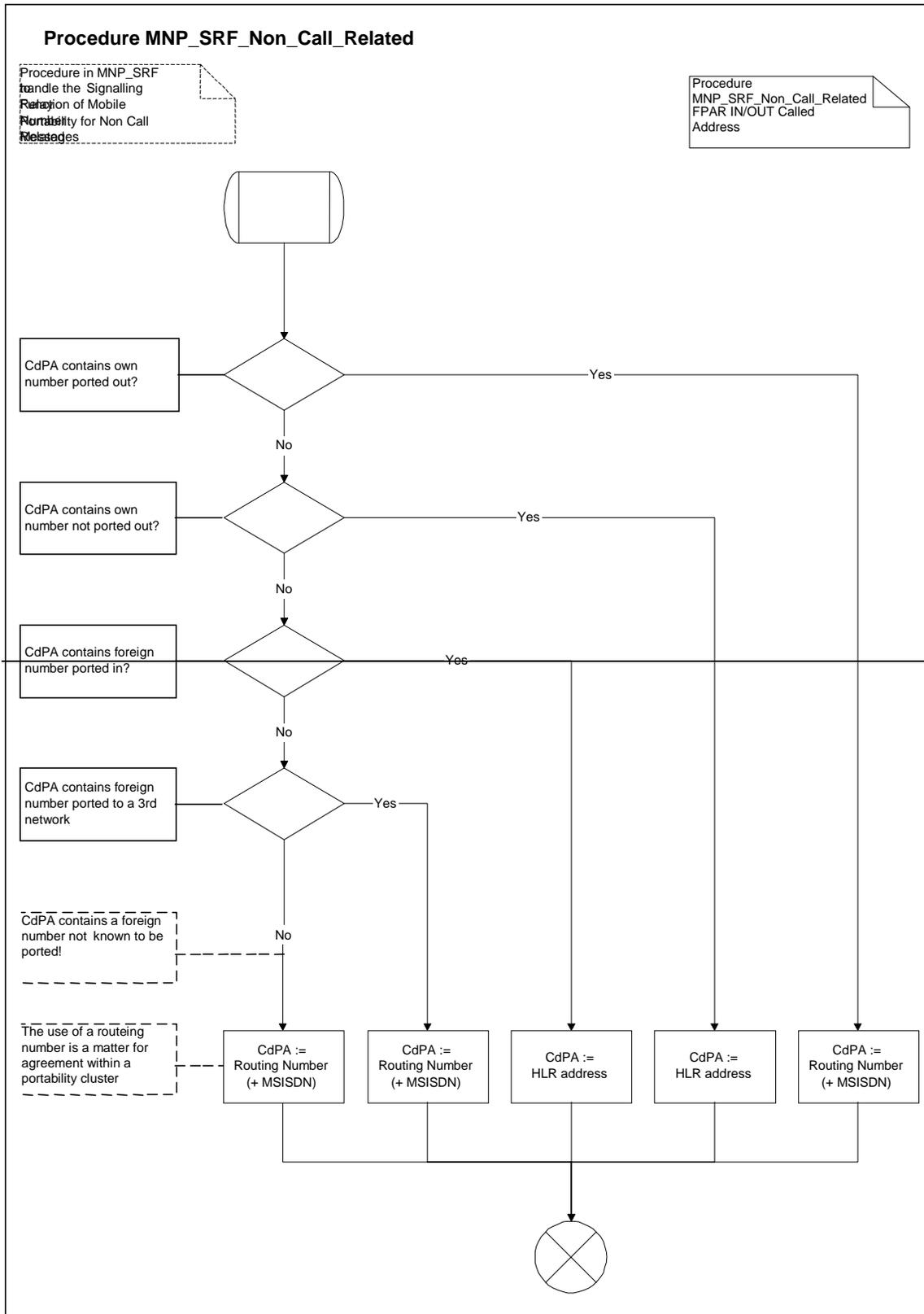
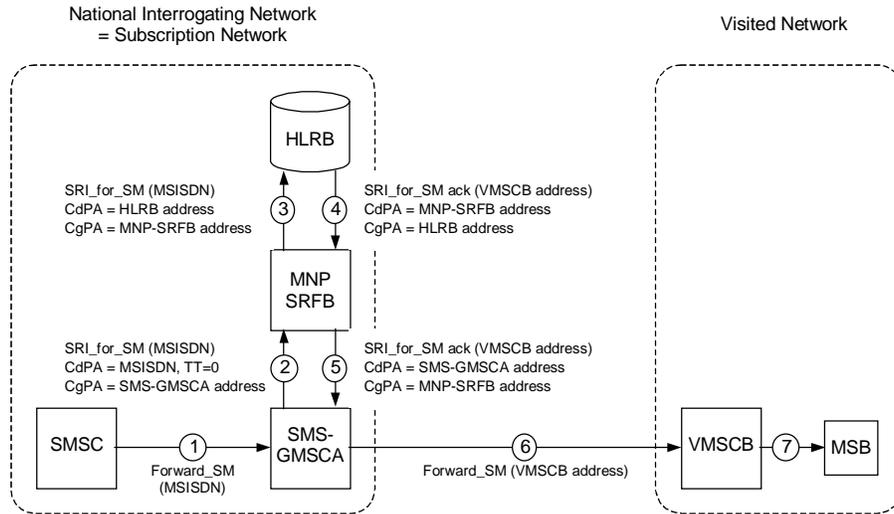


Figure B.3.1: Procedure MNP\_SRF\_Non\_Call\_Related

## B.4.2 Delivery of SMS to a Non-ported Number - Direct Routing – MNP-SRF acts as Higher-level Relay

Figure B.4.2 shows the MNP-SRF operation for delivering an SMS message to a non-ported number where the SRI\_for\_SM message is submitted by a national interrogating network. For further details of the higher level relay function (e.g. TC relay), the reader is referred to [8].



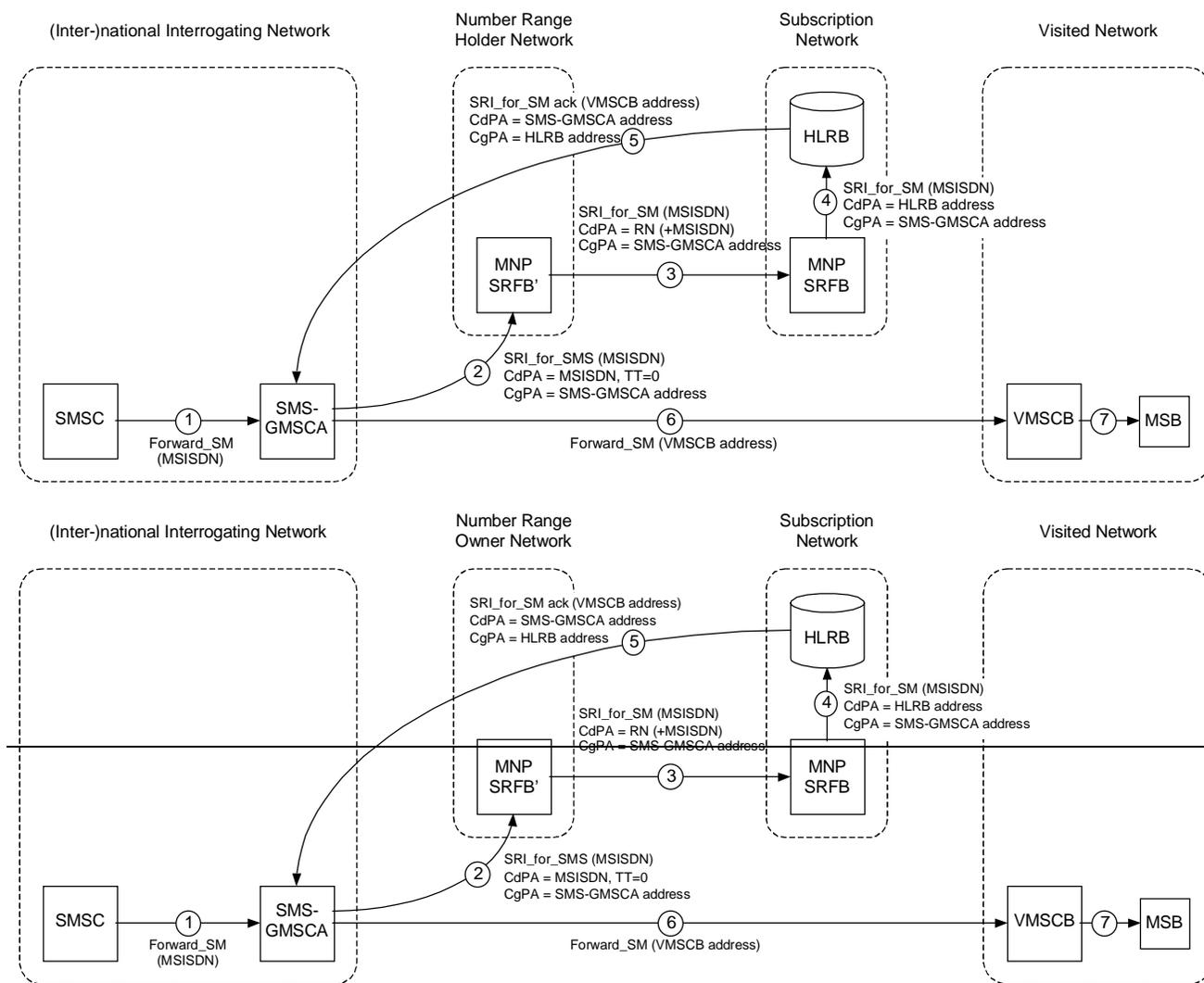
**Figure B.4.2: SRF operation for delivering an SMS message to a non-ported number where the SRI\_for\_SM message is submitted by a national interrogating network**

1. The SMSC forwards a SM to the SMS-GMSCA via a proprietary interface;
2. The SMS-GMSCA generates a routing enquiry for SM delivery. The MAP SRI\_for\_SM message is routed to the network's MNP-SRF;
3. When MNP-SRFB receives the message it terminates the TCAP dialogue and an MNP-SRF operation is triggered. The MNP-SRF functionality analyses the MSISDN in the TCAP portion of the message and identifies the MSISDN as being non-ported using information which may be retrieved from an NP database. The MNP-SRF function then initiates a new dialogue and routes the message to HLRB;
4. HLRB responds to the routing enquiry by sending back an SRI\_for\_SM ack with the address of the VMSC;
5. MNP-SRFB responds to the routing enquiry by sending back an SRI\_for\_SM ack with the address of the VMSC to the SMS-GMSCA
6. The SMS-GMSCA can now deliver the message to the VMSCB using a Forward\_SMS message.
7. VMSCB further delivers the message to MSB.

## B.4.3 Delivery of SMS to a Ported Number – Indirect Routing

Figure B.4.3 shows the MNP-SRF operation for delivering an SMS message to a ported number where the interrogating network does not support direct routing.

The message flows for this scenario are based on the use of an SCCP-relay function in the MNP-SRF(s). If the MNP-SRF(s) use(s) a higher-level relay function (e.g. TC-relay), then the response message will go via the MNP-SRF as shown in B.4.2. For further details of the signalling relay functions, the reader is referred to [8].



**Figure B.4.3: SRF operation for delivering an SMS message to a ported number where the interrogating network does not support direct routing**

1. The SMSC forwards a SM to the SMS-GMSCA via a proprietary interface;
2. The SMS-GMSCA generates a routing enquiry for SM delivery. The MAP SRI\_for\_SM message is routed to the number range owner/holder network's MNP-SRFB;
3. When MNP-SRFB' receives the message, MNP-SRF operation is triggered. The MNP-SRF functionality analyses the MSISDN in the CdPA and identifies the MSISDN as being ported using information which may be retrieved from an NP database. As the message is non-call related, the MNP-SRF function then populates the CdPA with either a routing number or a concatenation of a routing number and MSISDN. After modifying the CdPA, the message is routed to MNP-SRFB in the subscription network;
4. When MNP-SRFB receives the message, MNP-SRF operation is triggered. The MNP-SRF functionality analyses the MSISDN in the CdPA and identifies the MSISDN as being ported into the network using

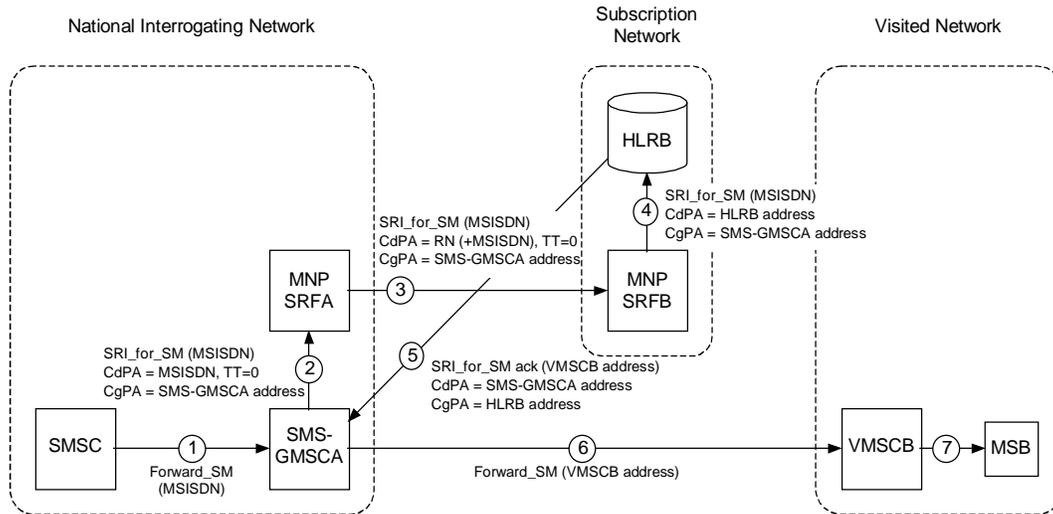
information which may be retrieved from an NP database. The MNP-SRF function then populates the CdPA with an HLRB address. After modifying the CdPA, the message is routed to HLRB;

5. HLRB responds to the routing enquiry by sending back an SRI\_for\_SM ack with the address of the VMSC;
6. The SMS-GMSC can now deliver the message to the VMSCB using a Forward\_SMS message.
7. VMSCB further delivers the message to MSB.

## B.4.4 Delivery of SMS to a Ported Number – Direct Routing

Figure B.4.4 shows the MNP-SRF operation for delivering an SMS message to a ported number where the interrogating network supports direct routing.

The message flows for this scenario are based on the use of an SCCP-relay function in the MNP-SRFs. If the MNP-SRFs use a higher-level relay function (e.g. TC-relay), then the response message will go via the MNP-SRF as shown in B.4.2. For further details of the signalling-relay functions, the reader is referred to [8].



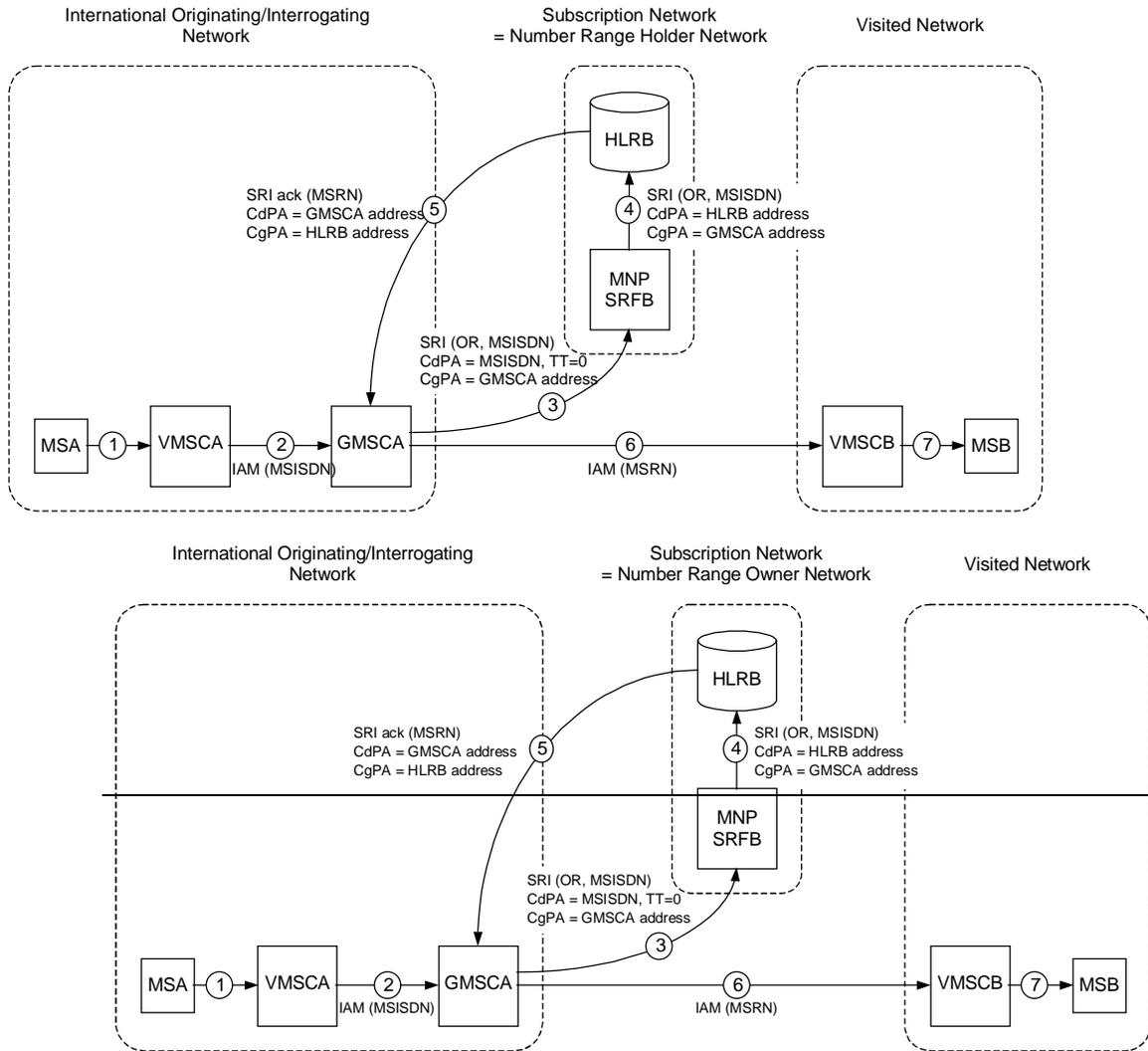
**Figure B.4.4: SRF operation for delivering an SMS message to a ported number where the interrogating network supports direct routing**

1. The SMSC forwards a SM to the SMS-GMSCA via a proprietary interface;
2. The SMS-GMSCA generates a routing enquiry for SM delivery. The MAP `SRI_for_SM` message is routed to the network's MNP-SRF;
3. When MNP-SRFA receives the message, MNP-SRF operation is triggered. The MNP-SRF functionality analyses the MSISDN in the CdPA and identifies the MSISDN as being ported using information which may be retrieved from an NP database. As the message is non-call related, the MNP-SRF function then populates the CdPA with either a routing number or a concatenation of a routing number and MSISDN. After modifying the CdPA, the message is routed to MNP-SRFB in the subscription network;
4. When MNP-SRFB receives the message, MNP-SRF operation is triggered. The MNP-SRF functionality analyses the MSISDN in the CdPA and identifies the MSISDN as being ported into the network using information which may be retrieved from an NP database. The MNP-SRF function then populates the CdPA with an HLRB address. After modifying the CdPA, the message is routed to HLRB;
5. HLRB responds to the routing enquiry by sending back an `SRI_for_SM ack` with the address of the VMSCB;
6. The SMS-GMSCA can now deliver the message to the VMSCB using a `Forward_SMS` message.
7. VMSCB further delivers the message to MSB.

## B.4.5 International SOR for a Non-ported Number

Figure B.4.5 shows the MNP-SRF operation for optimally routing an international call to a non-ported number.

The message flows for this scenario are based on the use of an SCCP-relay function in the MNP-SRF. If the MNP-SRF uses a higher-level relay function (e.g. TC-relay), then the response message will go via the MNP-SRF as shown in B.4.2. For further details of the signalling-relay functions, the reader is referred to [8].



**Figure B.4.5: SRF operation for optimally routing an international call to a non-ported number**

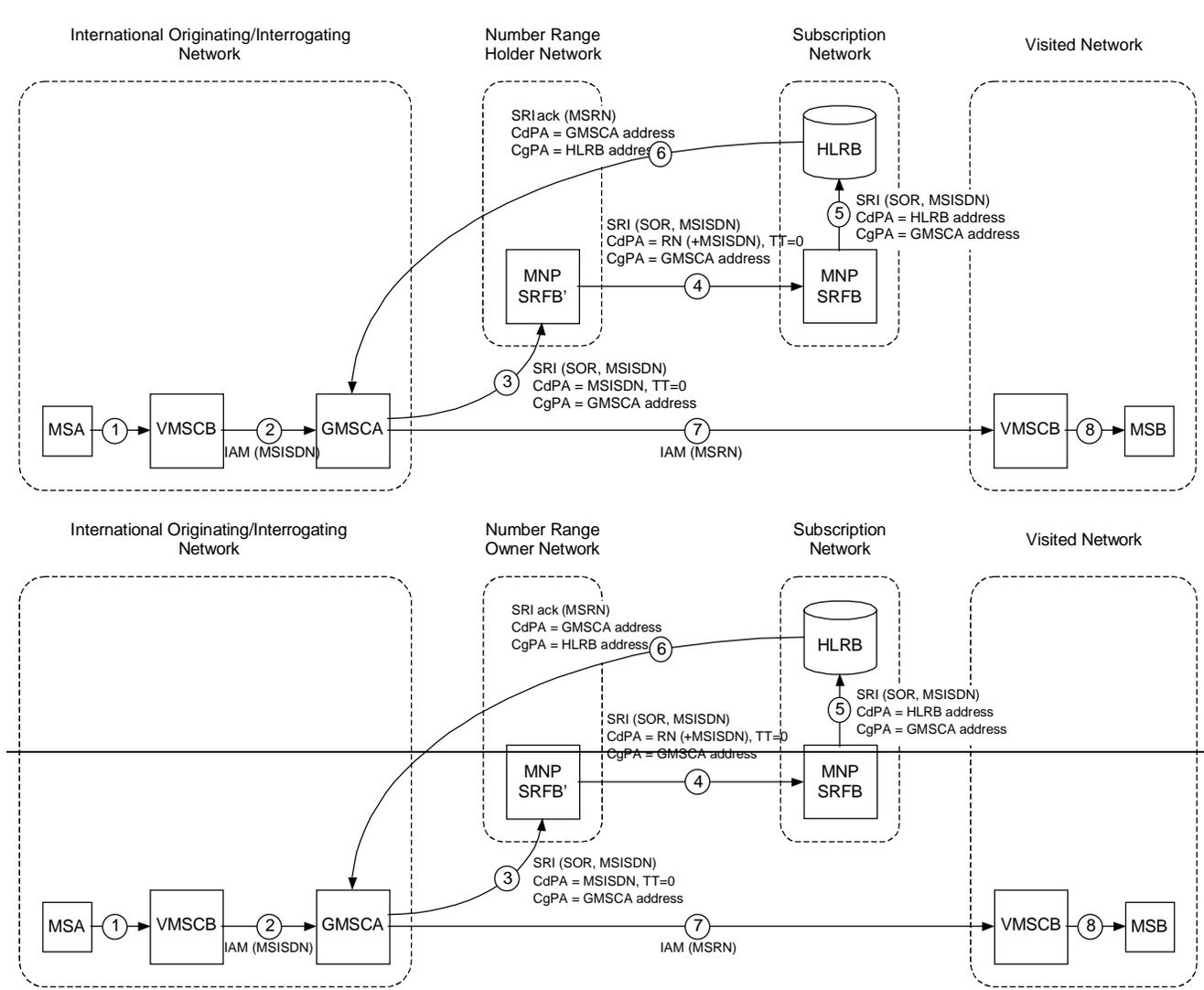
1. MSA originates a call to MSISDN;
2. VMSCA routes the call to the originating network's GMSCA;
3. When GMSCA receives the ISUP IAM, it requests routing information by submitting a MAP SRI with SOR parameter set to the number range owner/holder network of the dialled MSISDN. Within the number range owner/holder network, the message is routed to the network's MNP-SRF;
4. When MNP-SRFB receives the message, MNP-SRF operation is triggered. The MNP-SRF functionality analyses the MSISDN in the CdPA and identifies the MSISDN as being non-ported using information which may be retrieved from an NP database. The MNP-SRF function then populates the CdPA with an HLRB address. After modifying the CdPA, the message is routed to HLRB;
5. When HLRB receives the SRI, it responds to the GMSCA by sending back an SRI ack with a MSRN;

6. GMSCA uses the MSRN to route the call to VMSCB;
7. VMSCB further establishes a traffic channel to MSB.

### B.4.6 SOR for a Ported Number – Indirect Routing

Figure B.4.6 shows the MNP-SRF operation for optimally routing a call (using SOR) to a ported number where the interrogating network does not support direct routing.

The message flows for this scenario are based on the use of an SCCP-relay function in the MNP-SRFs. If the MNP-SRFs use a higher-level relay function (e.g. TC-relay), then the response message will go via the MNP-SRF as shown in B.4.2. For further details of the signalling-relay functions, the reader is referred to [8].



**Figure B.4.6: MNP-SRF operation for optimally routing a call (using SOR) to a ported number where the interrogating network does not support direct routing**

1. MSA originates a call to MSISDN;
2. VMSCA routes the call to the network’s GMSCA;
3. When GMSCA receives the ISUP IAM, it requests routing information by submitting a MAP SRI with SOR parameter set to the number range ~~owner~~holder network of the dialled MSISDN. Within the number range ~~owner~~holder network, the message is routed to the network’s MNP-SRF;
4. When MNP-SRFB’ receives the message, MNP-SRF operation is triggered. The MNP-SRF functionality analyses the MSISDN in the CdPA and identifies the MSISDN as being ported using information which may be retrieved from an NP database. As the message is non-call related, the MNP-SRF function then populates the

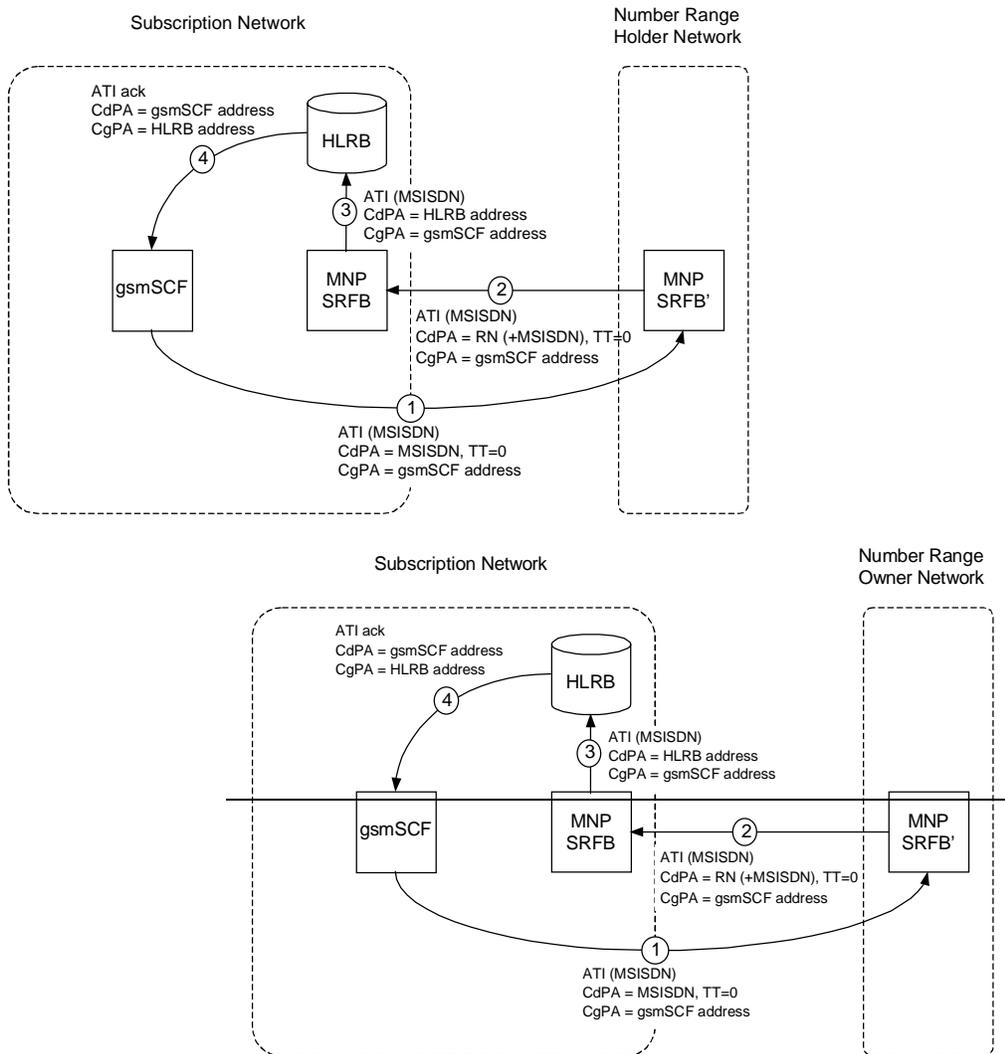
CdPA with either a routing number or a concatenation of a routing number and MSISDN. After modifying the CdPA, the message is routed to MNP-SRFB in the subscription network;

5. When MNP-SRFB receives the message, MNP-SRF operation is triggered. The MNP-SRF functionality analyses the MSISDN in the CdPA and identifies the MSISDN as being ported into the network using information which may be retrieved from an NP database. The MNP-SRF function then populates the CdPA with an HLRB address. After modifying the CdPA, the message is routed to HLRB;
6. When HLRB receives the SRI, it responds to the GMSCA by sending back an SRI ack with a MSRN;
7. GMSCA uses the MSRN to route the call to VMSCB;
8. VMSCB further establishes a traffic channel to MSB.

## B.4.7 Any Time Interrogation for a Ported Number – Indirect Routing

Figure B.4.7 shows the MNP-SRF operation for routing an Any\_Time\_Interrogation message for a ported number where the interrogating network does not support direct routing.

The message flows for this scenario are based on the use of an SCCP-relay function in the MNP-SRFs. If the MNP-SRFs use a higher-level relay function (e.g. TC-relay), then the response message will go via the MNP-SRF as shown in B.4.2. For further details of the signalling relay functions, the reader is referred to [8].



**Figure B.4.7: MNP-SRF operation for routing an Any\_Time\_Interrogation message for a ported number where the interrogating network does not support direct routing**

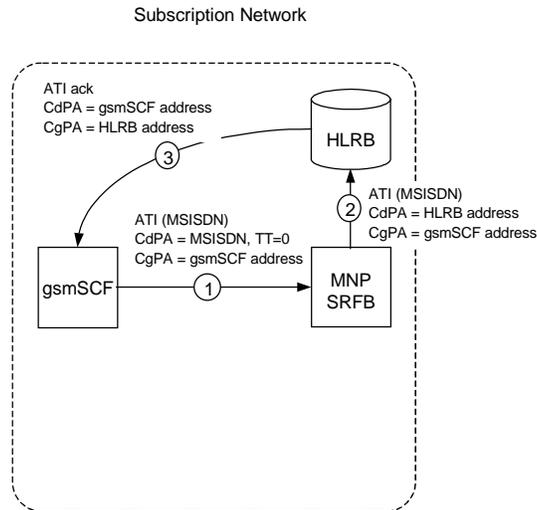
1. The gsmSCF generates an Any\_Time\_Interrogation (ATI) message. The message is routed to the number range owner/holder network's MNP-SRF;
2. When MNP-SRFB' receives the message, MNP-SRF operation is triggered. The MNP-SRF functionality analyses the MSISDN in the CdPA and identifies the MSISDN as being ported using information which may be retrieved from an NP database. As the message is non-call related, the MNP-SRF function then populates the CdPA with either a routing number or a concatenation of a routing number and MSISDN. After modifying the CdPA, the message is routed to MNP-SRFB in the subscription network;

3. When MNP-SRFB receives the message, MNP-SRF operation is triggered. The MNP-SRF functionality analyses the MSISDN in the CdPA and identifies the MSISDN as being ported into the network using information which may be retrieved from an NP database. The MNP-SRF function then populates the CdPA with an HLRB address. After modifying the CdPA, the message is routed to HLRB;
4. HLRB responds to the ATI by sending back an ATI ack with the requested information;

## B.4.8 Any Time Interrogation for a Ported Number – Direct Routeing

Figure B.4.8 shows the MNP-SRF operation for routeing an Any\_Time\_Interrogation message for a ported number where the interrogating network supports direct routeing.

The message flows for this scenario are based on the use of an SCCP-relay function in the MNP-SRF. If the MNP-SRF uses a higher-level relay function (e.g. TC-relay), then the response message will go via the MNP-SRF as shown in B.4.2. For further details of the signalling relay functions, the reader is referred to [8].



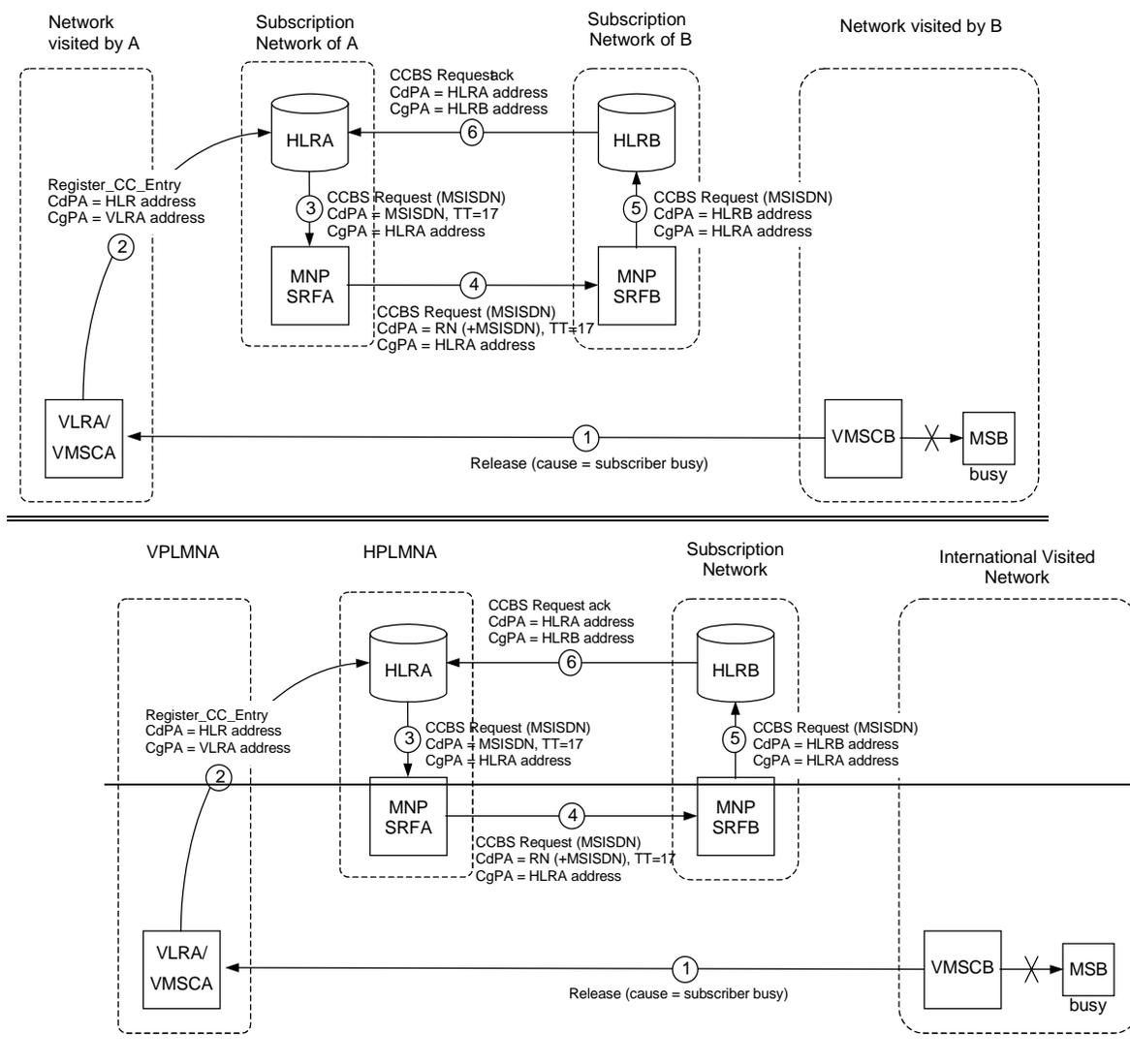
**Figure B.4.8: MNP-SRF operation for routeing an Any\_Time\_Interrogation message for a ported number where the interrogating network supports direct routeing**

1. The gsmSCF generates an Any\_Time\_Interrogation (ATI) message. The message is routed to the network's MNP-SRF;
2. When MNP-SRFB receives the message, MNP-SRF operation is triggered. The MNP-SRF functionality analyses the MSISDN in the CdPA and identifies the MSISDN as being ported into the network using information which may be retrieved from an NP database. The MNP-SRF function then populates the CdPA with an HLRB address. After modifying the CdPA, the message is routed to HLRB;
3. HLRB responds to the ATI by sending back an ATI ack with the requested information;

### B.4.9 CCBS where the Busy Subscriber is a Ported Subscriber – Direct Routing

Figure B.4.9 shows the MNP-SRF operation for routing a CCBS Request for a ported number where the interrogating network supports direct routing.

The message flows for this scenario are based on the use of an SCCP-relay function in the MNP-SRFs. If the MNP-SRFs use a higher-level relay function (e.g. TC-relay), then the response message will go via the MNP-SRF as shown in B.4.2. For further details of the signalling relay functions, the reader is referred to [8].



**Figure B.4.9: MNP-SRF operation for routing a CCBS Request for a ported number where the interrogating network supports direct routing**

1. The VMSCA receives a ISUP Release message with cause value ‘subscriber busy’ from VMSCB;
2. VLRA/VMSCA sends a Register\_CC\_Entry to HLR A using the HLR A address as CdPA on SCCP;
3. The HLR A sends a CCBS Request message to the networks MNP-SRFA;
4. When MNP-SRFA receives the message, MNP-SRF operation is triggered. The MNP-SRF functionality analyses the MSISDN in the CdPA and identifies the MSISDN as being ported using information which may be retrieved from an NP database. As the message is non-call related, the MNP-SRF function then populates the CdPA with either a routing number or a concatenation of a routing number and MSISDN. After modifying the CdPA, the message is routed to MNP-SRFB in the subscription network;

5. When MNP-SRFB receives the message, MNP-SRF operation is triggered. The MNP-SRF functionality analyses the MSISDN in the CdPA and identifies the MSISDN as being ported into the network using information which may be retrieved from an NP database. The MNP-SRF function then populates the CdPA with an HLRB address. After modifying the CdPA, the message is routed to HLRB;
6. HLRB can now respond to HLRA by sending back a CCBS ack message;

# Annex C (normative): MNP Signalling Relay Function - Call Related Signalling

## C.1 Handling of Call Related Signalling

The only call related MAP message affected by MNP is the ~~MAP~~ MAP SEND\_ROUTEING ROUTING INFORMATION (SRI) message without OR parameter set sent to the HLR.

In a PLMN supporting MNP with direct routeing using signalling relay, all incoming calls and calls originating in the network for which the called party number is within the ranges owned by any network in the portability ~~cluster~~ domain, the gateway MSCs will send an SRI such that it will be handled by the MNP-SRF in that network.

In a PLMN supporting MNP with indirect routeing using signalling relay, all incoming calls and calls originating in the network for which the called party number is within the range owned by the network, the gateway MSCs will send SRI such that it will be handled by the MNP-SRF in that network.

The MNP-SRF obtains routeing information from the NP database to identify the subscription network associated with a particular national MSISDN. The interface between the MNP-SRF and the NP database is considered implementation dependent and is not detailed further.

From the perspective of the PLMN in which the MNP-SRF resides, the CdPA represents one of:

1. An own number ported out;
2. An own number not ported out;
3. A foreign number ported in;
4. A foreign number ported to a foreign network;
5. A foreign number not known to be ported.

Cases 4 and 5 are applicable only for direct routeing.

In case 1, the MNP-SRF may perform one of the following depending on agreements within the number portability ~~cluster~~ domain.

- a. An SRI response is sent containing the necessary routeing information to route the call to the subscription network. This is performed by an internal MAP Application Termination Function (MATF) known as the Number Portability Location Register (NPLR).
- b. If indirect routeing of calls with reference to the subscription network is used, the message is relayed to the MNP-SRF in the subscription network, whose NPLR provides the necessary routeing information in an SRI response. The use of an NPLR in the subscription network can only be by agreement within the number portability ~~cluster~~ domain.

In cases 2 and 3 the MNP-SRF relays the message to the HLR. ~~For further details of the signalling relay function, the reader is referred to [8].~~

In case 4, an SRI response is sent, containing the necessary routeing information to route the call to the subscription network.

In case 5, an SRI response is sent, containing the necessary routeing information to route the call to the number range ~~owner~~ holder network.

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## C.2 Functional Requirements of Network Entities

### C.2.1 Procedure MNP\_SRF\_MATF\_Call\_Related

Figure C.2.1.1 shows the procedure MNP\_SRF\_MATF\_Call\_Related. This procedure handles call-related signalling messages. It is called from the process MNP\_SRF (see clause 4.3).

The check “message has been relayed” identifies all call related signalling messages which are relayed from the number range ownerholder network towards the subscription network in the case of Indirect Routeing with reference to subscription network implementation. These messages only refer to numbers ported into the network.

The check “own number not ported out” identifies all mobile numbers from number ranges allocated to the network the MNP-SRF/MATF is located in and which are not ported to other networks. In this case the call related message is relayed to the HLR in the network

The check “foreign number ported in” identifies all mobile numbers from the number ranges not allocated to the network the MNP-SRF/MATF is located in and which are served by the network the MNP-SRF/MATF is located in. In this case the call related message is relayed to the HLR in the network.

The check “foreign number not known to be ported” identifies all mobile numbers from the number ranges not allocated to the network the MNP-SRF/MATF is located in and which are also not served by the network the MNP-SRF/MATF is located in. In this case the call is sent to the SRF\_MATF procedure for handling.

The check “foreign number ported to foreign network” identifies all mobile numbers from the number ranges not allocated to the network the MNP-SRF/MATF is located in and which are not served by the network the MNP-SRF is located in and not served by the network the number range is allocated to, i.e. the number is ported between two other networks. In this case the call related message is sent to the SRF\_MATF procedure for handling.

The remaining cases “own number ported out” are mobile numbers allocated to the network the MNP-SRF/MATF is located in and which are served by other networks, i.e. the number is ported out to another network. In this case the call is relayed to the MATF in the subscription network if this option is the one used by the operator, or sent to the SRF\_MATF procedure for handling if not.

### C.2.2 Process SRI\_NPLR

Figure C.2.2 shows the process SRI\_NPLR.

The check “unknown subscriber” identifies a subscriber without any associated available information.

If the GMSC is in the database own network then a routeing number is provided to route to the number range ownerholder network.

If the GMSC is not in the database own network then the enquiry has been routed from the number range ownerholder network, so the call should fail.

The database query uses the MSISDN received at the application level in the SRI, rather than the CdPA of the SCCP level.

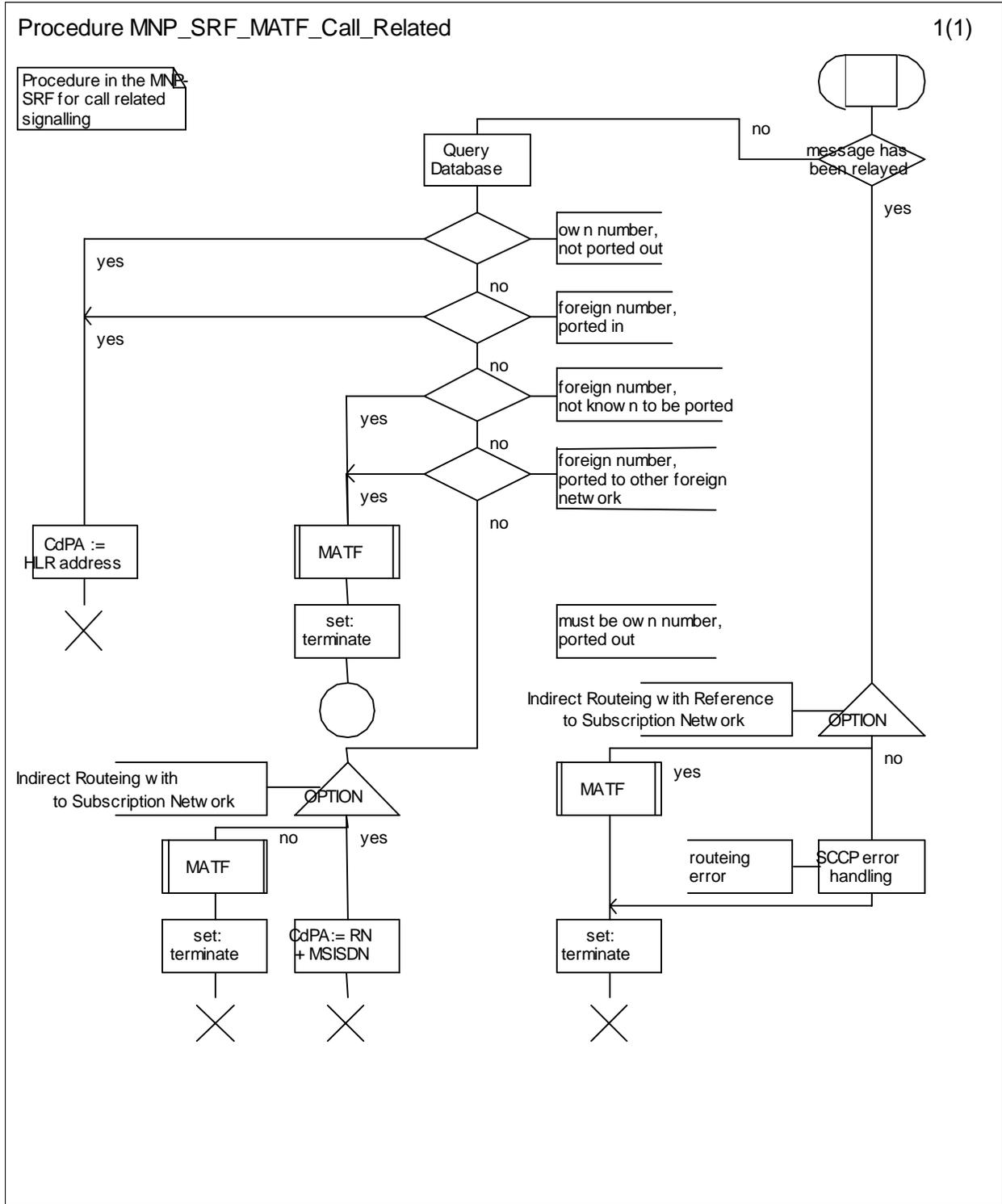


Figure C.2.1.1: Procedure MNP\_SRF\_MATF\_Call\_Related

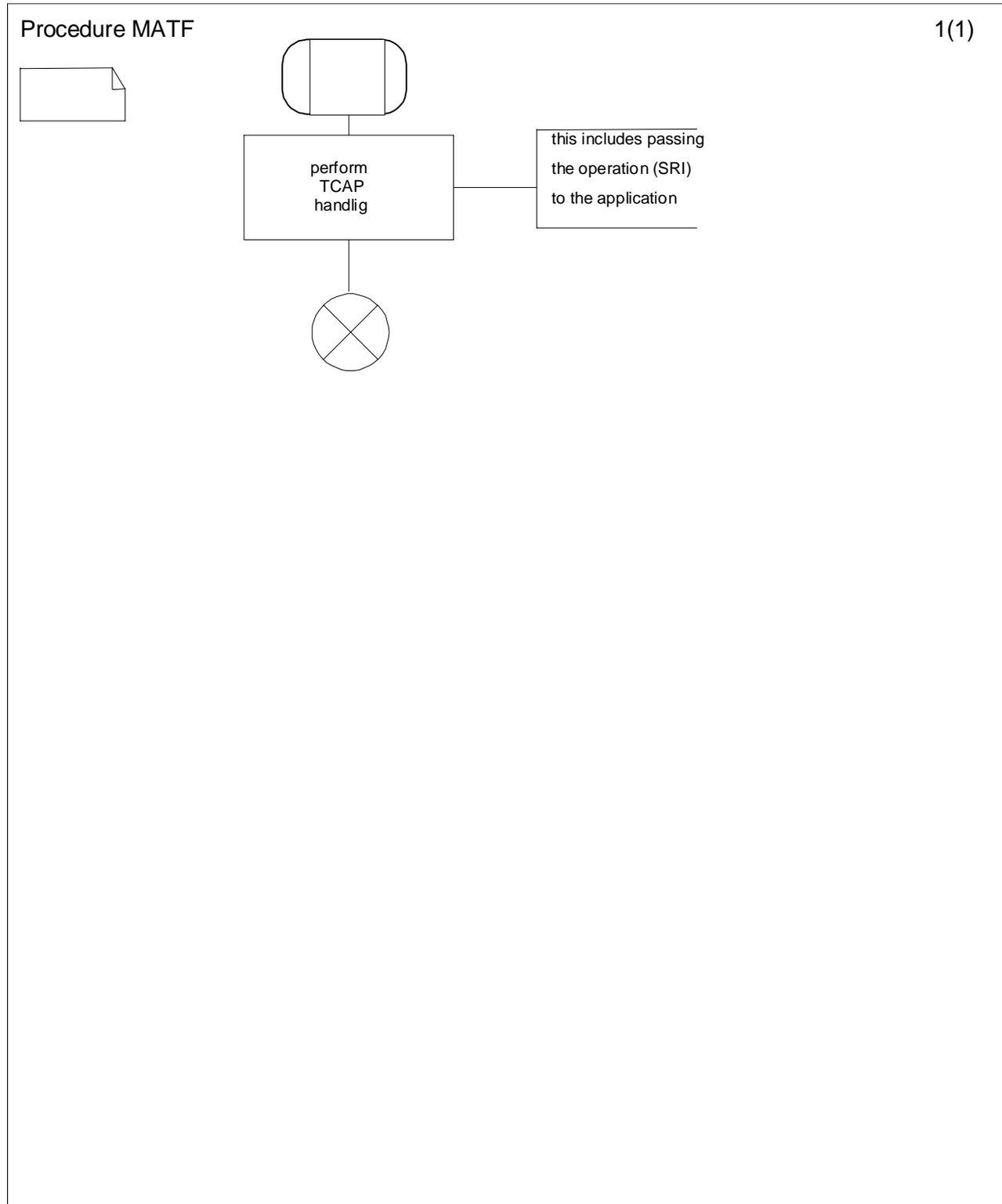
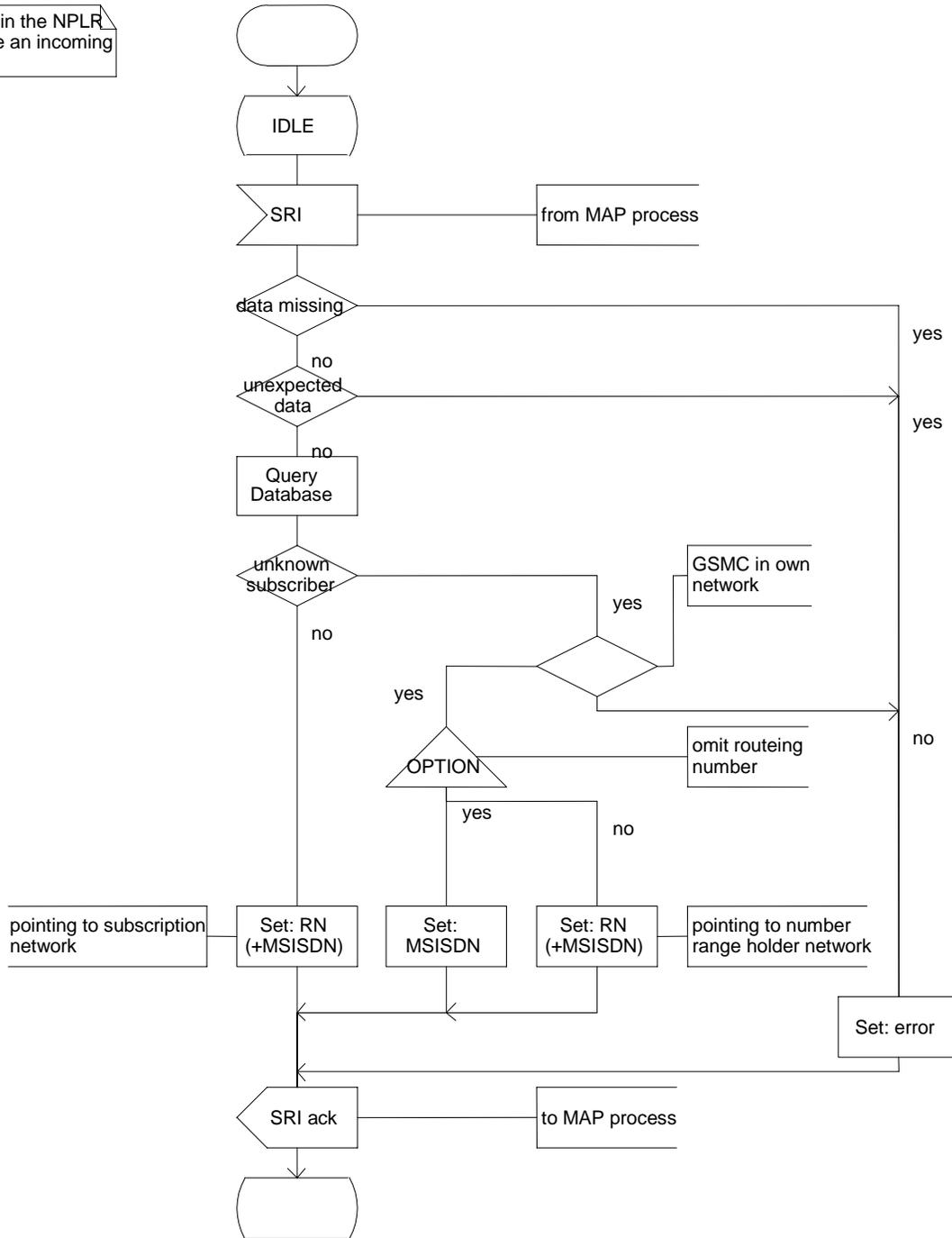


Figure C.2.1.2: Procedure MATF

Process SRI\_NPLR

1(1)

Process in the NPLR to handle an incoming SRI





## C.3 Call Scenarios

The notation TT=SRI in diagrams in this section assumes that SRI=CRMNP. The use of other translation types is for further study. The message flows for the following scenarios are based on the use of an SCCP relay function in MNP-SRF(s). The message flows for the higher level relay function (e.g. TC relay) in MNP-SRF are not covered here, but the principle can be found in C.5B.4.2. For further details of the signalling relay function, the reader is referred to [8].

### C.3.1 Call to a Non-Ported Number or Number Ported into the Network

Figure C.3.1 shows the signalling involved for a call to a non-ported number or number ported into the network (see GSM 03.18 [4]).

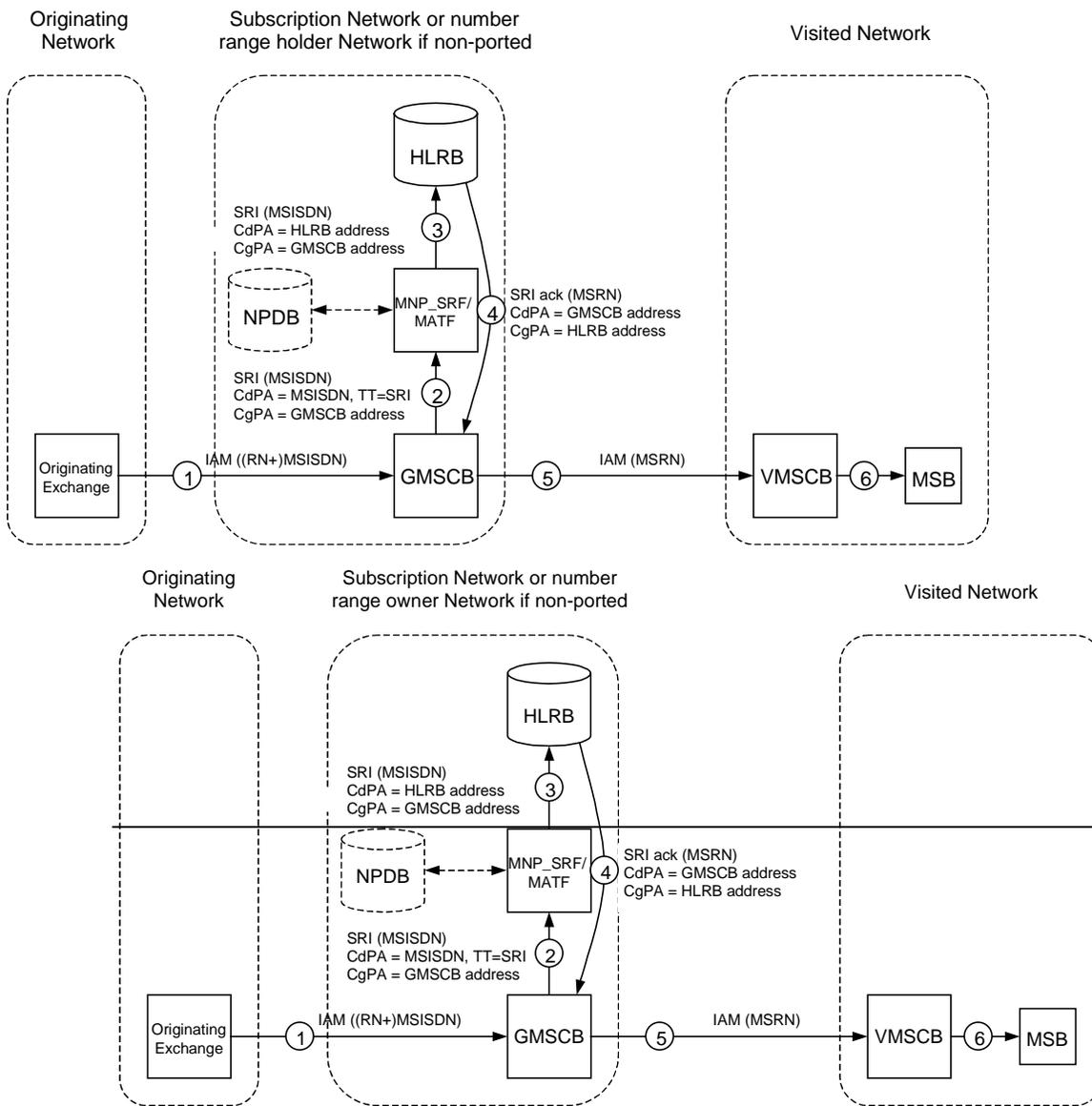
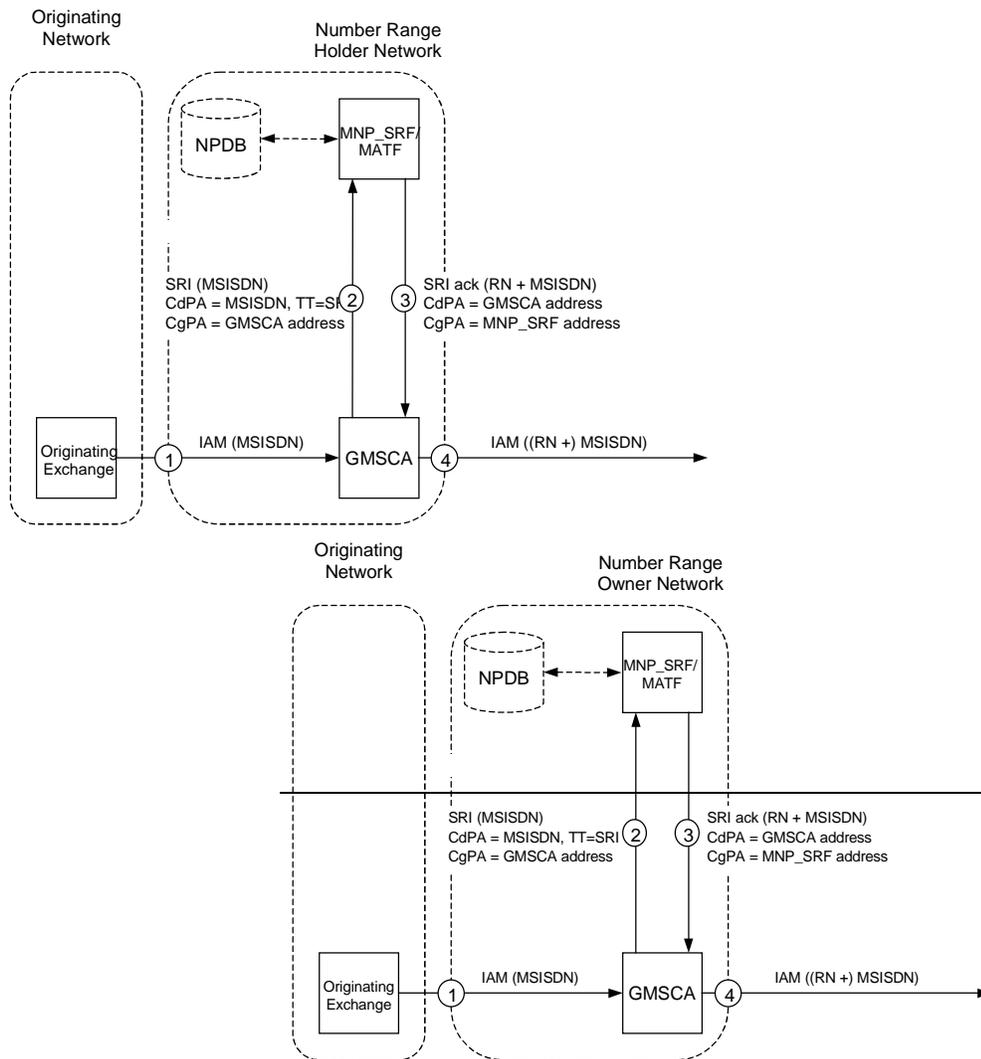


Figure C.3.1: Call to a non-ported number

1. From an Originating Exchange a call is set up to MSISDN. The call is routed to the subscription network being the number range ~~owner~~holder network, if the number is non-ported.
2. When GMSCB receives the ISUP IAM, it requests routing information by submitting a MAP SRI to the MNP\_SRF/MATF. The TT on SCCP may be set to 'SRI'.
3. When the MNP\_SRF/MATF receives the message, the MNP\_SRF/MATF analyses the MSISDN in the CdPA and identifies the MSISDN as being non-ported. The MNP\_SRF/MATF function then replaces the CdPA by an HLRB address. After modifying the CdPA, the message is routed to HLRB.
4. When HLRB receives the SRI, it responds to the GMSCB by sending an SRI ack with an MSRN that identifies the MSB in the VMSCB;
5. GMSCB uses the MSRN to route the call to VMSCB.

## C.3.4 Call to a Ported Number – Indirect Routing

Figure C.3.4 shows the signalling involved for a call to a ported number via indirect routing.

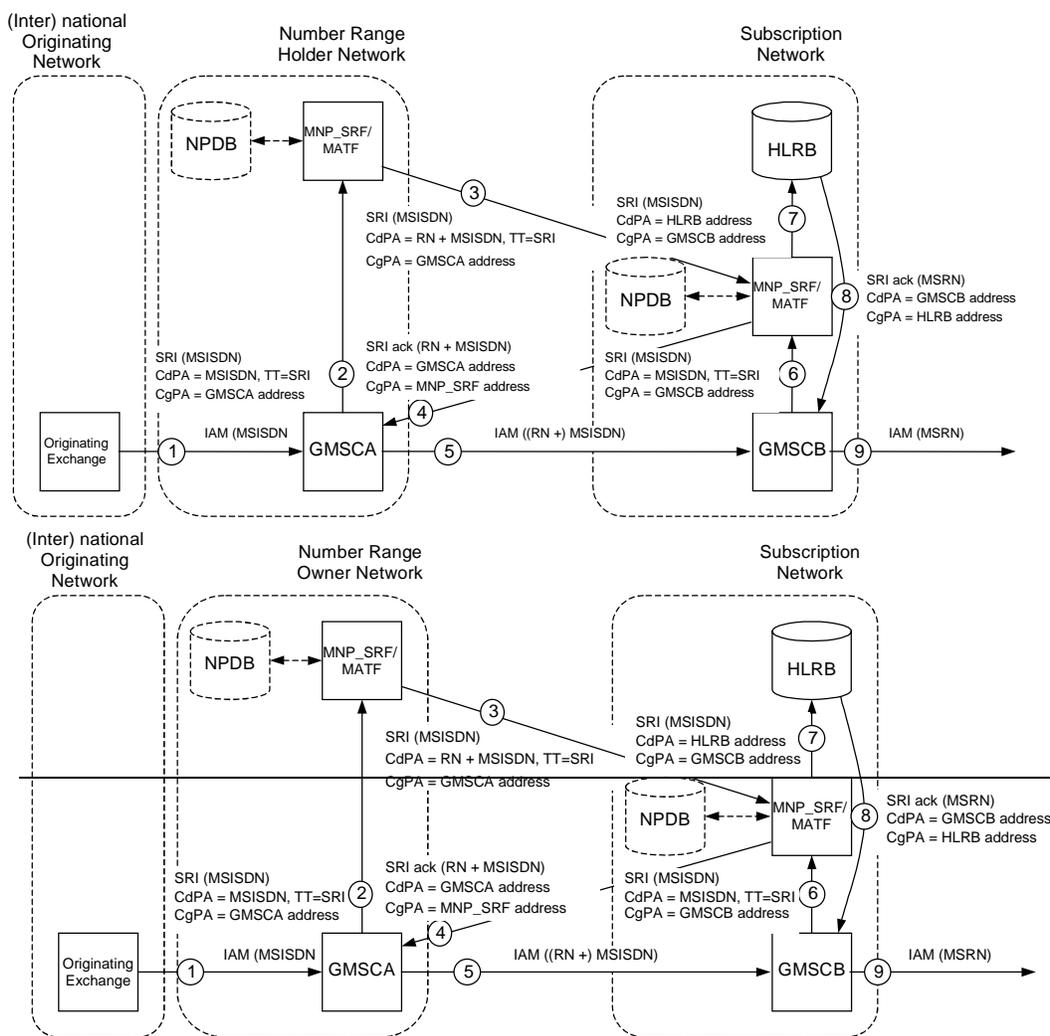


**Figure C.3.4: Call to a ported number via indirect routing**

1. From an Originating Exchange a call is set up to MSISDN. The call is routed to the number range owner holder network;
2. When GMSCA in the number range owner holder network receives the ISUP IAM, it requests routing information by submitting a MAP SRI to MNP\_SRF/MATF. The TT on SCCP may be set to 'SRI';
3. When the MNP\_SRF/MATF receives the message, it analyses the MSISDN in the CdPA and identifies the MSISDN as being ported to another network. As the message is an SRI message, the MNP\_SRF/MATF responds to the GMSCA by sending an SRI ack with a RN + MSISDN;
4. GMSCA uses the RN + MSISDN to route the call to GMSCB in the subscription network. Depending on the interconnect agreement, the RN will be added in the IAM or not.

### C.3.5 Call to a Ported Number – Indirect Routing with Reference to Subscription Network

Figure C.3.5 shows the signalling involved for a call to a ported number where indirect routing with reference to the subscription network is used.



**Figure C.3.5: National or international originated call to a ported number where indirect routing with reference to the subscription network is used**

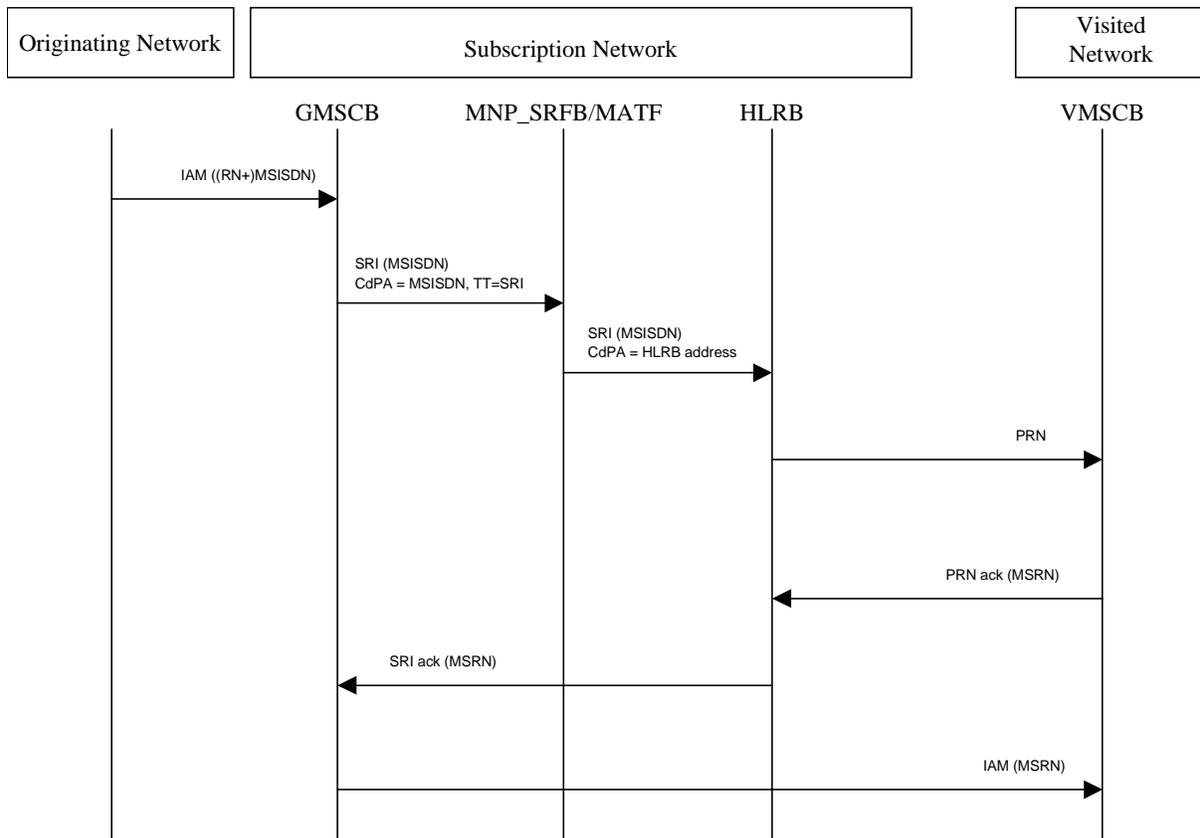
1. From an Originating Exchange a call is set up to MSISDN. The call is routed to the number range owner/holder network;
2. When GMSCA in the number range owner/holder network receives the ISUP IAM, it requests routing information by submitting a MAP SRI to the MNP\_SRF/MATF. The TT on SCCP may be set to 'SRI';
3. When MNP\_SRF/MATF receives the message, MNP\_SRF/MATF operation is triggered. The MNP\_SRF/MATF functionality analyses the MSISDN in the CdPA and identifies the MSISDN as being ported to another network. As the message is a SRI message, the MNP\_SRF/MATF function relays the message to the subscription network by adding a routing number to the CdPA which information may be retrieved from a database. After modifying the CdPA, the message is routed to the subscription network;
4. When MNP\_SRF/MATF in the subscription network receives the SRI, it responds to the GMSCA in the number range owner/holder network by sending a SRI ack with a RN + MSISDN;
5. GMSCA uses the (RN +) MSISDN to route the call to GMSCB in the subscription network; Depending on the interconnect agreement, the RN will be added in the IAM or not.

6. When GMSCB in the subscription network receives the ISUP IAM, it requests routing information by submitting a MAP SRI to MNP\_SRF/MATF. The TT on SCCP may be set to 'SRI';
7. When MNP\_SRF/MATF receives the message, MNP\_SRF/MATF operation is triggered. The MNP\_SRF/MATF functionality analyses the MSISDN in the CdPA and identifies the MSISDN as being ported into the network. The MNP\_SRF/MATF function then replaces the CdPA by an HLRB address which information may be retrieved from a database. After modifying the CdPA, the message is routed to HLRB;
8. When HLRB receives the SRI, it responds to the GMSCB by sending an SRI ack with an MSRN that identifies the MSB in the VMSCB;
9. GMSCB uses the MSRN to route the call to VMSCB.

NOTE: The MNP\_SRF/MATF in this scenario has only information about all ported numbers to one subscription network, except those for which subscription information is held in the subscription networks HLR. In this scenario the routing depends always on the number range owner holder and the subscription network.

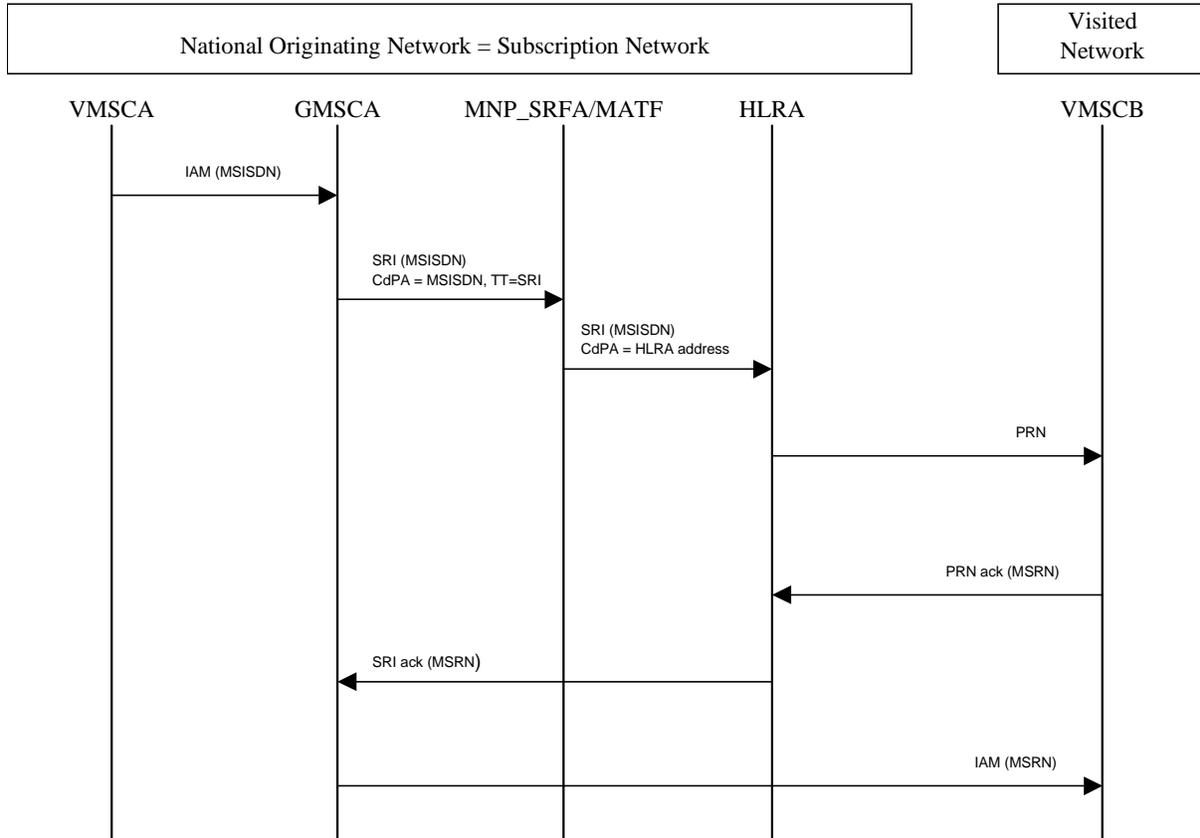
## C.4 Information Flows

Figure C.4.1 shows the information flow for a successful delivery of a call to a non-porting number or number ported into the network. The figure is related to figure C.3.1.



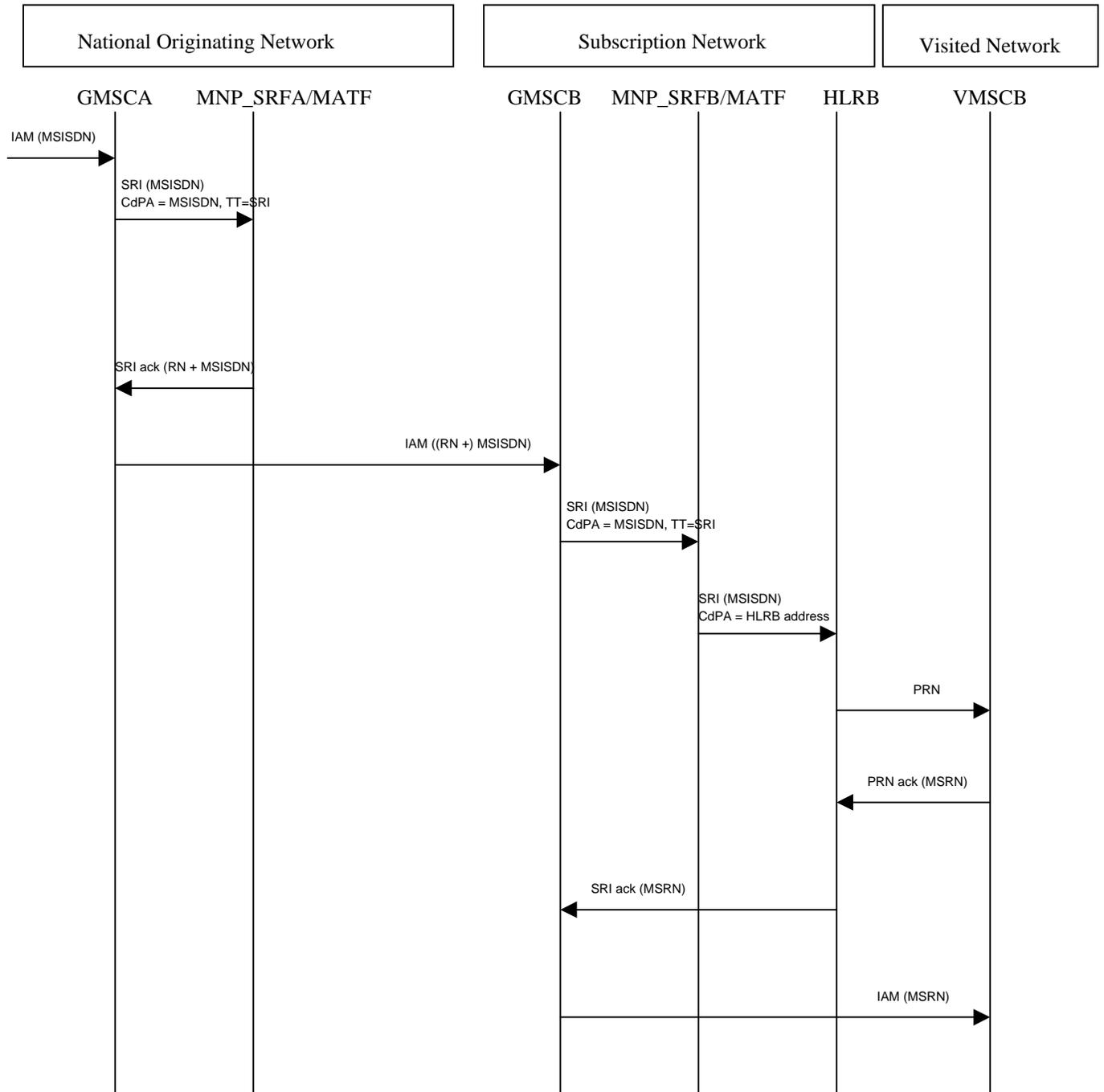
**Figure C.4.1: Successful delivery of a call to a non-porting subscriber or number ported into the network**

Figure C.4.2 shows the signalling involved for a call to a ported number via direct routing where the call is originated in the subscription network. The figure is related to figure C.3.2.



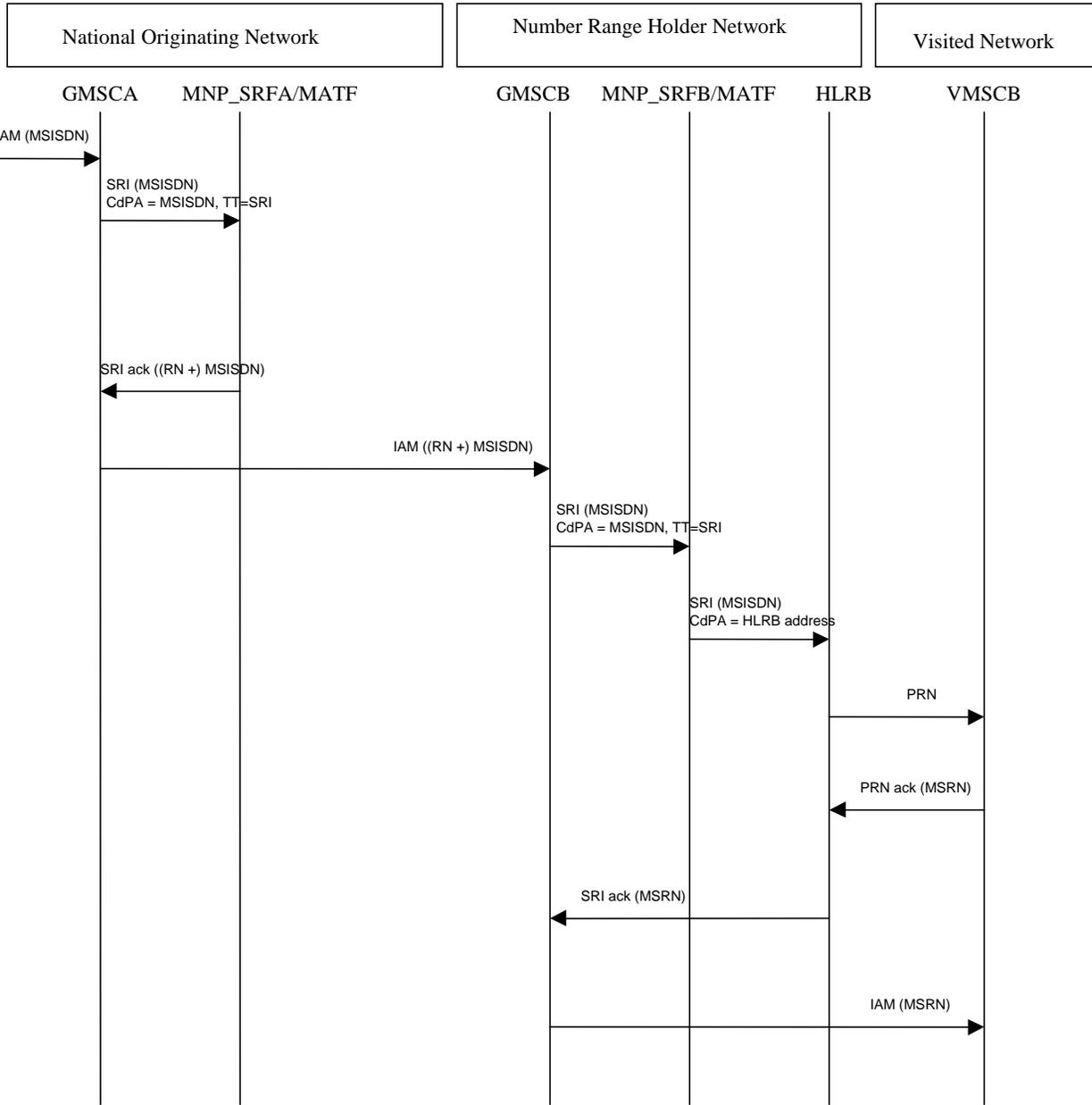
**Figure C.4.2: Successful delivery of a call to a ported number via direct routing where the call is originated in the subscription network**

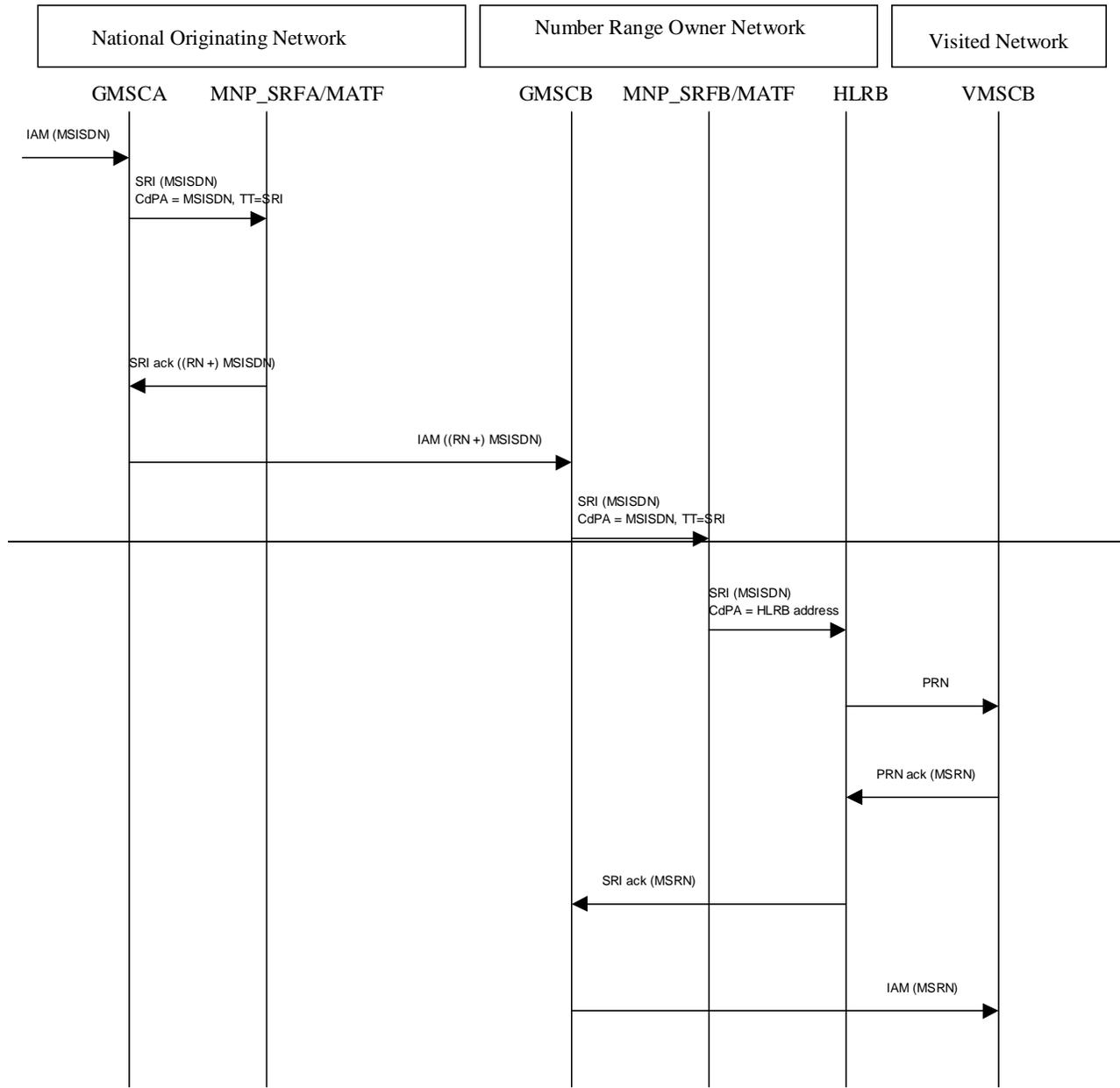
Figure C.4.3 shows the signalling involved for a national mobile originated call to a ported number via direct routing. The figure is related to figure C.3.3



**Figure C.4.3: Successful delivery of a national mobile originated call to a ported number via direct routing**

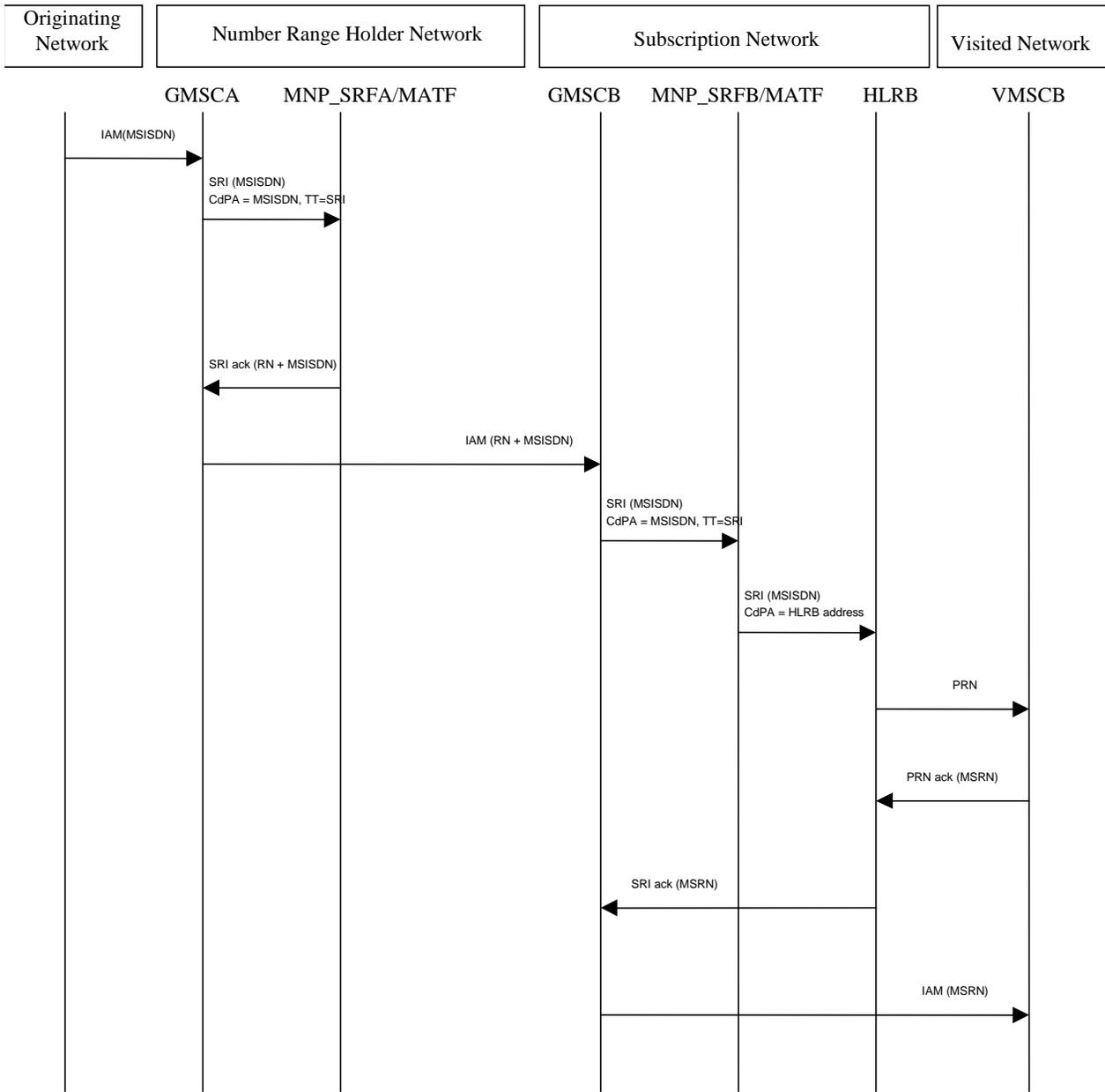
Figure C.4.4 shows the signalling involved for a national mobile originated call to a not known to be ported number via direct routing. The figure is related to figure C.3.3.





**Figure C.4.4: Successful delivery of a national mobile originated call to a not known to be ported number via direct routing**

Figure C.4.5 shows the signalling involved for a call to a ported number via indirect routing. The figure is related to figure C.3.4



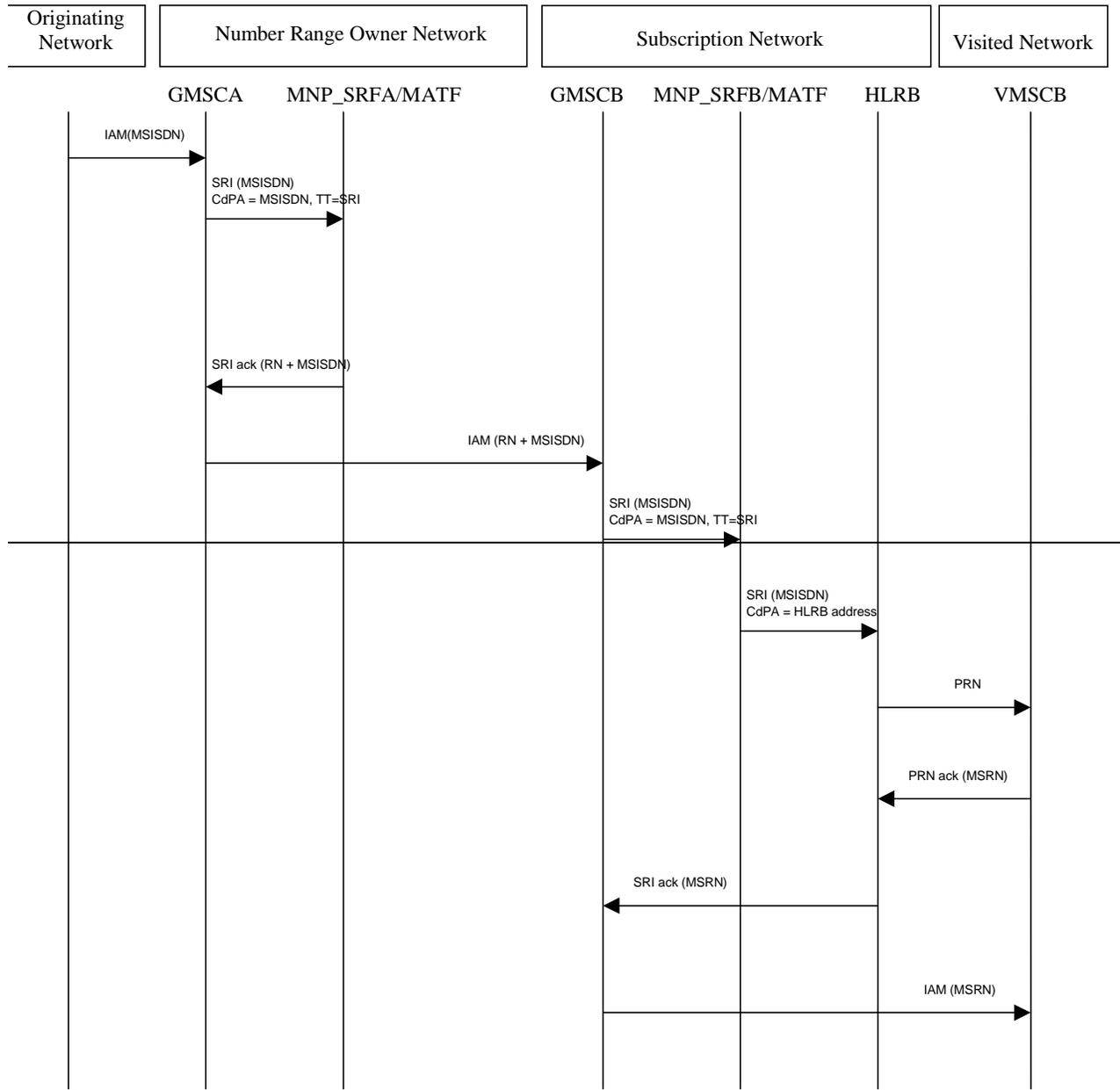
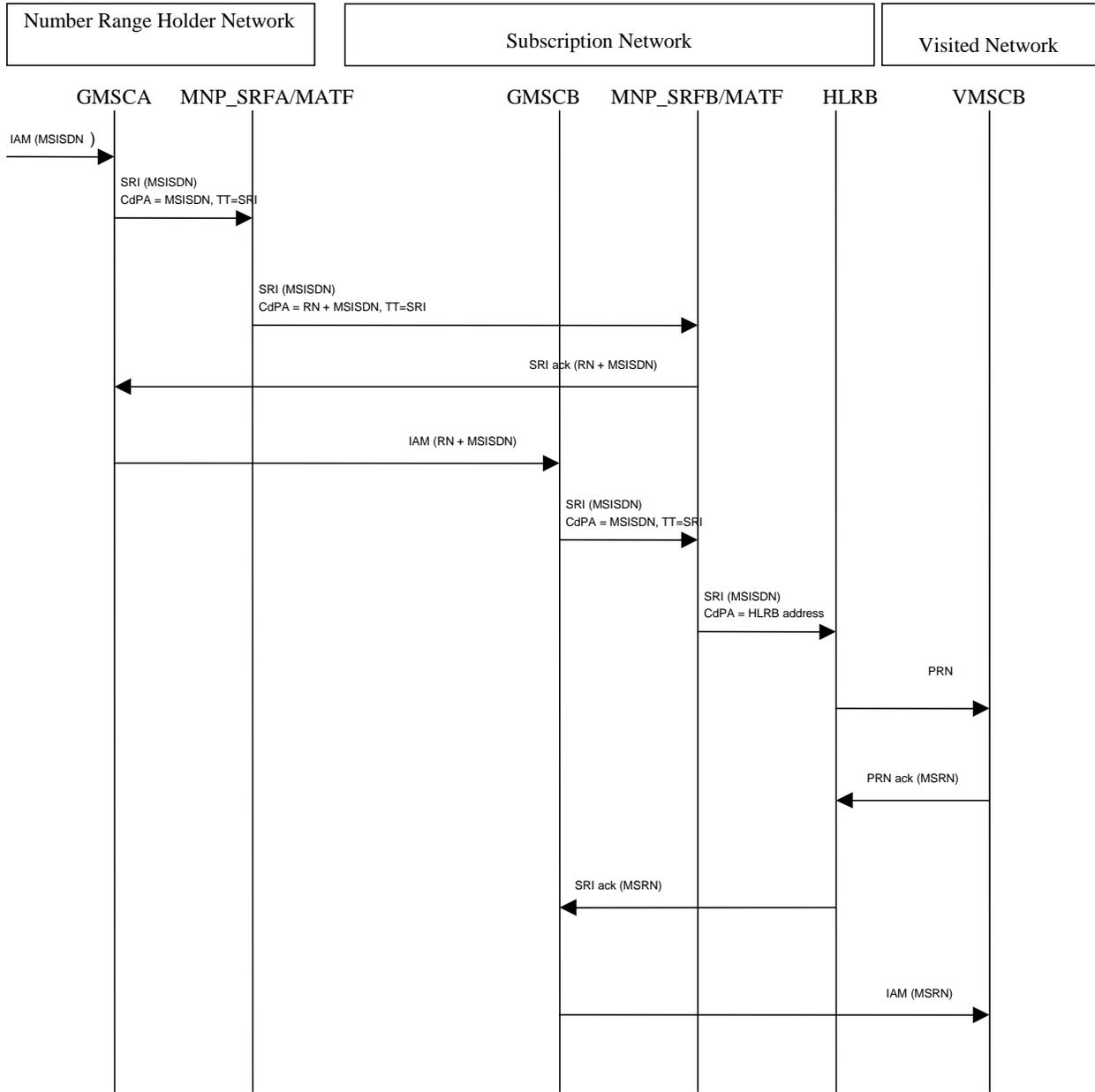


Figure C.4.5: Successful delivery of a call to a ported number via indirect routing

Figure C.4.6 shows the signalling involved for a call to a ported number where indirect routing with reference to the subscription network is used. The figure is related to figure C.3.5.



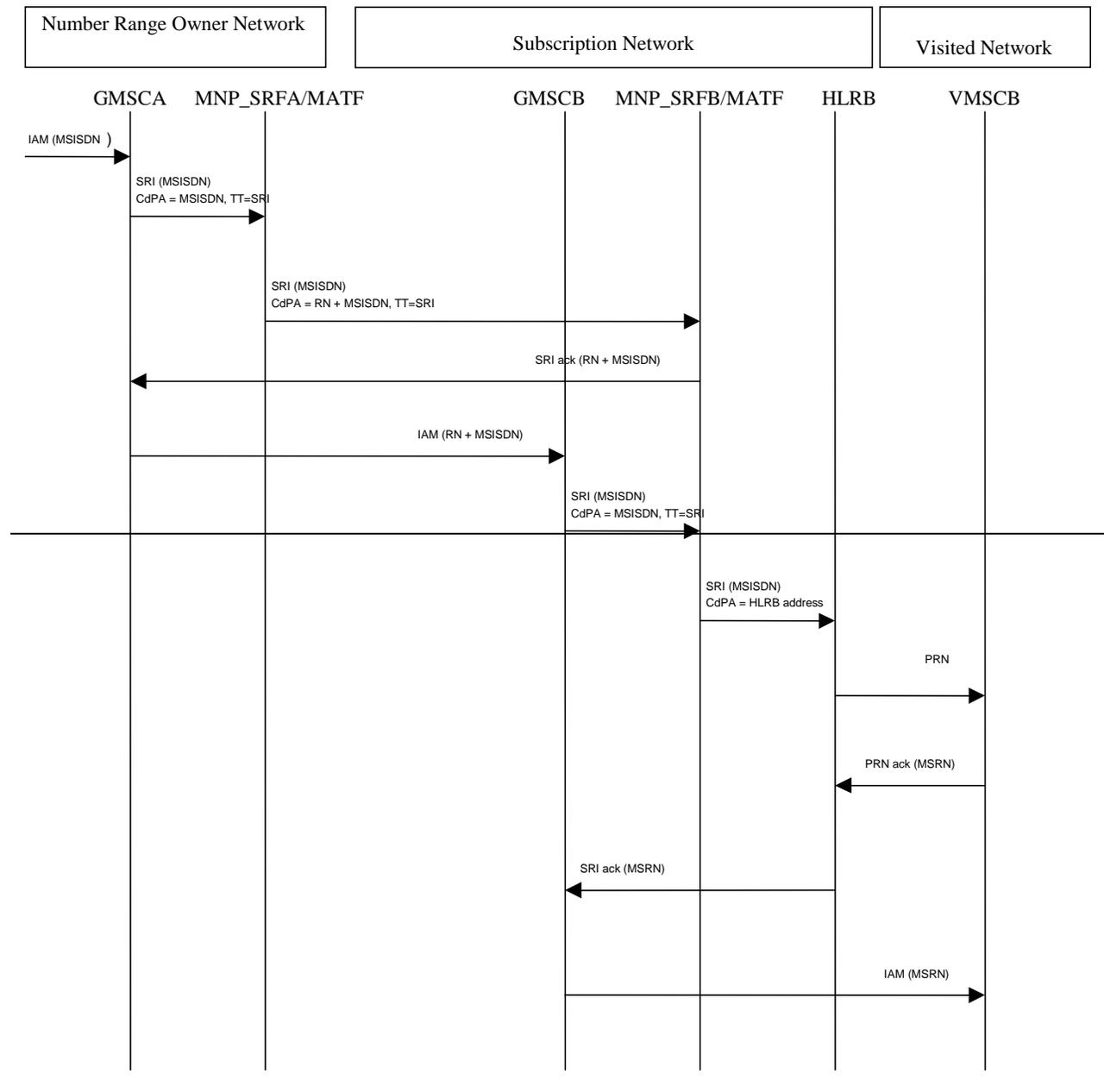


Figure C.4.6: Successful delivery for a call to a ported number where indirect routing with reference to the subscription network is used

---

## C.6 Handling of MAP to ISUP mapping (informative)

Different configurations can be possible within a portability clusterdomain depending on the versions of MAP and ISUP protocols being used. The following sections describe possible interworking scenarios.

### C.6.1 Mapping direction: ISUP to MAP

The GMSC always constructs the Send Routeing Info message using the MSISDN. If the incoming IAM corresponds to a ported number the GMSC shall retrieve the MSISDN from the corresponding parameter in the IAM.

### C.6.2 Mapping direction: MAP to ISUP

In MAP SRIack messages from NPLR, MAP versions 1 and 2 only support concatenate addressing for MNP. If MSISDN parameter is present in the SRIack, this means that separate addressing is used in MAP; this is only possible if MAP version 3 is used. MAP version 3 can also support concatenate addressing. In all cases, when a Routeing Number is returned, it is included in the MSRN parameter of the SRIack.

Regardless of how MAP is established, the possible mappings of the parameters in ISUP IAM message is one of these 4 options (see also [7]):

- 1. CdPN parameter includes only the MSISDN
- 2. CdPN parameter includes both RN and MSISDN concatenated
- 3. CdPN parameter includes the MSISDN and NRN parameter includes the Routeing Number
- 4. CdPN parameter includes the Routeing Number and CDN parameter includes the MSISDN

In all cases, the method to transport the routing number in the IAM depends on the interfaces agreed by the operators in the portability clusterdomain.

# CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

**23.066 CR 007r1**

Current Version: **3.1.0**

GSM (AA.BB) or 3G (AA.BBB) specification number ↑

↑ CR number as allocated by MCC support team

For submission to: **CN #7**  
list expected approval meeting # here ↑

for approval   
for information

strategic   
non-strategic  (for SMG use only)

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: <ftp://ftp.3gpp.org/Information/CR-Form-v2.doc>

**Proposed change affects:**  
(at least one should be marked with an X)

(U)SIM  ME  UTRAN / Radio  Core Network

**Source:**

**N2**

**Date:**

**2000-02-15**

**Subject:**

**Editorial cleanup**

**Work item:**

**Mobile Number Portability**

**Category:**

(only one category shall be marked with an X)

F Correction   
A Corresponds to a correction in an earlier release   
B Addition of feature   
C Functional modification of feature   
D Editorial modification

**Release:**

Phase 2   
Release 96   
Release 97   
Release 98   
Release 99   
Release 00

**Reason for change:**

As agreed by PCG, references to GSM specifications have to be replaced by references to the corresponding 3G specifications; similarly, GSM-specific material in the text has to be replaced by UMTS-specific or generic material. Some other editorial corrections have also been made.

**Clauses affected:**

**1, 2.1, 3.2, 4.1, 4.3, A.3.1, A.3.2.1, A.4.2.4, B.1.2, C.1, C.2.2, C.3, C.4, D, History**

**Other specs affected:**

Other 3G core specifications  → List of CRs:  
Other GSM core specifications  → List of CRs:  
MS test specifications  → List of CRs:  
BSS test specifications  → List of CRs:  
O&M specifications  → List of CRs:

**Other comments:**



help.doc

<----- double-click here for help and instructions on how to create a CR.

---

# 1 Scope

The present document describes several alternatives for the realisation of Mobile Number Portability.

The present document includes information applicable to network operators, service providers, switch and database manufacturers and national regulators.

It is left to operator and implementation decisions which option, or combination of options, is used, taking into account the regulatory and architectural constraints that may prevail. The possible implications of these options on internal node functions and on signalling performance are not covered in the present document.

Normative Annex A of the present document describes the technical realisation of the handling of calls to ported [UMTS or GSM](#) mobile subscribers using IN technology.

Normative Annex C of the present document describes the technical realisation of the handling of calls to ported [UMTS or GSM](#) mobile subscribers using Signalling Relay technology.

Normative Annex A and Normative Annex C describe alternative solutions. The network operator may choose the solution to be used in his network.

Normative Annex B of the present document describes the technical realisation of the handling of non-call related SCCP signalling for ported [UMTS or GSM](#) mobile subscribers using Signalling Relay technology.

The present document does not specify the porting process.

---

## 2 References

### 2.1 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

~~• A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.~~

~~• For this Release 1998 document, references to GSM documents are for Release 1998 versions (version 7.x.y).~~

[1] GSM 01.04: (ETR 350) "Digital cellular telecommunications system (Phase 2+); Abbreviations and acronyms".

[2] ETS 300 009 (December 1991): "Integrated Services Digital Network (ISDN); CCITT Signalling System No. 7 – Signalling Connection Control Part (SCCP) [connectionless services] to support international interconnection".

~~[3] GSM 02.66: "Digital cellular telecommunications system (Phase 2+); Support of Mobile Number Portability (MNP); Service description. Stage 1".~~

[3] [3G 22.066: "Support of Mobile Number Portability \(MNP\); Service Description – Stage 1"](#).

~~[4] GSM 03.18: "Digital cellular telecommunications system (Phase 2+); Basic call handling; Technical realisation".~~

[4] [3G 23.018: "Basic Call Handling; Technical Realisation"](#).

~~[5] GSM 09.02 (ETS 300 974): "Digital cellular telecommunications system (Phase 2+); Mobile Application Part (MAP) specification".~~

[5] (void)

[6] ETS 300 374-1: "Intelligent Network (IN); Intelligent Network Capability Set 1 (CS1); Core Intelligent Network Application Protocol (INAP); Part 1: protocol specification".

[7] draft EN 302 097 V1.1.2 (1999-01): "Integrated Services Digital Network (ISDN); Signalling System No.7; ISDN User Part (ISUP); Enhancements for support of Number Portability (NP)".

## 3.2 Abbreviations

~~Abbreviations used in the present document are listed in GSM 01.04 (11).~~

For the purposes of the present document, the following abbreviations apply:

<a href="#">CCBS</a>	Call Completion on Busy Subscriber
<a href="#">CCF</a>	Call Completion Function
<a href="#">CdPA</a>	Called Party Address
<a href="#">CgPA</a>	Calling Party Address
<a href="#">CRMNP</a>	Call Related Mobile Number Portability
GMSC	Gateway MSC
GMSCB	The GMSC in HPLMNB
HLR	Home Location Register
HPLMNB	The subscription network of the B subscriber
<a href="#">IAM</a>	Initial Address Message
IDP	Initial Detection Point
IE	Information Element
INE	Interrogating Network Entity
IF	Information Flow
IPLMN	Interrogating PLMN
MATF	MAP application Terminating Function
MNP	Mobile Number Portability
MNP-SRF	Signalling Relay Function for support of MNP
MSA	Mobile Station of the A subscriber
MSB	Mobile Station of the B subscriber
MSC	Mobile service Switching Centre
<a href="#">MSRN</a>	Mobile Station Roaming Number
NPDB	Number Portability Database
NPLMN	The number range owner network of the B subscriber
<a href="#">NPLR</a>	Number Portability Location Register
OQoD	Originating call Query on Digit Analysis
PLMN	Public Land Mobile Network
QoHR	Query on HLR Release
RN	Routing Number
SMS	Short Message Service
SOR	Support of Optimal Routeing
SRI	Send Routeing Information
TQoD	Terminating call Query on Digit Analysis
TT	Translation Type
VMSC	The Visited MSC
VMSCB	The VMSC of the B subscriber

Further GSM related abbreviations are given in GSM 01.04.

## 4 General

### 4.1 Overview

Mobile Number Portability (MNP) is the ability for a [UMTS or GSM](#) mobile subscriber to change the **GSM** subscription network within a portability cluster whilst retaining her original MSISDN or MSISDNs.

As part of the porting process administrative actions have to be performed by the **GSM**-network operators of the number range owner network, donor network, recipient network and, as an option, by operators of other national [UMTS or GSM](#) networks as follows:

a) if the number range owner network is identical with the donor network:

Recipient network:	add an entry in the HLR; add an entry in the Number Portability Database.
Donor network:	add an entry in the Number Portability Database; delete the entry related to the ported MSISDNs in the HLR.
Other networks in the portability cluster:	add an entry in the Number Portability Database (if direct routing is used).

b) if the number range owner network is identical with the recipient network:

Recipient network:	add an entry in the HLR; delete any entry related to the ported MSISDN in the Number Portability Database.
Donor network:	delete any entry related to the ported MSISDN in the Number Portability Database; delete the entry related to the ported MSISDNs in the HLR.
Other networks in the portability cluster:	delete any entry related to the ported MSISDN in the Number Portability Database.

c) if the number range owner network is different from both the recipient and the donor network:

Recipient network:	add an entry in the HLR; add an entry in the Number Portability Database.
Number range owner network:	update the Number Portability Database
Donor network:	delete (or update) the entry in the Number Portability Database; delete the entry related to the ported MSISDNs in the HLR.
Other networks in the portability cluster:	update the Number Portability Database (if an entry for the ported MSISDN exists ).

Note that the order of sequence for the administrative actions to be performed both within a network and by different network operators is significant with respect to prevention of disruption in service to the mobile subscriber and prevention of looping calls between networks during the porting process.

Termination of a subscription for a ported number results in the deletion of any entry in an HLR and NPDB of that number.

If a call fails because databases are not correctly synchronised, the network entity which detects the inconsistency will raise an MNP specific alarm to the operation and maintenance subsystem.

The present document does not specify the porting process; it specifies the functionality needed to set-up calls to both ported and non ported subscribers (Normative Annex A and Normative Annex C) and the functionality needed to relay non-call related signalling messages to the HLR in the subscription network (Normative Annex B).

## 4.3 Common Functionality of the MNP-SRF

In a PLMN which supports mobile number portability, SCCP messages sent to an HLR may be relayed by an MNP-SRF. Depending on the implemented solution (IN-based or MNP-SRF-based), on the type of message (call-related or non-call-related) and on the porting status of the called subscriber the MNP-SRF may modify the SCCP called party address and route the message to a different HLR or to the subscription network, or terminate the dialogue and response to the INE.

Figure 1 shows the general steering functionality for SCCP message routing. It shows the SCCP routing principle for mobile number portability within a network.

Note that call related messages in the IN-based solution are not routed to the MNP-SRF. Therefore Normative Annex A of the present document does not mention the MNP-SRF.

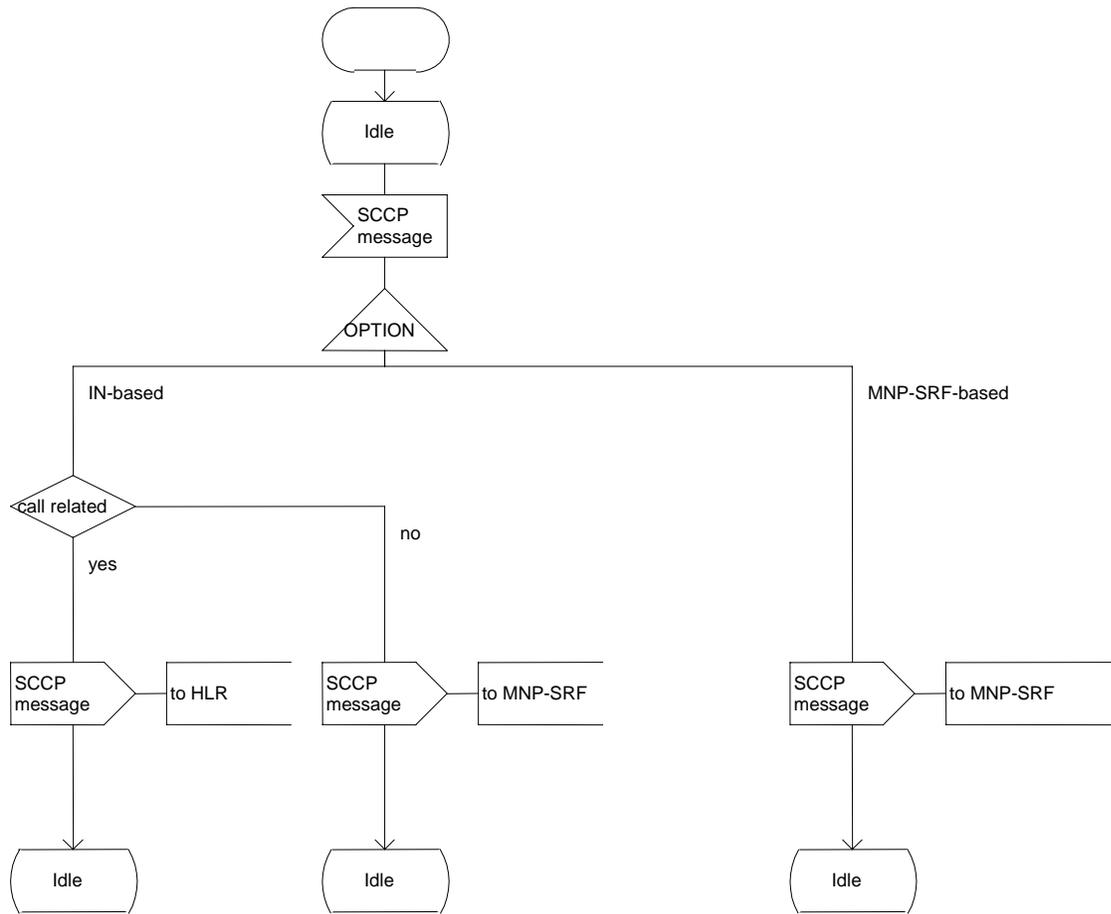
However, the usage of the IN-based solution for the call-related messages should allow operators to have the routing of the non call-related messages determined in the same database. ~~See [8] for the description of the access of the MNP-SRF (node with relay capability) to the NPDB (external database).~~

In order to guard against the possibility that the porting data for an MSISDN is inconsistent between PLMNs in a porting cluster, the SCCP hop counter may be used to prevent indefinite looping of messages between PLMNs. The MNP-SRF would then decrement the SCCP hop counter for every message that is relayed. It should be noted that the use of the SCCP hop counter requires the use of unsegmented SCCP XUDT messages as defined in ITU-T 1996 SCCP recommendations.

### Process SCCP\_Steering\_Function

1(1)

general Steering Function  
for SCCP routing



Process SCCP\_Steering\_Function

1(1)

general Steering Function  
for SCCP routing

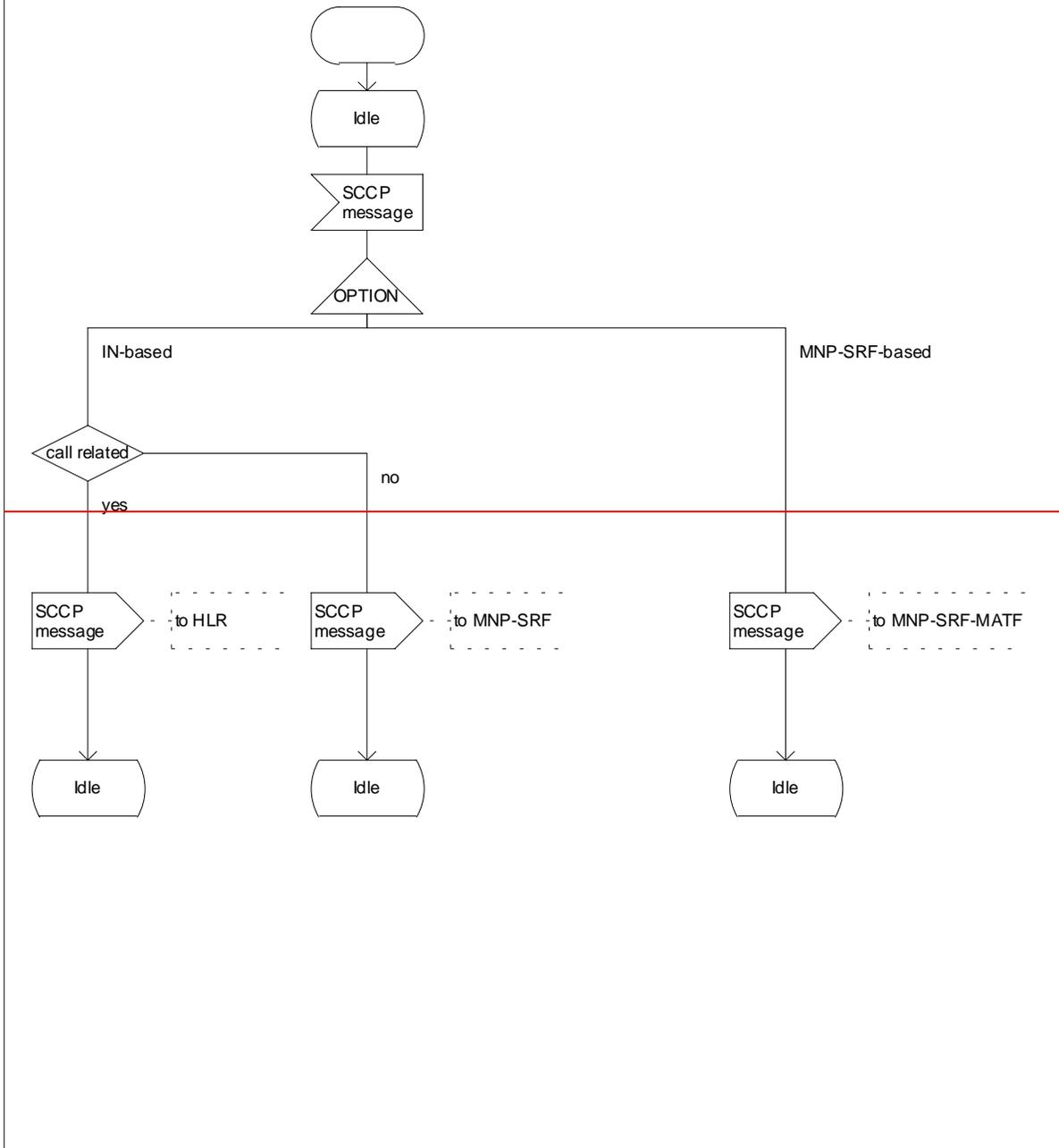


Figure 1: Steering Function for SCCP Message routing

---

## A.3 Functional requirements of network entities

### A.3.1 Functional requirement of GMSC

#### A.3.1.1 Procedure MOBILE\_NUMBER\_PORTABILITY\_IN\_QoHR

The procedure MOBILE\_NUMBER\_PORTABILITY\_IN\_QoHR is shown in figure A.1.3. It is called from the procedure Obtain\_Routeing\_Address defined in ~~GSM-03~~[TS 23.018](#) [4].

The text in this clause is a supplement to the definition in the SDL diagrams; it does not duplicate the information in the SDL diagrams.

The IDP message contains the service key for MNP query and the called party's MSISDN.

### A.3.1.2 Procedure MOBILE\_NUMBER\_PORTABILITY\_IN\_TQoD

The procedure MOBILE\_NUMBER\_PORTABILITY\_IN\_TQoD is shown in figure A.14. It is called from the procedure Obtain\_Routeing\_Address defined in ~~GSM-03~~[TS 23.018](#) [4].

The text in this clause is a supplement to the definition in the SDL diagrams; it does not duplicate the information in the SDL diagrams.

The IDP message contains the service key for MNP query and the called party's MSISDN.

## A.3.2 Functional requirement of MSC

### A.3.2.1 Procedure MOBILE\_NUMBER\_PORTABILITY\_IN\_OQoD

The procedure MOBILE\_NUMBER\_PORTABILITY\_IN\_OQoD is shown in figure A.15. It is called from the procedure Outgoing\_Call\_Setup\_MSC and from the process MT\_CF\_MSC defined in ~~GSM-03-TS 23.0~~18 [4].

The text in this clause is a supplement to the definition in the SDL diagrams; it does not duplicate the information in the SDL diagrams.

The MSC may recognise own numbers as not being within the ported number range. For foreign numbers however, the MSC will not in general know whether the number is portable. The test “called party number is a portable national MSISDN” takes the “yes” exit if the number is a foreign national MSISDN or an own portable MSISDN.

The IDP message contains the service key for MNP query and the called party’s MSISDN.

#### A.4.2.4 CONTINUE

[This message is specified in \[6\].](#) This message does not contain any information element.

## B.1.2 Network Architecture

In a PLMN which supports MNP, non-call related signalling messages as mentioned in section B.1.1 are relayed by an MNP-Signalling Relay Function (MNP-SRF). The MNP-SRF provides re-routeing capability for signalling messages addressed using the MSISDN. The MNP-SRF obtains routeing information from the NP database to identify the subscription network associated with a particular national MSISDN. The interface between the MNP-SRF and the NP database is considered implementation dependent and is not detailed further. For further details see clause 4.3. ~~For further details of the signalling relay function, the reader is referred to [9].~~

---

# Annex C (normative): MNP Signalling Relay Function - Call Related Signalling

## C.1 Handling of Call Related Signalling

The only call related MAP message affected by MNP is the MAP SEND\_ROUTEING\_INFORMATION (SRI) message without OR parameter set sent to the HLR.

In a PLMN supporting MNP with direct routeing using signalling relay, all incoming calls and calls originated in the network for which the called party number is within the ranges owned by any network in the portability cluster, the gateway MSCs will send an SRI such that it will be handled by the MNP-SRF in that network.

In a PLMN supporting MNP with indirect routeing using signalling relay, all incoming calls and calls originating in the network for which the called party number is within the range owned by the network, the gateway MSCs will send SRI such that it will be handled by the MNP-SRF in that network.

The MNP-SRF obtains routeing information from the NP database to identify the subscription network associated with a particular national MSISDN. The interface between the MNP-SRF and the NP database is considered implementation dependent and is not detailed further.

From the perspective of the PLMN in which the MNP-SRF resides, the CdPA represents one of:

1. An own number ported out;
2. An own number not ported out;
3. A foreign number ported in;
4. A foreign number ported to a foreign network;
5. A foreign number not known to be ported.

Cases 4 and 5 are applicable only for direct routeing.

In case 1, the MNP-SRF may perform one of the following depending on agreements within the number portability cluster.

- a. An SRI response is sent containing the necessary routeing information to route the call to the subscription network. This is performed by an internal MAP Application Termination Function (MATF) known as the Number Portability Location Register (NPLR).
- b. If indirect routeing of calls with reference to the subscription network is used, the message is relayed to the MNP-SRF in the subscription network, whose NPLR provides the necessary routeing information in an SRI response. The use of an NPLR in the subscription network can only be by agreement within the number portability cluster.

In cases 2 and 3, the MNP-SRF relays the message to the HLR. ~~For further details of the signalling relay function, the reader is referred to [8].~~

In case 4, an SRI response is sent, containing the necessary routeing information to route the call to the subscription network.

In case 5, an SRI response is sent, containing the necessary routeing information to route the call to the number range owner network.

## C.2.2 Process SRI\_NPLR

Figure C.2.2 shows the process SRI\_NPLR.

The check “unknown subscriber” identifies a subscriber without any associated available information.

If the GMSC is in the database own network then a routing number is provided to route to the number range owner network.

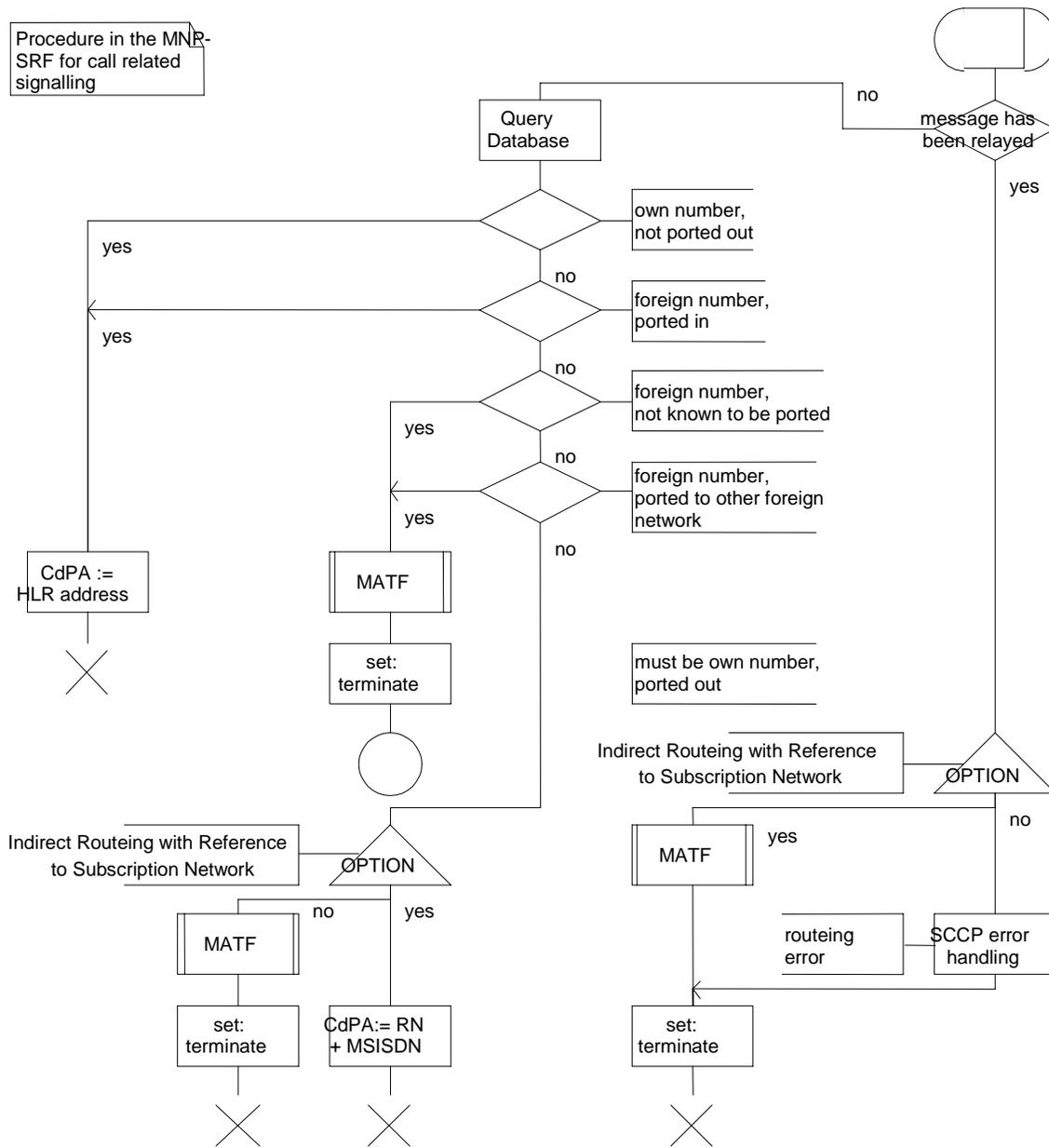
If the GMSC is not in the database own network then the enquiry has been routed from the number range owner network, so the call should fail.

The database query uses the MSISDN received at the application level in the SRI, rather than the CdPA of the SCCP level.

Procedure MNP\_SRF\_MATF\_Call\_Related

1(1)

Procedure in the MNP-SRF for call related signalling



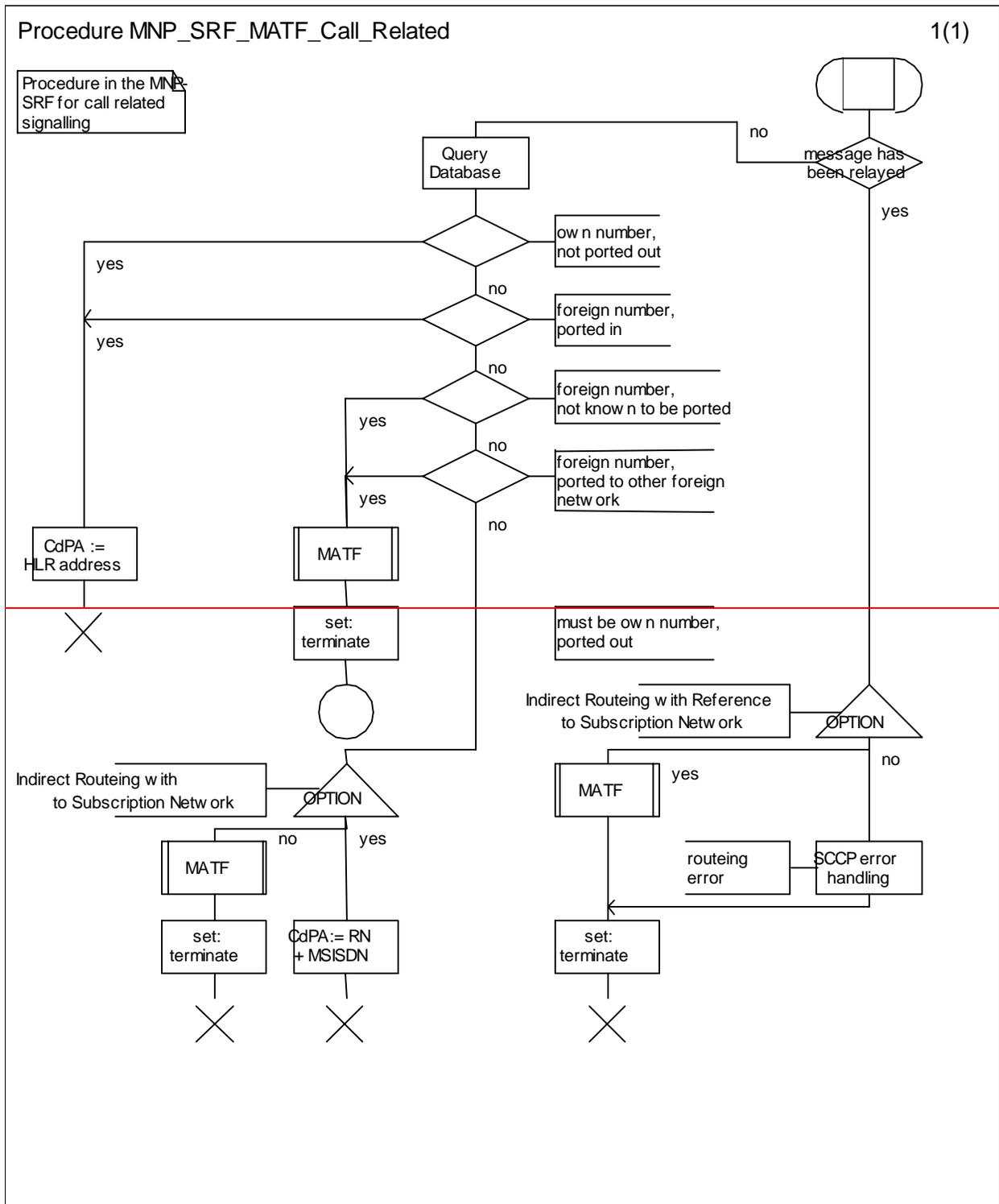
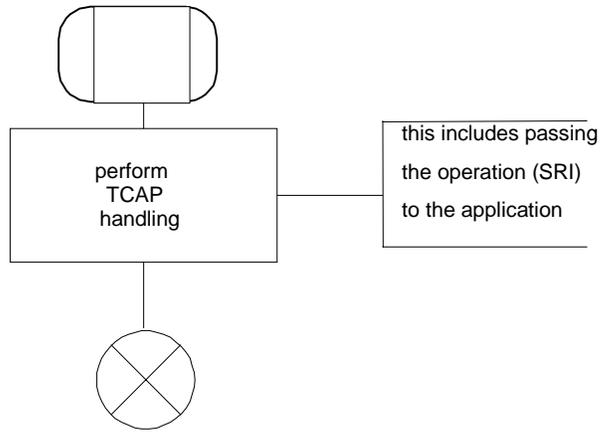


Figure C.2.1.1: Procedure MNP\_SRF\_MATF\_Call\_Related

Procedure MATF

1(1)



Procedure MATF

1(1)

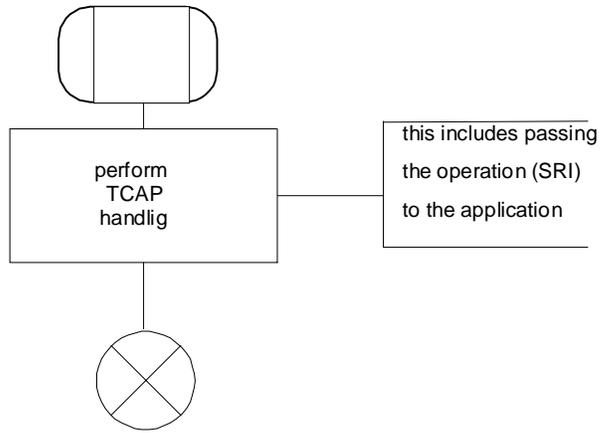


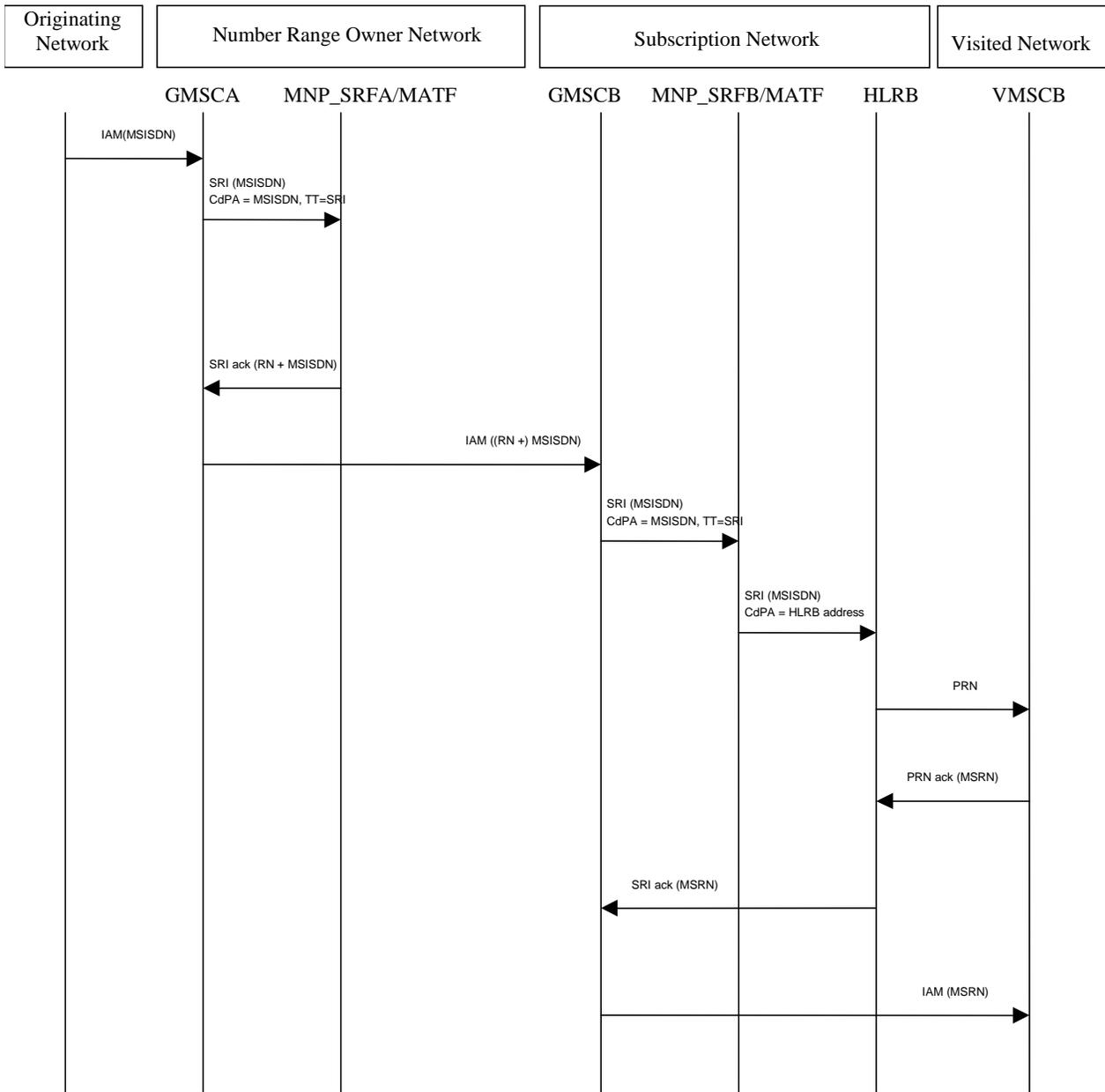
Figure C.2.1.2: Procedure MATF

---

## C.3 Call Scenarios

The notation TT=SRI in diagrams in this section assumes that SRI=CRMNP. The use of other translation types is for further study. The message flows for the following scenarios are based on the use of an SCCP relay function in MNP-SRF(s). The message flows for the higher level relay function (e.g. TC relay) in MNP-SRF are not covered here, but the principle can be found in C.5.2. ~~For further details of the signalling relay function, the reader is referred to [8].~~

Figure C.4.5 shows the signalling involved for a call to a ported number via indirect routing. The figure is related to figure C.3.4



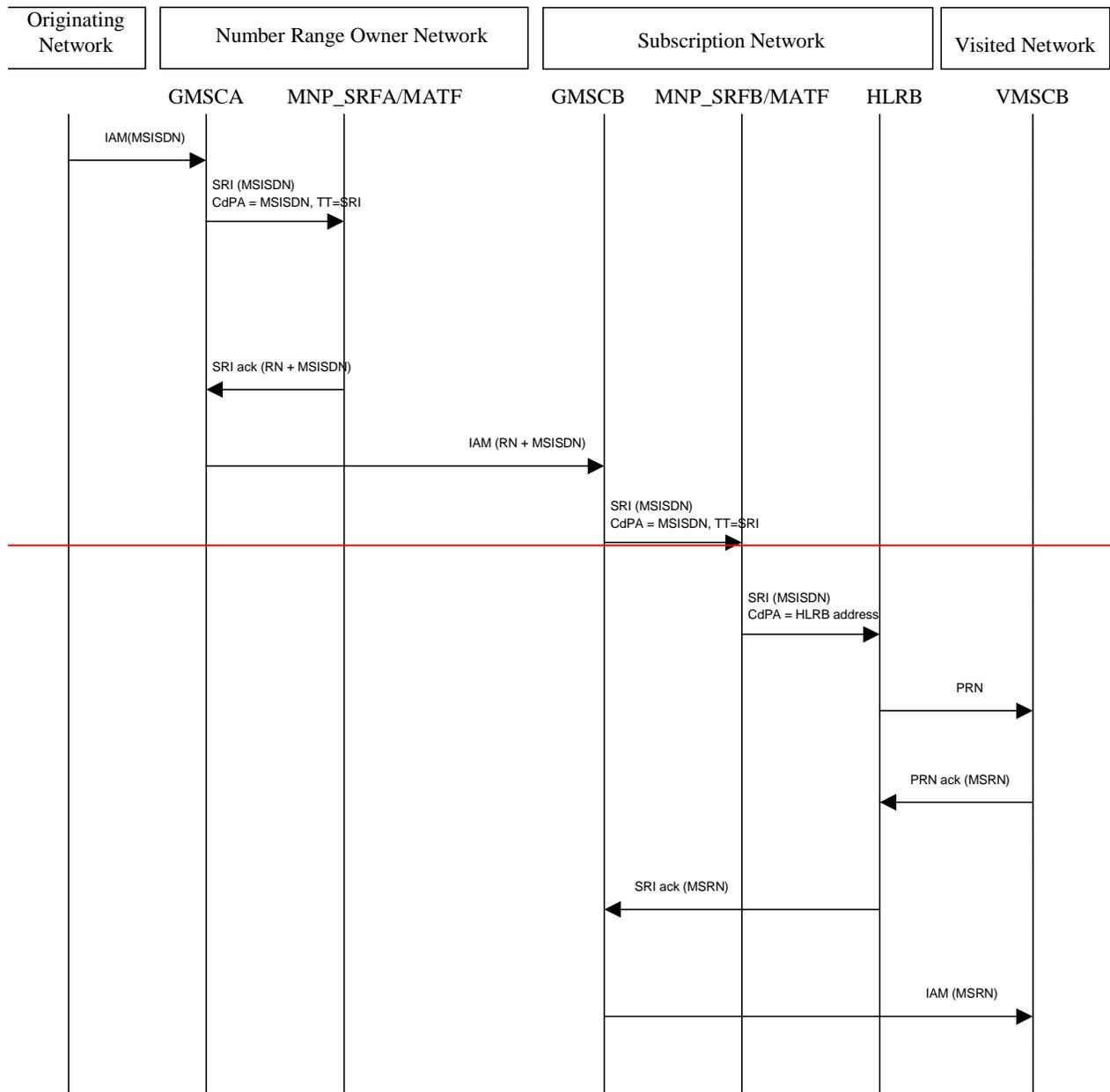
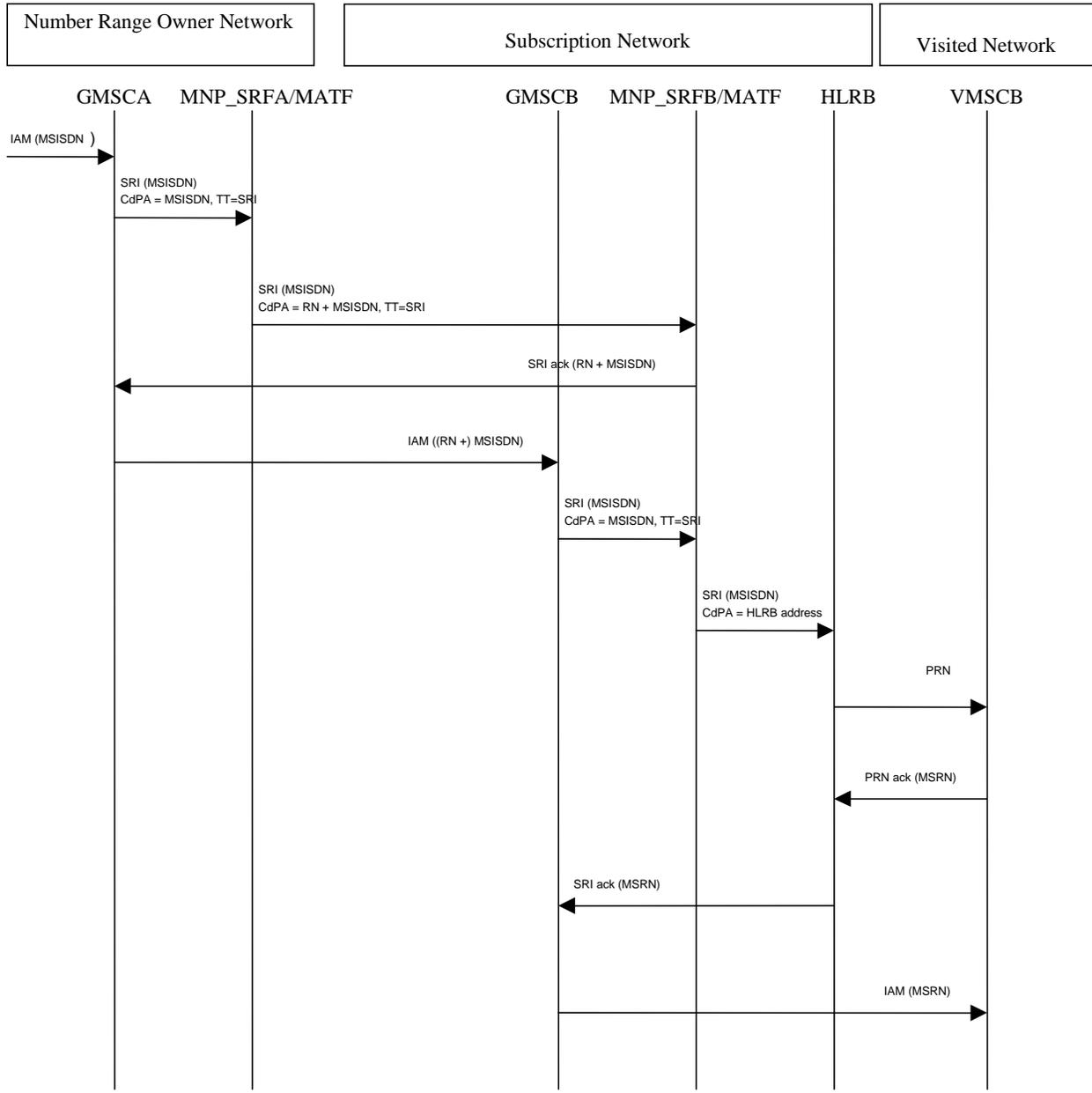


Figure C.4.5: Successful delivery of a call to a ported number via indirect routing

Figure C.4.6 shows the signalling involved for a call to a ported number where indirect routing with reference to the subscription network is used. The figure is related to figure C.3.5.



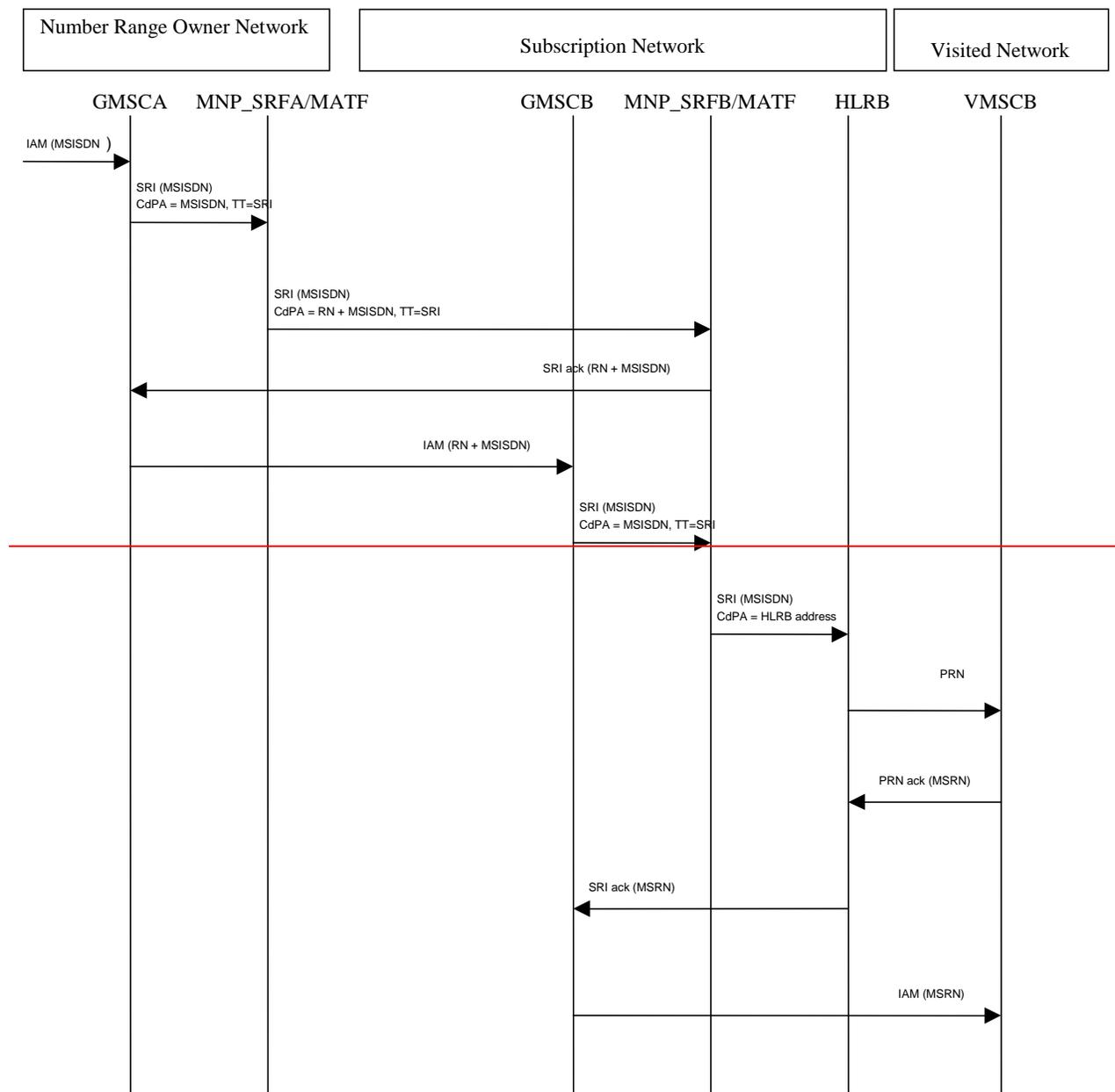


Figure C.4.6: Successful delivery for a call to a ported number where indirect routing with reference to the subscription network is used

## Annex D: Change history

TSG CN#	Spec	Version	CR	<Phase>	New Version	Subject/Comment
03	GSM 03.66	7.1.0				Transferred to 3GPP CN24
Aug 1999	23.066	3.0.0				
Oct 1999	23.066	3.0.0	001		3.1.0	Harmonisation of terminology <b>interrogating</b>
Oct 1999	23.066	3.0.0	002		3.1.0	Proposed changes to B.4.2 Delivery of SMS to a Non-ported Number - Direct Routeing – MNP-SRF acts as Higher-level Relay
Oct 1999	23.066	3.0.0	003		3.1.0	Clarification of NPLR functionality in not known to be ported case

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## History

<b>Document history</b>		
V3.0.0	May 1999	Approved at TSGN #3. Under TSG <del>TSG</del> -CN Change Control.
V 3.0.0	August 1999	For publication
V 3.1.0	October 1999	V3.1.0 created after CN#05

# CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

**23.066 CR 008r4**

Current Version: **3.1.0**

GSM (AA.BB) or 3G (AA.BBB) specification number ↑

↑ CR number as allocated by MCC support team

For submission to: **CN #7**  
list expected approval meeting # here ↑

for approval   
for information

strategic   
non-strategic  (for SMG use only)

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: <ftp://ftp.3gpp.org/Information/CR-Form-v2.doc>

**Proposed change affects:**  
(at least one should be marked with an X)

(U)SIM  ME  UTRAN / Radio  Core Network

**Source:**

**N2**

**Date:**

**03.03.2000**

**Subject:**

**Alignment of IN interface with Fixed Networks**

**Work item:**

**Mobile Number Portability**

**Category:**

(only one category shall be marked with an X)

F Correction   
A Corresponds to a correction in an earlier release   
B Addition of feature   
C Functional modification of feature   
D Editorial modification

**Release:**

Phase 2   
Release 96   
Release 97   
Release 98   
Release 99   
Release 00

**Reason for change:**

It was agreed in the MNP ad hoc meeting in Madrid, January 12, 2000, to "open" the GMSC-NPDB interface so as to leave undefined which messages will be used in each traffic case, in a similar manner as it is done in the specifications for Fixed Networks. The SDL description in A.3.3.1 has also be aligned with the description of A.1.4.1 OQoD – Number Ported.

A new table has been added to A.4 to map the messages in the GMSC-NPDB interface into INAP operations.

**Clauses affected:**

**A.2, A.3, A.4**

**Other specs affected:**

Other 3G core specifications  → List of CRs:  
Other GSM core specifications  → List of CRs:  
MS test specifications  → List of CRs:  
BSS test specifications  → List of CRs:  
O&M specifications  → List of CRs:

**Other comments:**



help.doc

<----- double-click here for help and instructions on how to create a CR.

## A.2 Information flows

In the following figures the NPDB is shown as belonging to the number range owner network or to the national originating network. However, the NPDB may be shared within one portability cluster i.e. nation-wide.

Figure A.2.1 shows the information flow for successful QoHR.

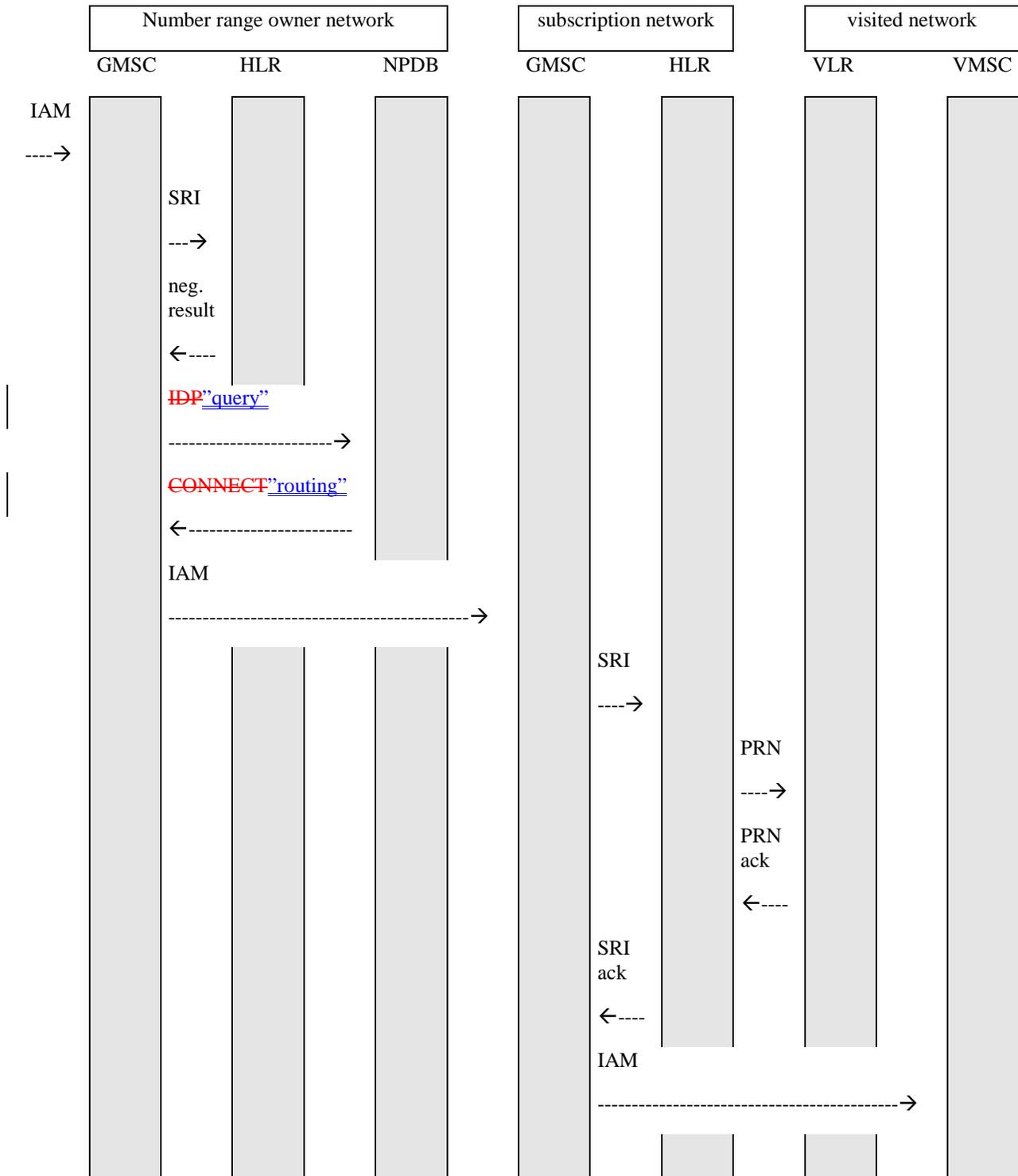


Figure A.2.1

Figure A.2.2 shows the information flow for unsuccessful QoHR (~~misdialed~~-unallocated number).

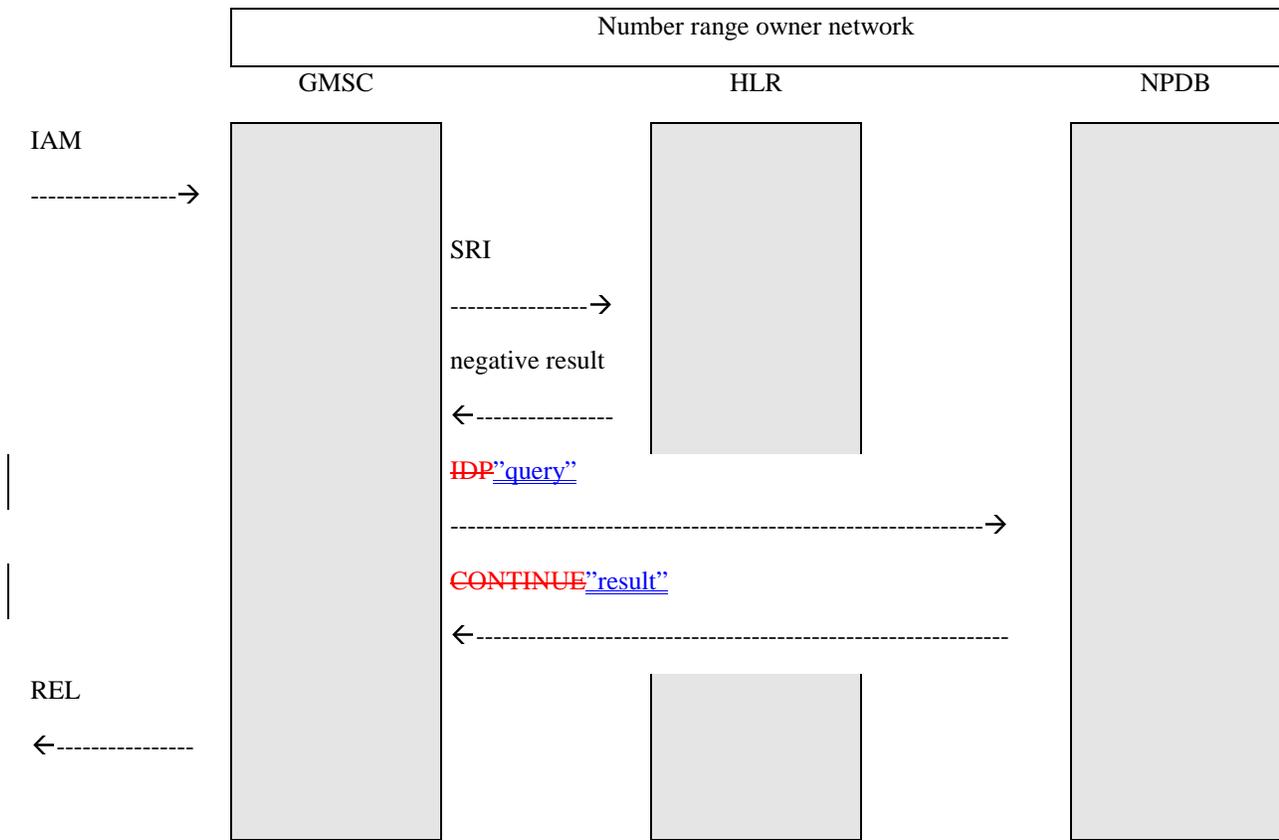


Figure A.2.2

Figure A.2.3 shows the information flow for successful TQoD.

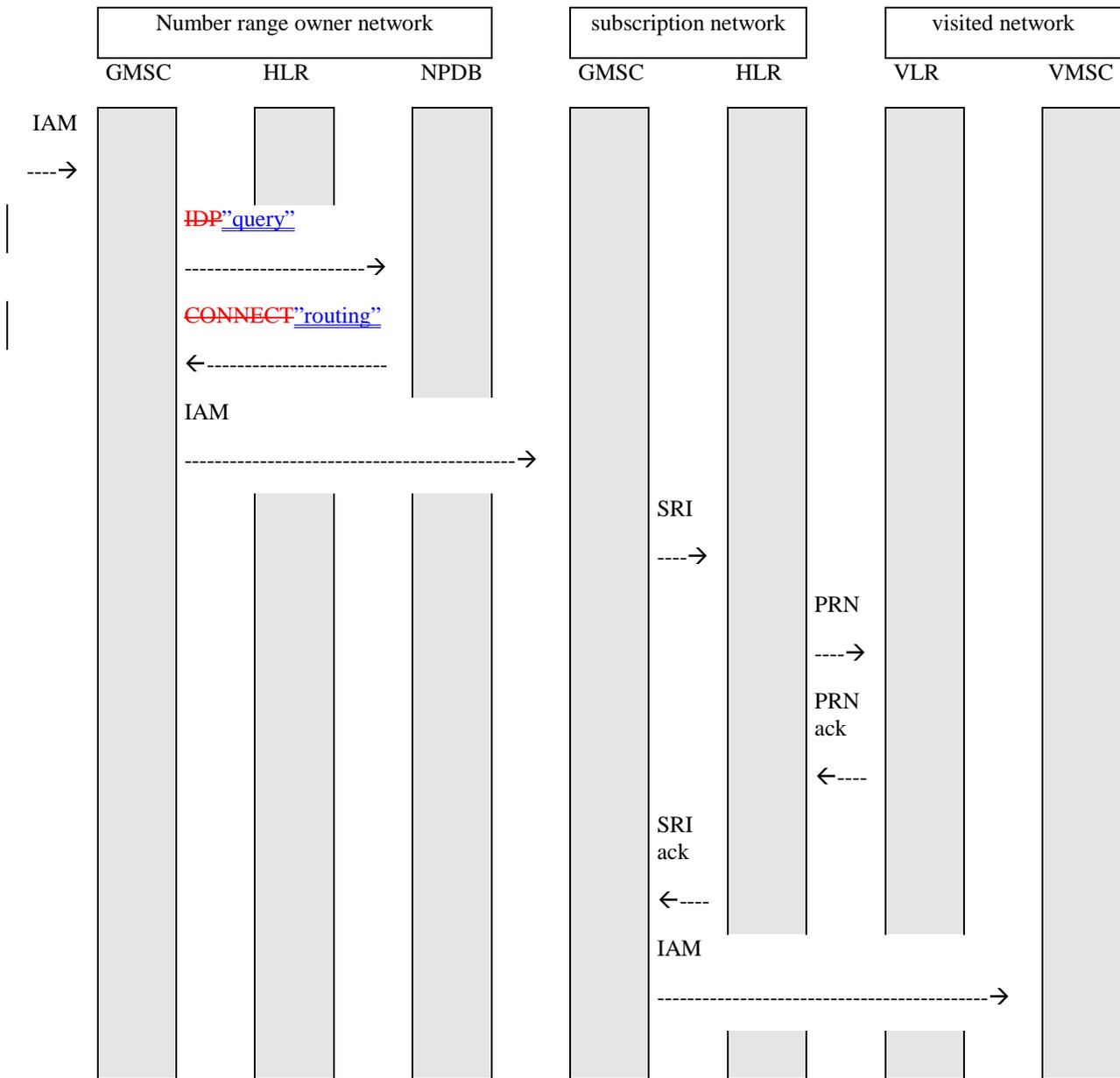


Figure A.2.3

Figure A.2.4 shows the information flow for unsuccessful TQoD (number not ported).

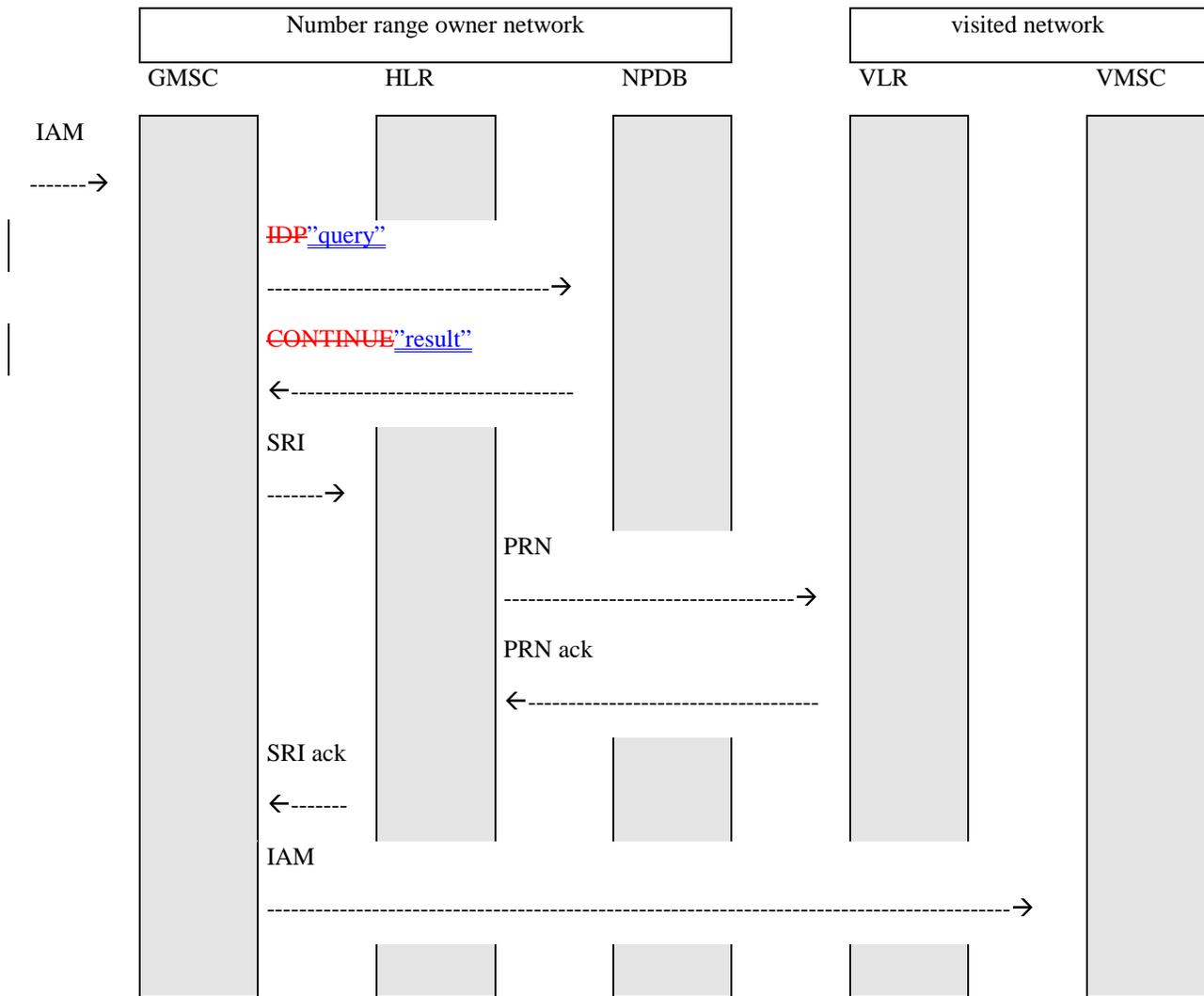


Figure A.2.4

Figure A.2.5 shows the information flow for successful OQoD (number ported).

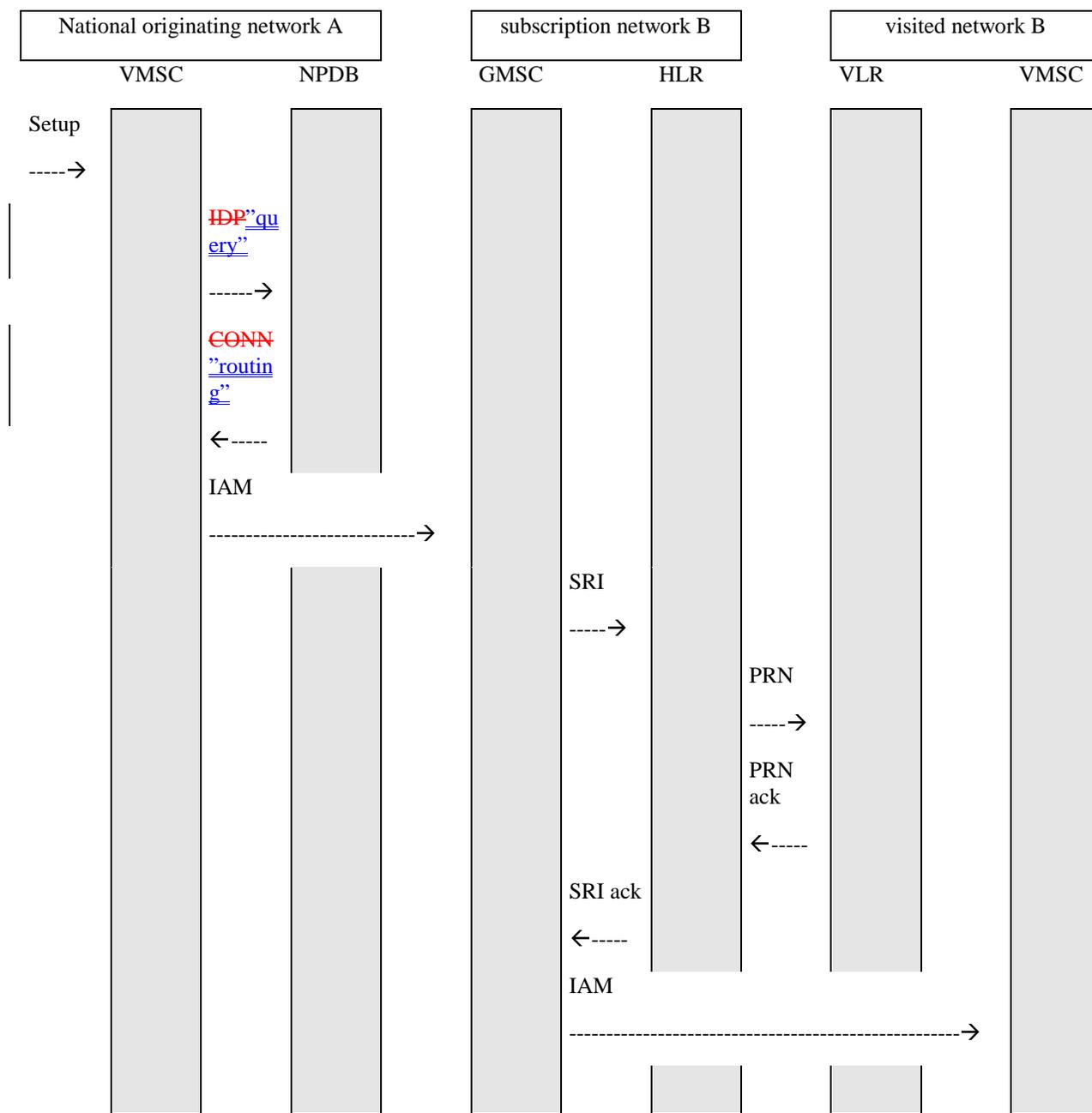


Figure A.2.5

Figure A.2.6 shows the information flow for unsuccessful OQoD (number not ported in).

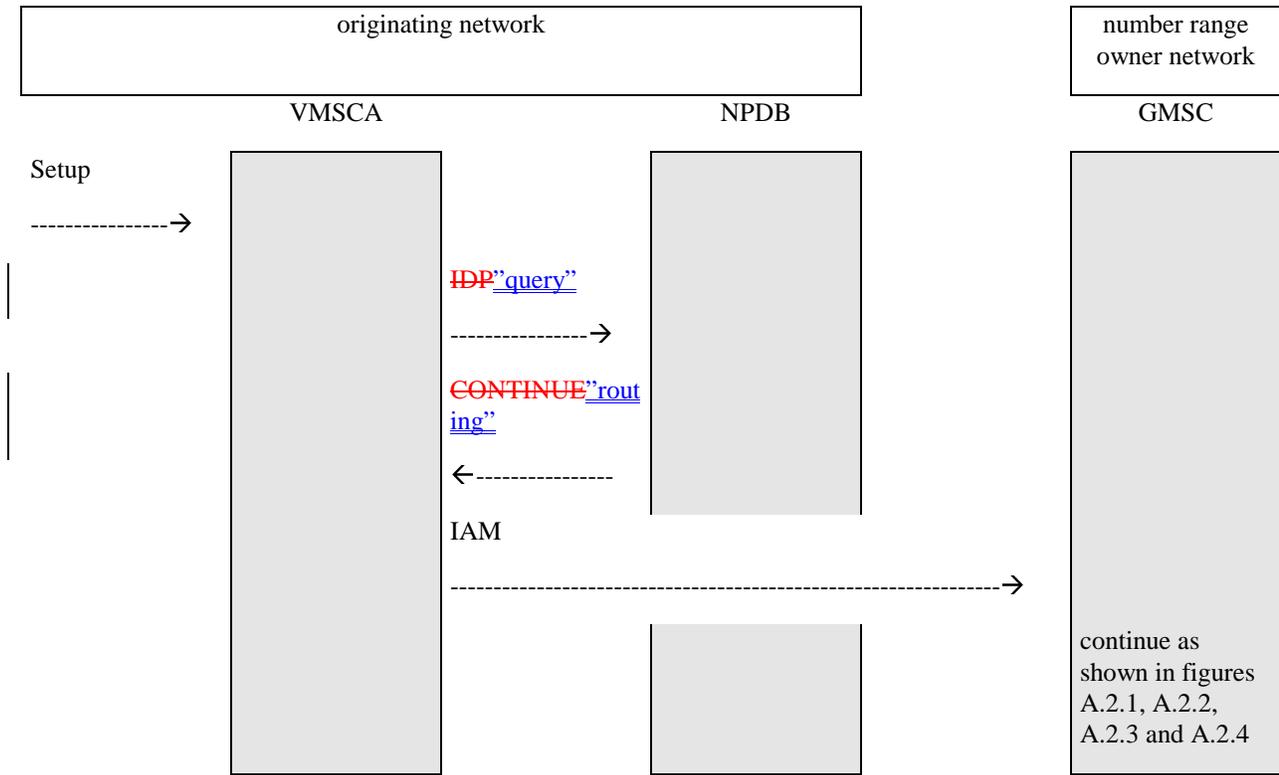


Figure A.2.6

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## A.3 Functional requirements of network entities

### A.3.1 Functional requirement of GMSC

#### A.3.1.1 Procedure MOBILE\_NUMBER\_PORTABILITY\_IN\_QoHR

The procedure MOBILE\_NUMBER\_PORTABILITY\_IN\_QoHR is shown in figure A.1.3. It is called from the procedure Obtain\_Routing\_Address defined in GSM 03.18 [4].

The text in this clause is a supplement to the definition in the SDL diagrams; it does not duplicate the information in the SDL diagrams.

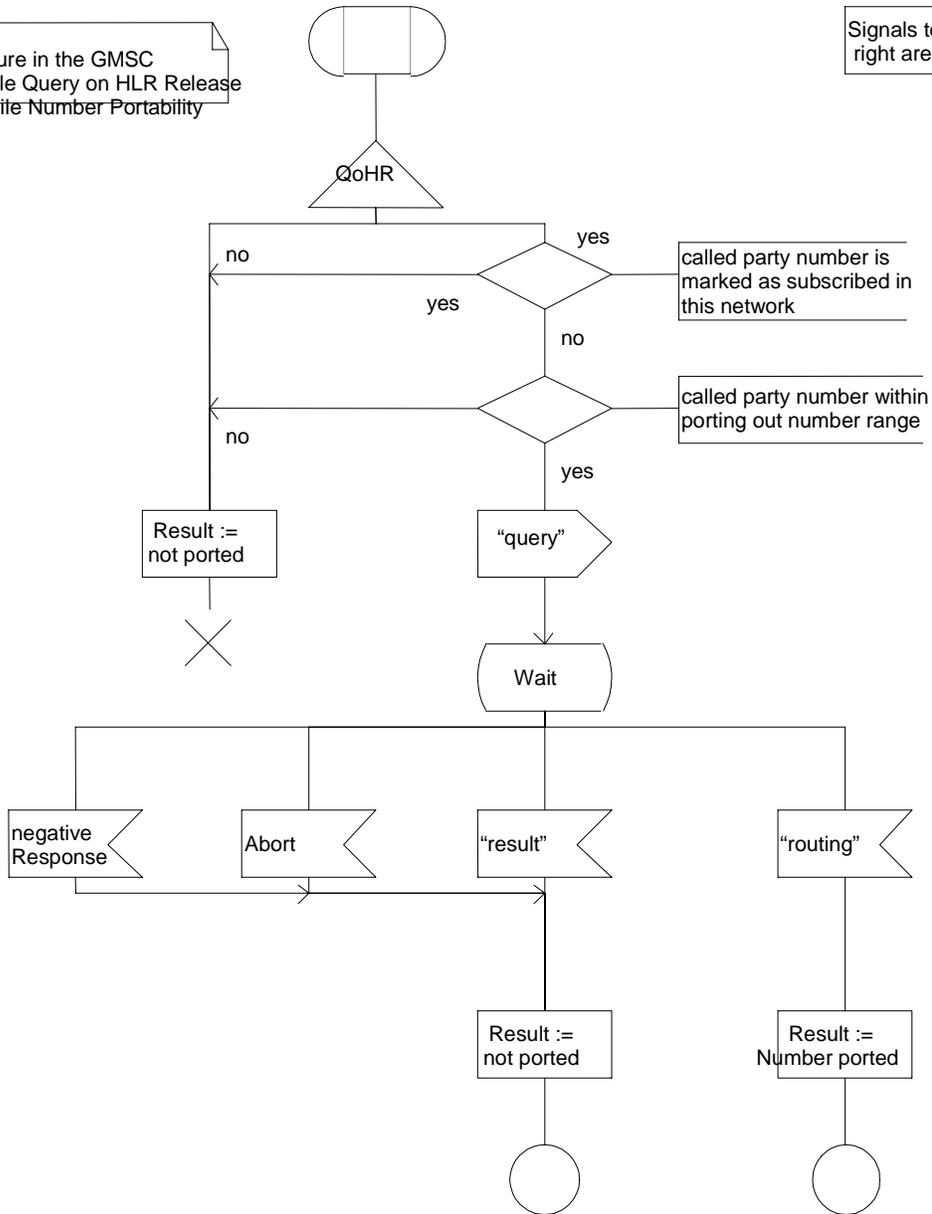
The ~~IDP-message~~[query to NPDB](#) contains the service key for MNP query and the called party's MSISDN.

Procedure MOBILE\_NUMBER\_PORTABILITY\_IN\_QoHR

1(1)

Procedure in the GMSC to handle Query on HLR Release for Mobile Number Portability

Signals to/from the right are to/from the NPDB



Procedure MOBILE\_NUMBER\_PORTABILITY\_IN\_QoHR

1(1)

Procedure in the GMSC to handle Query on HLR Release for Mobile Number Portability

Signals to/from the right are to/from the NPDB

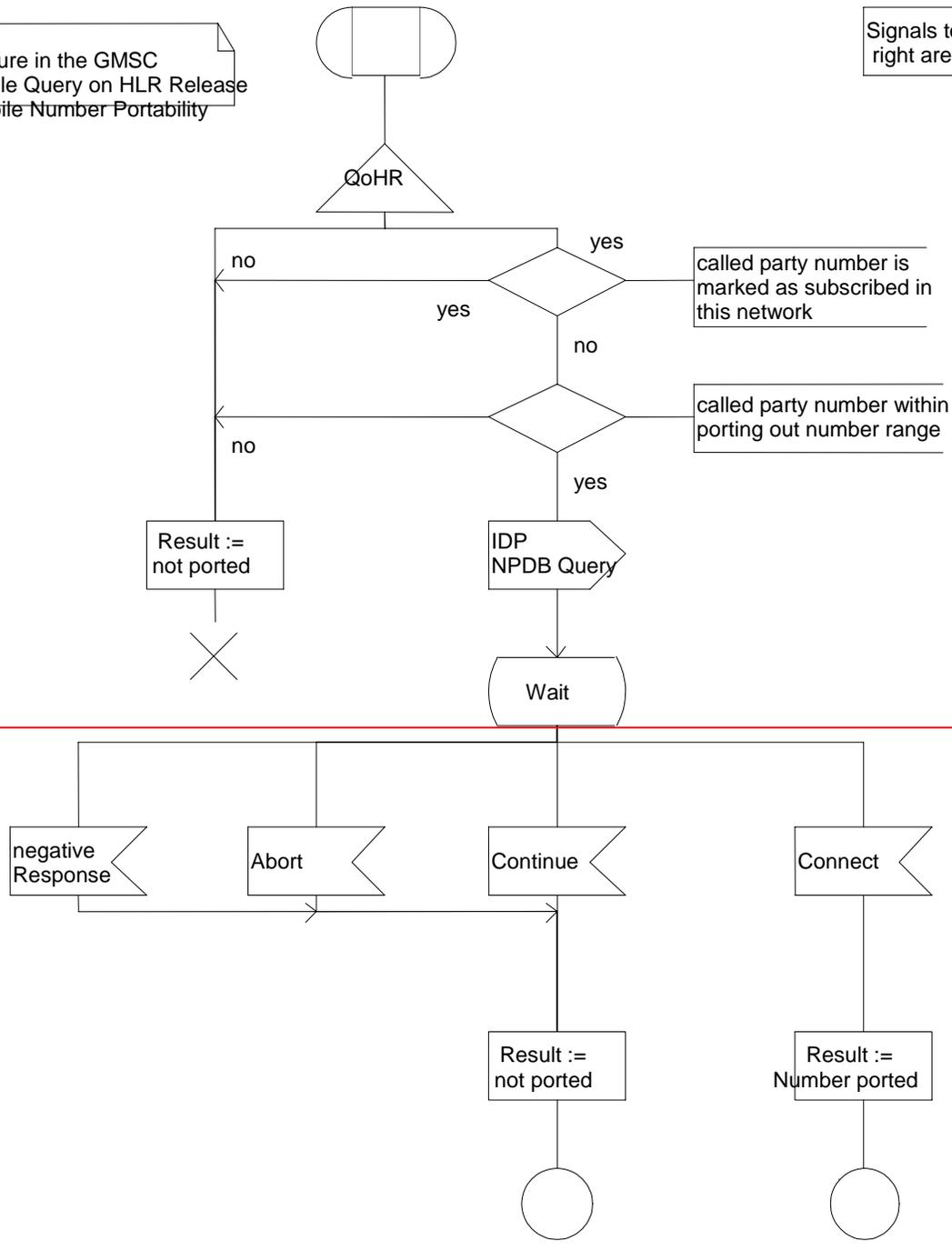


Figure A.13: Procedure MOBILE\_NUMBER\_PORTABILITY\_IN\_QoHR

### A.3.1.2 Procedure MOBILE\_NUMBER\_PORTABILITY\_IN\_TQoD

The procedure MOBILE\_NUMBER\_PORTABILITY\_IN\_TQoD is shown in figure A.14. It is called from the procedure Obtain\_Routing\_Address defined in GSM 03.18 [4].

The text in this clause is a supplement to the definition in the SDL diagrams; it does not duplicate the information in the SDL diagrams.

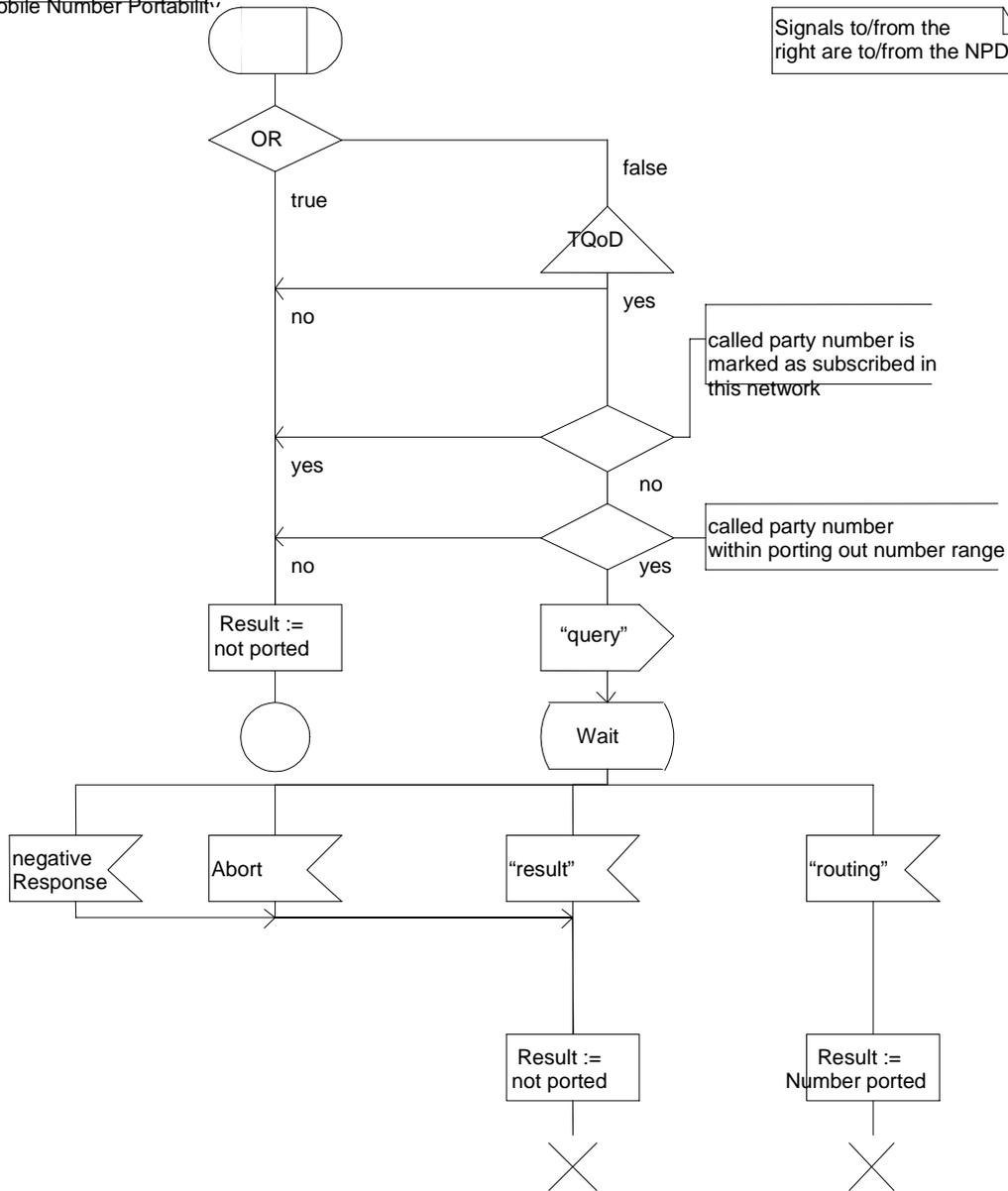
The ~~IDP message~~ ["query" to NPDB](#) contains the service key for MNP query and the called party's MSISDN.

### Procedure MOBILE\_NUMBER\_PORTABILITY\_IN\_TQoD

1(1)

Procedure in the GMSC to handle Terminating call Query on Digit Analysis for Mobile Number Portability

Signals to/from the right are to/from the NPDB



Procedure MOBILE\_NUMBER\_PORTABILITY\_IN\_TQoD

1(1)

Procedure in the GMSC to handle Terminating call Query on Digit Analysis for Mobile Number Portability

Signals to/from the right are to/from the NPDB

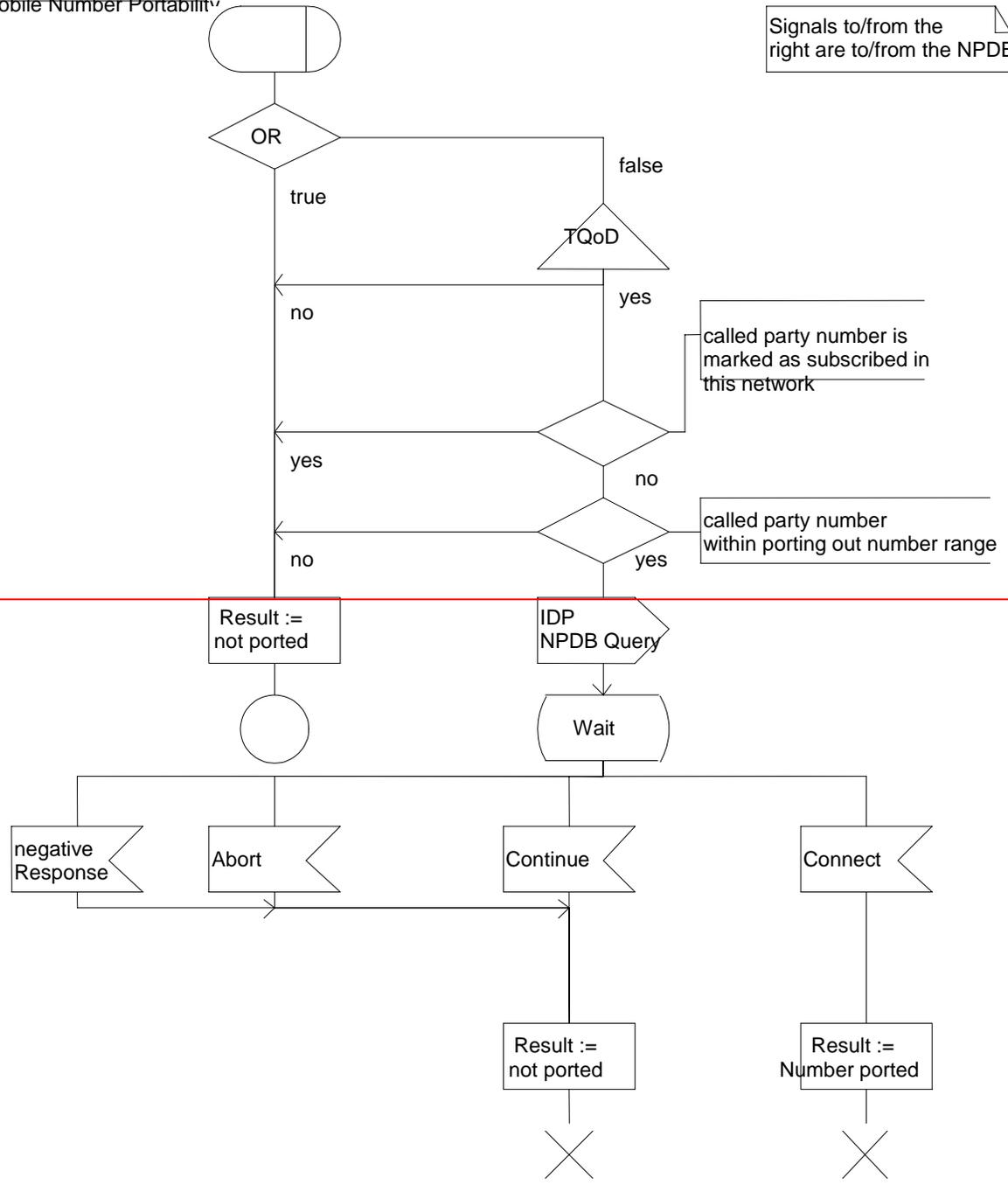


Figure A.14: Procedure MOBILE\_NUMBER\_PORTABILITY\_IN\_TQoD

## A.3.2 Functional requirement of MSC

### A.3.2.1 Procedure MOBILE\_NUMBER\_PORTABILITY\_IN\_OQoD

The procedure MOBILE\_NUMBER\_PORTABILITY\_IN\_OQoD is shown in figure A.15. It is called from the procedure Outgoing\_Call\_Setup\_MSC and from the process MT\_CF\_MSC defined in GSM 03.18 [4].

The text in this clause is a supplement to the definition in the SDL diagrams; it does not duplicate the information in the SDL diagrams.

The MSC may recognise own numbers as not being within the ported number range. For foreign numbers however, the MSC will not in general know whether the number is portable. The test “called party number is a portable national MSISDN” takes the “yes” exit if the number is a foreign national MSISDN or an own portable MSISDN.

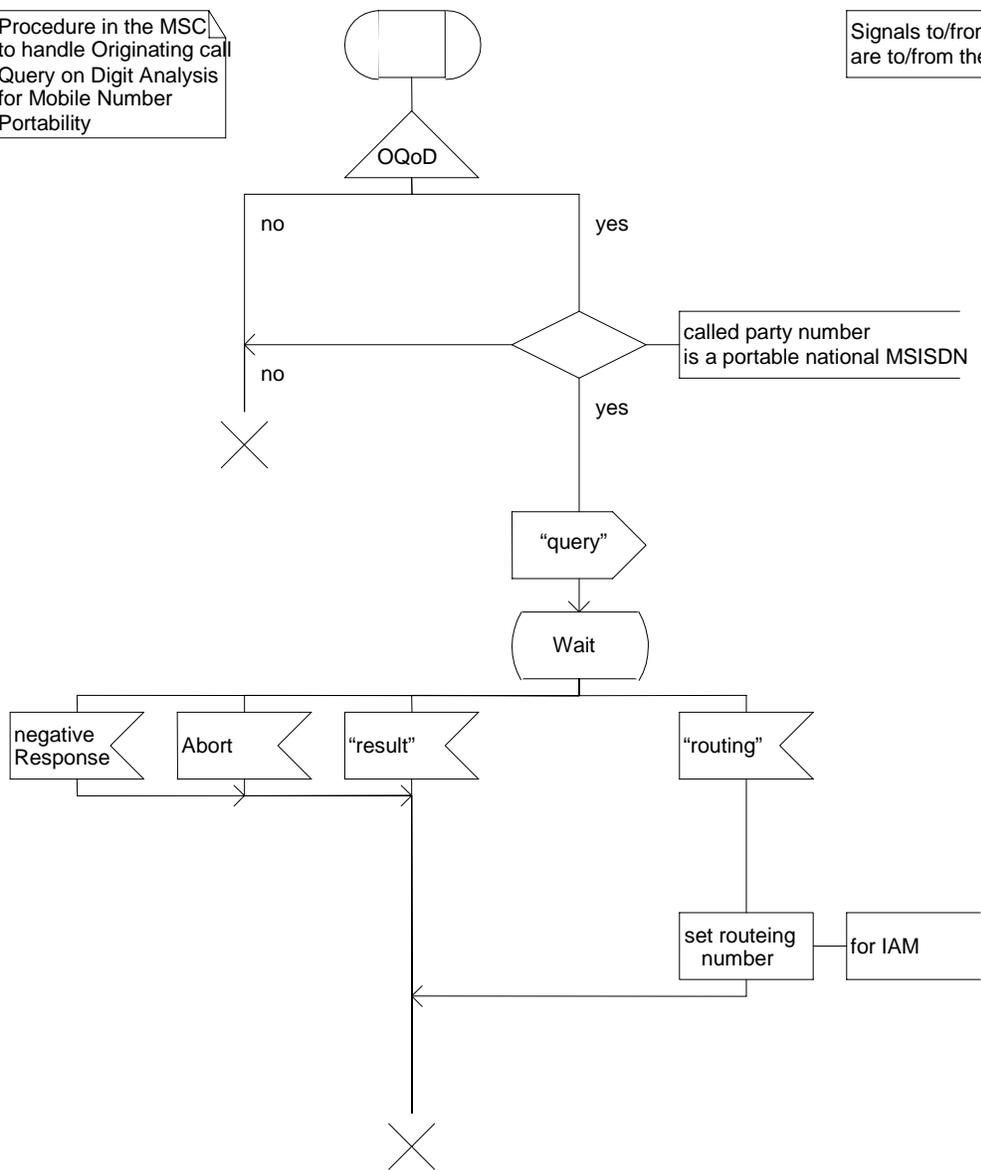
The ~~MDP message~~ [“query” to NPDB](#) contains the service key for MNP query and the called party’s MSISDN.

Procedure MOBILE\_NUMBER\_PORTABILITY\_IN\_OQoD

1(1)

Procedure in the MSC to handle Originating call Query on Digit Analysis for Mobile Number Portability

Signals to/from the right are to/from the NPDB



Procedure MOBILE\_NUMBER\_PORTABILITY\_IN\_OQoD

1(1)

Procedure in the MSC to handle Originating call Query on Digit Analysis for Mobile Number Portability

Signals to/from the right are to/from the NPDB

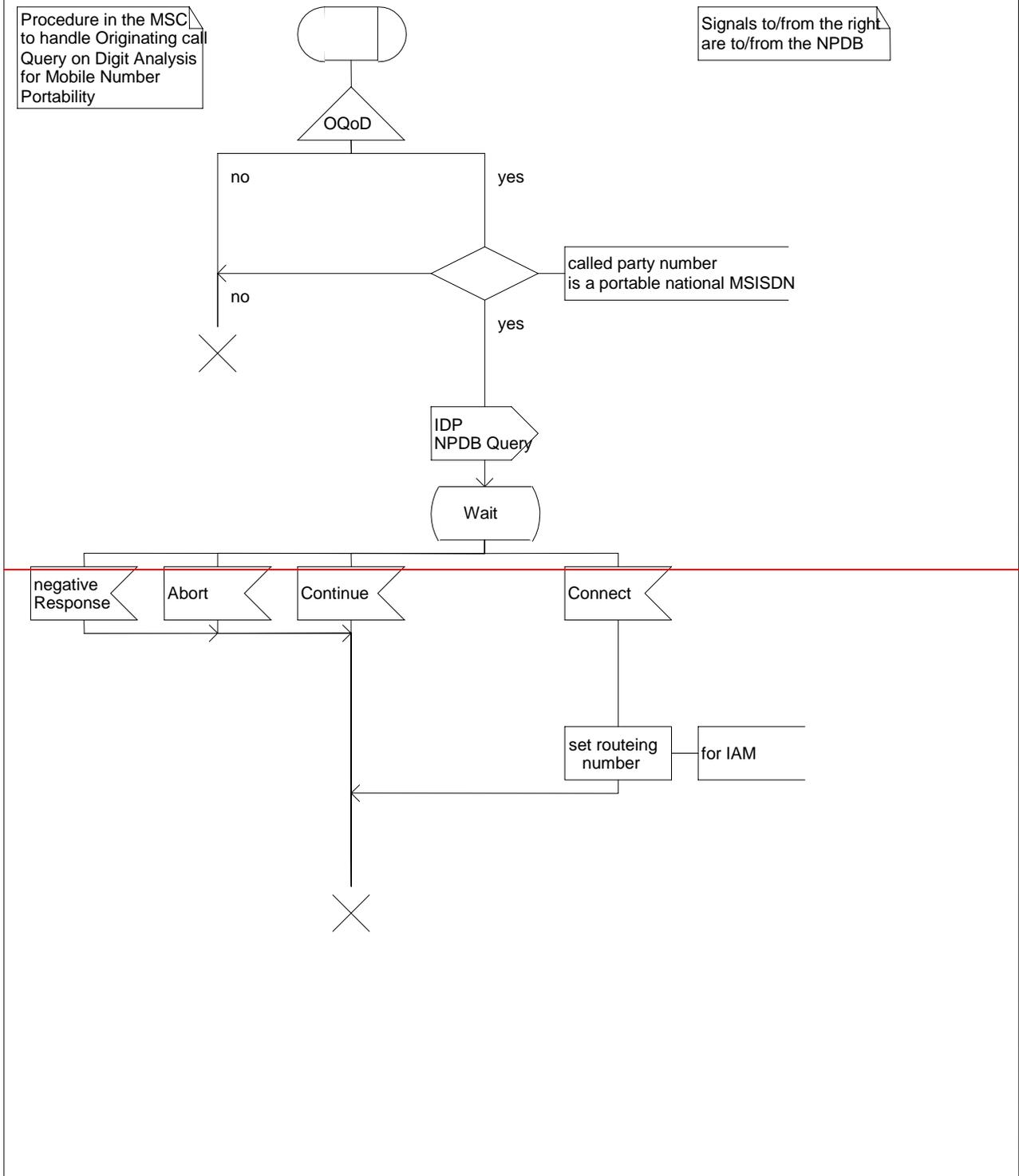


Figure A.15: Procedure MOBILE\_NUMBER\_PORTABILITY\_IN\_OQoD

### A.3.3 Functional requirement of NPDB

#### A.3.3.1 Process IDPIN\_QUERY\_NPDB

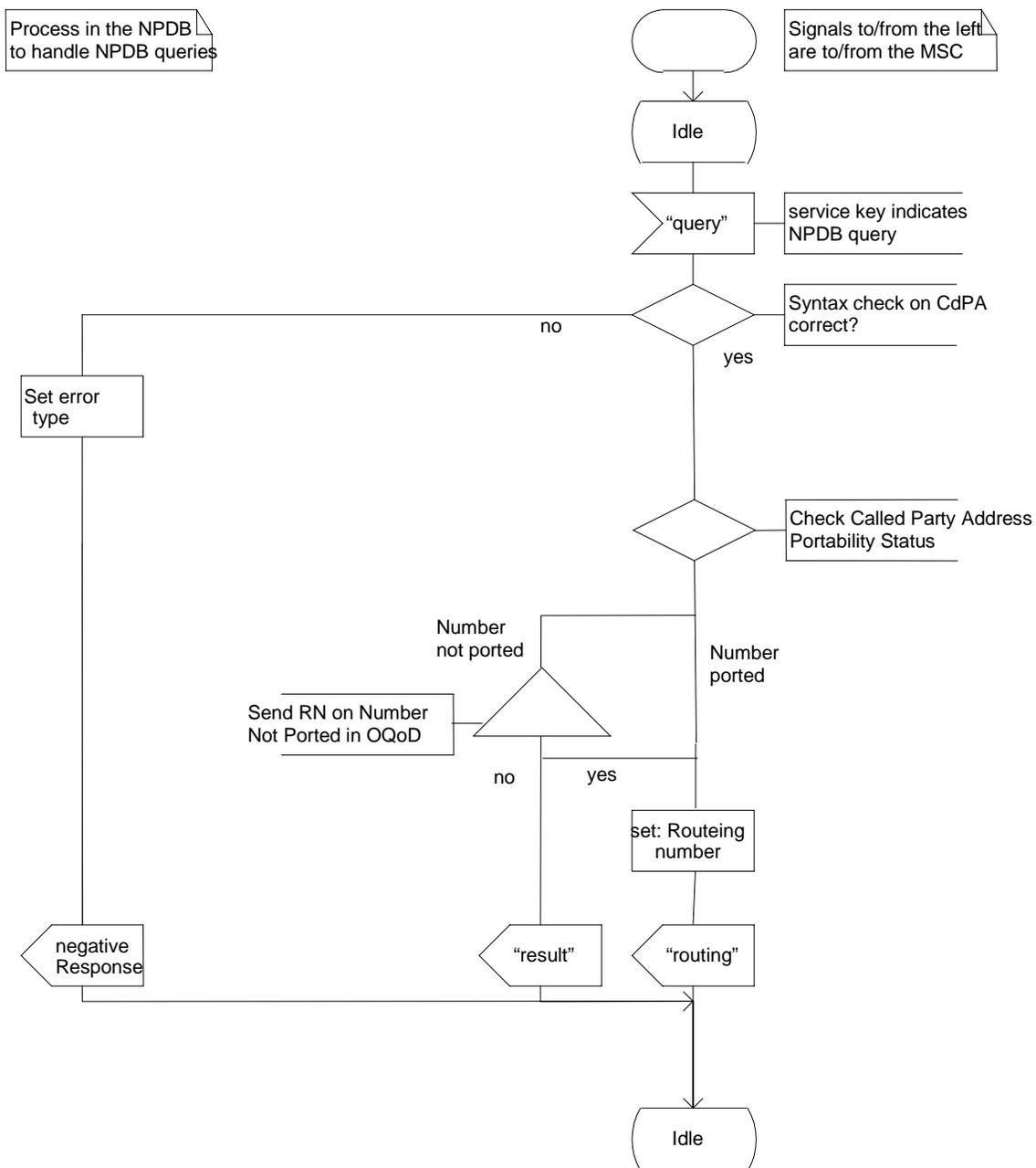
The process IDPIN\_QUERY\_NPDB is shown in figure A.16.

### Process IN\_QUERY\_NPDB

1(1)

Process in the NPDB to handle NPDB queries

Signals to/from the left are to/from the MSC



Process IDP\_NPDB

1(1)

Process in the NPDB to handle NPDB queries

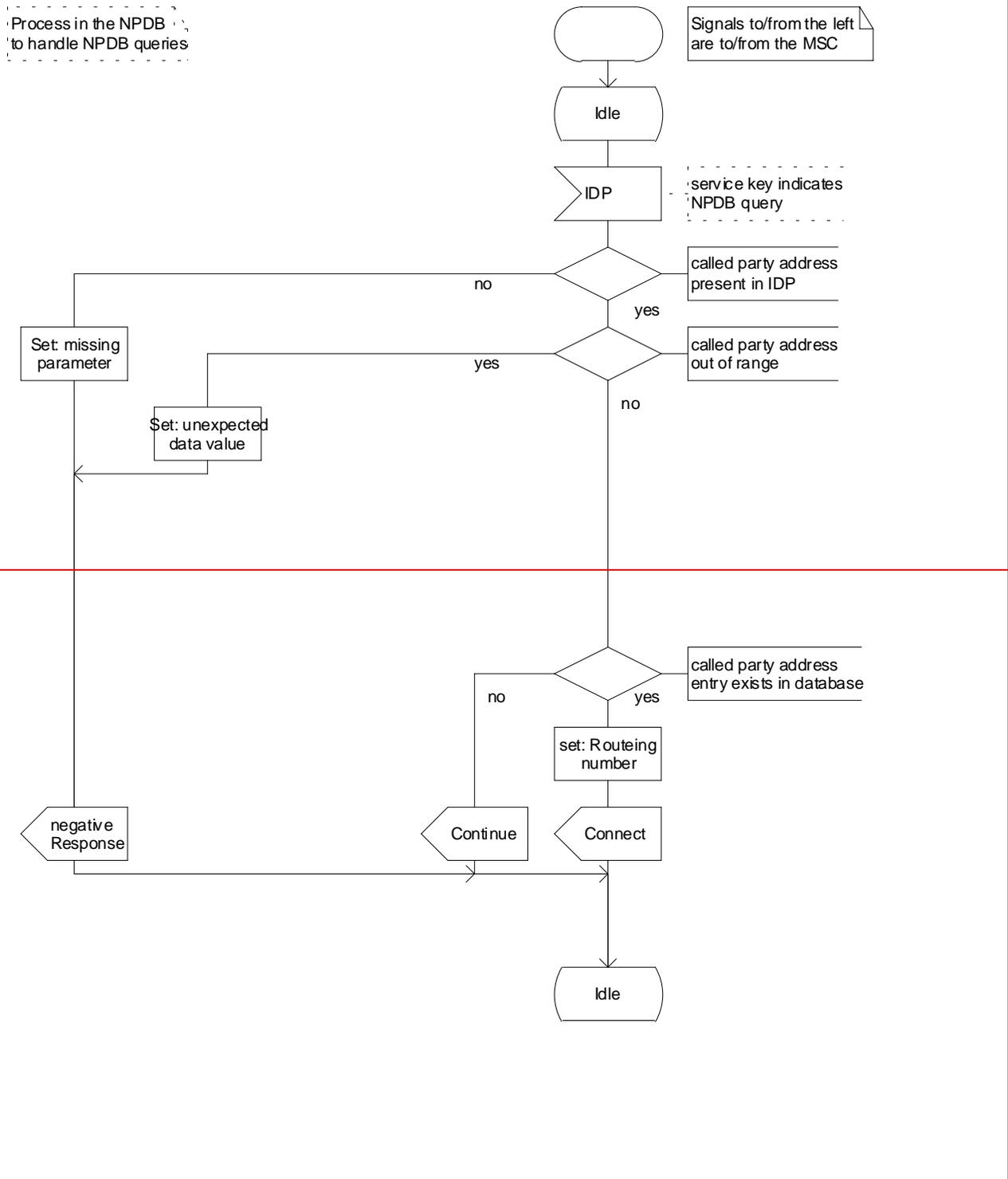


Figure A.16: Process **IDPIN\_QUERY**\_NPDB

## A.4 Contents of messages

This clause specifies the content of the following messages:

On the ISUP interface:

IAM;

On the MSC - NPDB interface:

“query”

“routing”

“result”;

~~INITIAL DP~~

~~CONTINUE~~

~~CONNECT;~~

Messages in the MSC – NPDB interface are mapped into INAP messages according to the following table:

<u>Messages in MSC-NPDB interface</u>	<u>INAP messages</u>
<u>“query”</u>	<u>INITIAL DP</u>
<u>“routing”</u>	<u>CONNECT</u> <u>CONTINUE</u>
<u>“result”</u>	<u>CONTINUE</u> <u>RELEASE CALL</u>

In the tables which follow, information elements are shown as mandatory (M), conditional © or optional (O). A mandatory information element shall always be present. A conditional information element shall be present if certain conditions are fulfilled; if those conditions are not fulfilled it shall be absent. An optional element may be present or absent, at the discretion of the application at the sending entity.

### A.4.1 Messages on the ISUP interface

#### A.4.1.1 IAM

This message is specified in [7]. It is necessary for the IAM to contain the information needed to route the call to the subscription network of the ported subscriber. The ways in which this may be coded are shown in [7].

### A.4.2 Messages on the MSC - NPDB interface

#### A.4.2.1 INITIAL DP

This message is specified in [6]. The following information elements are required:

Information element name	Required	Description
Service Key	M	Identifies the requested IN service (MNP query).
Called Party Number	M	The possibly ported MSISDN

#### A.4.2.2 INITIAL DP negative response

This message is specified in [6]. The negative response information element can take the following values:

1. missing parameter;
2. unexpected data value;
3. [unexpected parameter](#);
4. [system failure](#).

### A.4.2.3 CONNECT

This message is specified in [6]. It shall be ensured that the information in the Connect message shall be aligned with the coding supported in the ISUP signalling.

### A.4.2.4 CONTINUE

This message does not contain any information element.

### [A.4.2.5 RELEASE CALL](#)

[This message is specified in \[6\]. The following information elements are required:](#)

<a href="#">Information element name</a>	<a href="#">Required</a>	<a href="#">Description</a>
<a href="#">Cause</a>	<a href="#">M</a>	<a href="#">Indicates the reason for releasing the call</a>

# CHANGE REQUEST

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**23.066 CR 009r3**

Current Version: **3.1.0**

GSM (AA.BB) or 3G (AA.BBB) specification number ↑

↑ CR number as allocated by MCC support team

For submission to: **CN #7**  
list expected approval meeting # here ↑

for approval   
for information

strategic   
non-strategic  (for SMG use only)

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

**Proposed change affects:**  
(at least one should be marked with an X)

(U)SIM  ME  UTRAN / Radio  Core Network

**Source:** **N2**

**Date:** **03.03.2000**

**Subject:** **Detection of database synchronisation errors in SRF**

**Work item:** **Mobile Number Portability**

**Category:**

(only one category shall be marked with an X)

F Correction   
A Corresponds to a correction in an earlier release   
B Addition of feature   
C Functional modification of feature   
D Editorial modification

**Release:** Phase 2   
Release 96   
Release 97   
Release 98   
Release 99   
Release 00

**Reason for change:**

The current specification of MNP does not provide a mechanism to detect NPDB synchronisation errors. This CR introduces a procedure to detect such errors in the SRF solution for call and non-call related signalling.

**Clauses affected:** **4.3, 6 (new clause), B.3.1, C.2.2**

**Other specs affected:**

Other 3G core specifications  → List of CRs: 29.002-063r4  
Other GSM core specifications  → List of CRs:  
MS test specifications  → List of CRs:  
BSS test specifications  → List of CRs:  
O&M specifications  → List of CRs:

**Other comments:**



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<----- double-click here for help and instructions on how to create a CR.

## 4.3 Common Functionality of the MNP-SRF

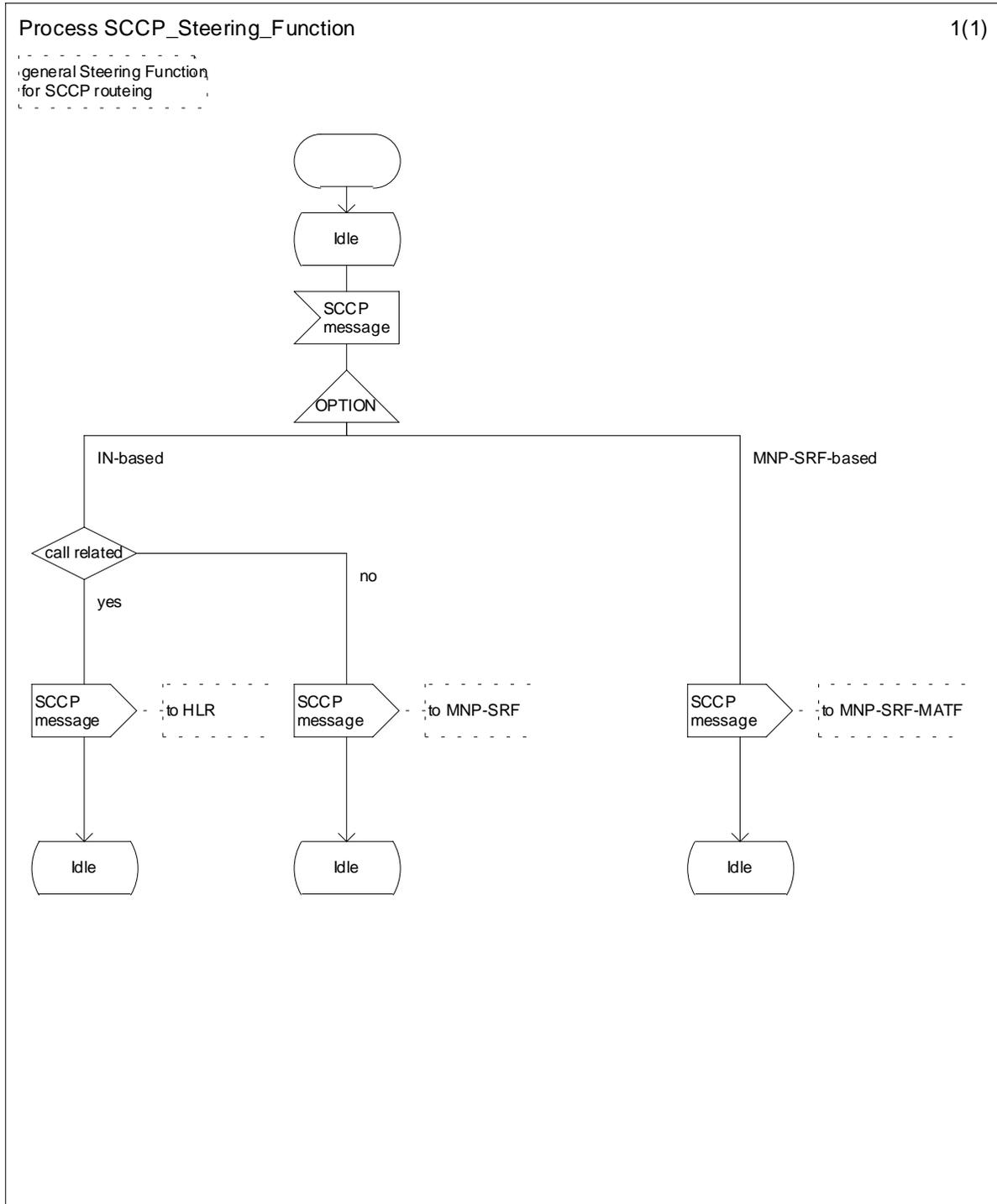
In a PLMN which supports mobile number portability, SCCP messages sent to an HLR may be relayed by an MNP-SRF. Depending on the implemented solution (IN-based or MNP-SRF-based), on the type of message (call-related or non-call-related) and on the porting status of the called subscriber the MNP-SRF may modify the SCCP called party address and route the message to a different HLR or to the subscription network, or terminate the dialogue and response to the INE.

Figure 1 shows the general steering functionality for SCCP message routing. It shows the SCCP routing principle for mobile number portability within a network.

Note that call related messages in the IN-based solution are not routed to the MNP-SRF. Therefore Normative Annex A of the present document does not mention the MNP-SRF.

However, the usage of the IN-based solution for the call-related messages should allow operators to have the routing of the non call-related messages determined in the same database. See [8] for the description of the access of the MNP-SRF (node with relay capability) to the NPDB (external database).

In order to guard against the possibility that the porting data for an MSISDN is inconsistent between PLMNs in a porting cluster, the SCCP hop counter may be used to prevent indefinite looping of messages between PLMNs. The MNP-SRF would then decrement the SCCP hop counter for every message that is relayed. It should be noted that the use of the SCCP hop counter requires the use of unsegmented SCCP XUDT messages as defined in ITU-T 1996 SCCP recommendations.



**Figure 1: Steering Function for SCCP Message routing**

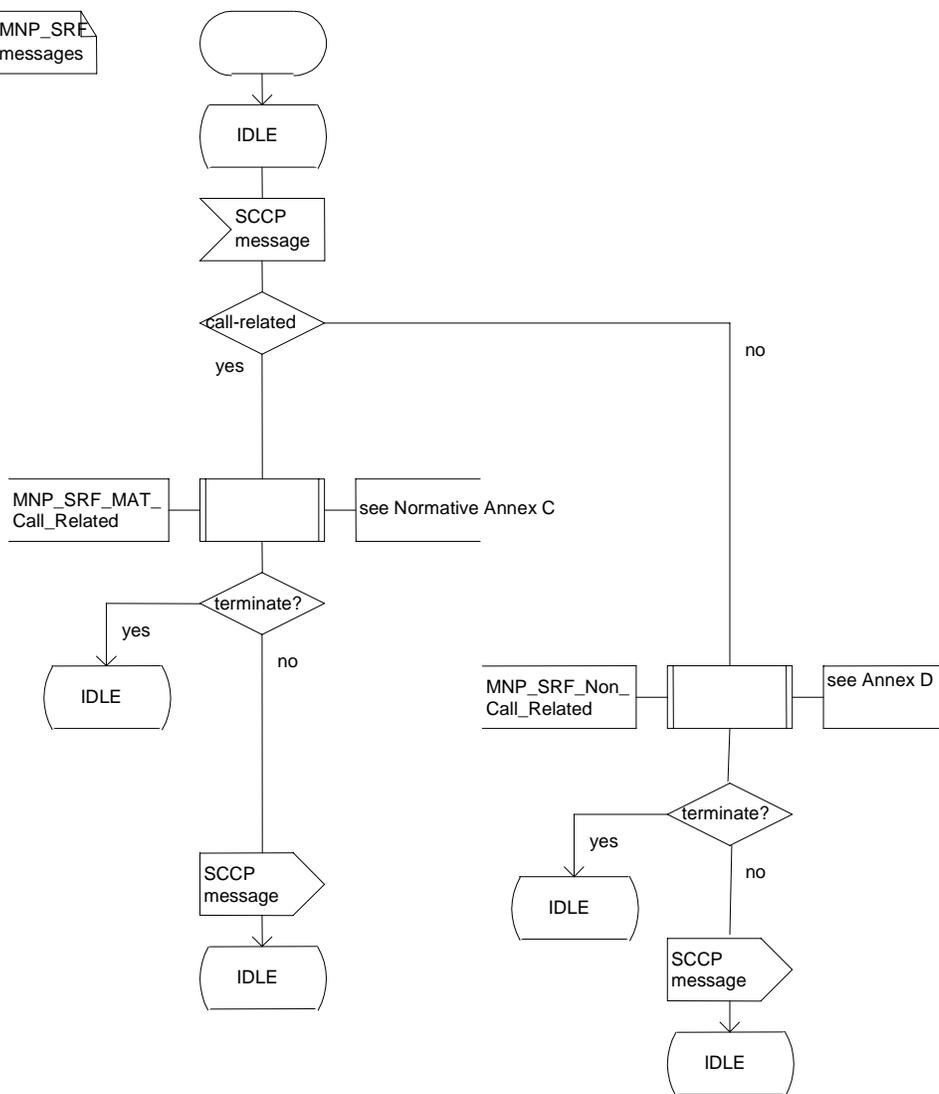
Figure 2 shows the process MNP\_SRF in the MNP-SRF. The procedures MNP\_SRF\_MATF\_Call\_Related and MNP\_SRF\_Non\_Call\_Related are described in Normative Annex C and Normative Annex B of the present document. Note that in networks which support the IN-based solution for call related signalling, a distinction on SCCP level for call related and non-call related messages is needed and that the MNP-SRF does not require to include a MATF since call related messages are not routed to the MNP-SRF.

The test "call-related" is a test on the SCCP Translation Type if a dedicated Translation Type value for call related messages is used in the network. The handling of SCCP messages in the MNP-SRF in networks which do not make use of a dedicated Translation Type value for call related messages is for further study.

### Process MNP\_SRF

1(1)

Process in the MNP\_SRF to relay SCCP messages



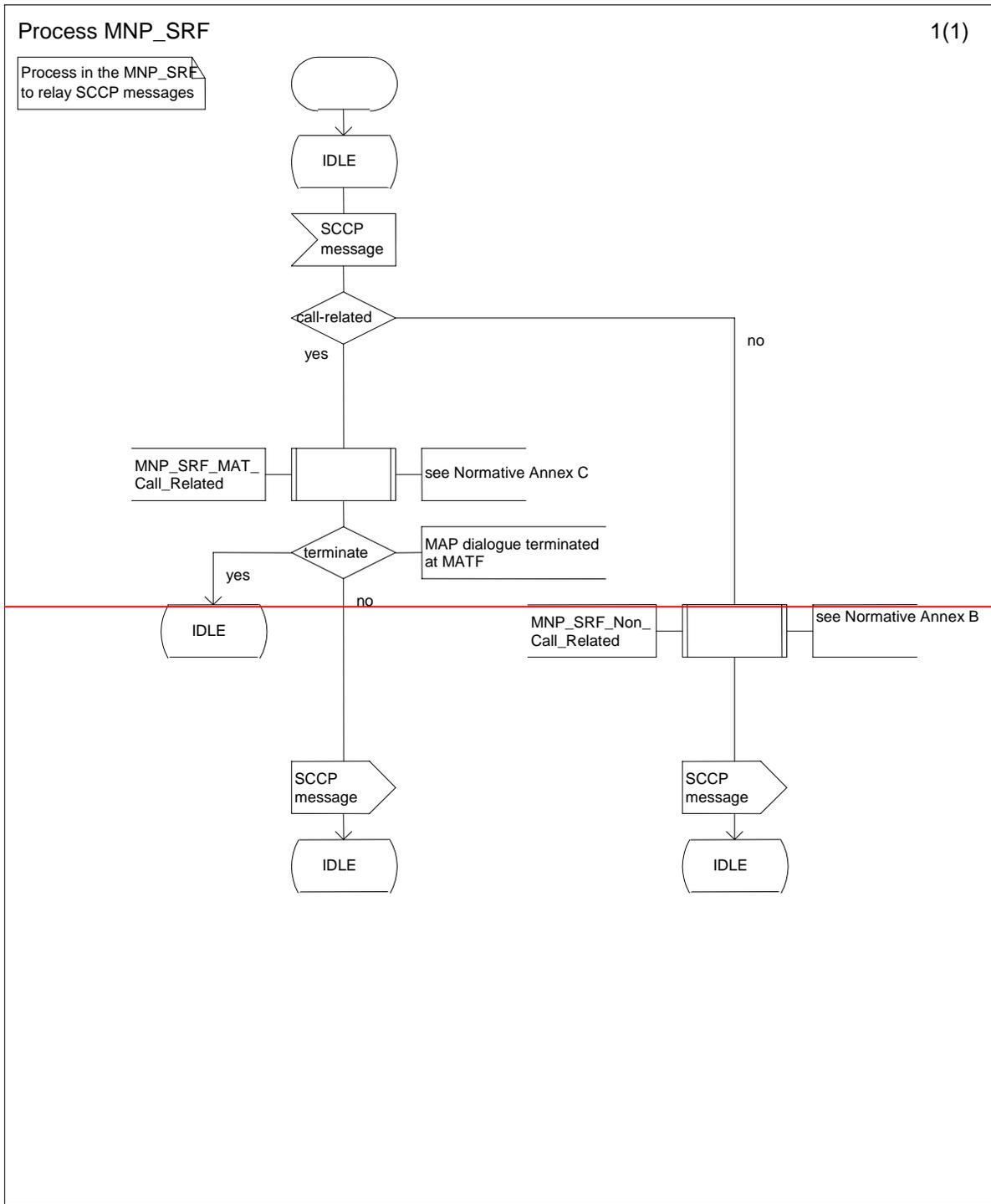


Figure 2: Process MNP\_SRF

## 6 Functional requirements of network entities

### 6.1 Procedure MNP\_SRF\_Check\_MNP\_Indicator

The procedure MNP\_SRF\_Check\_MNP\_Indicator is shown in figure 4. It is called from the procedures MNP\_SRF\_Non\_Call\_Related and MNP\_SRF\_MATF\_Call\_Related.

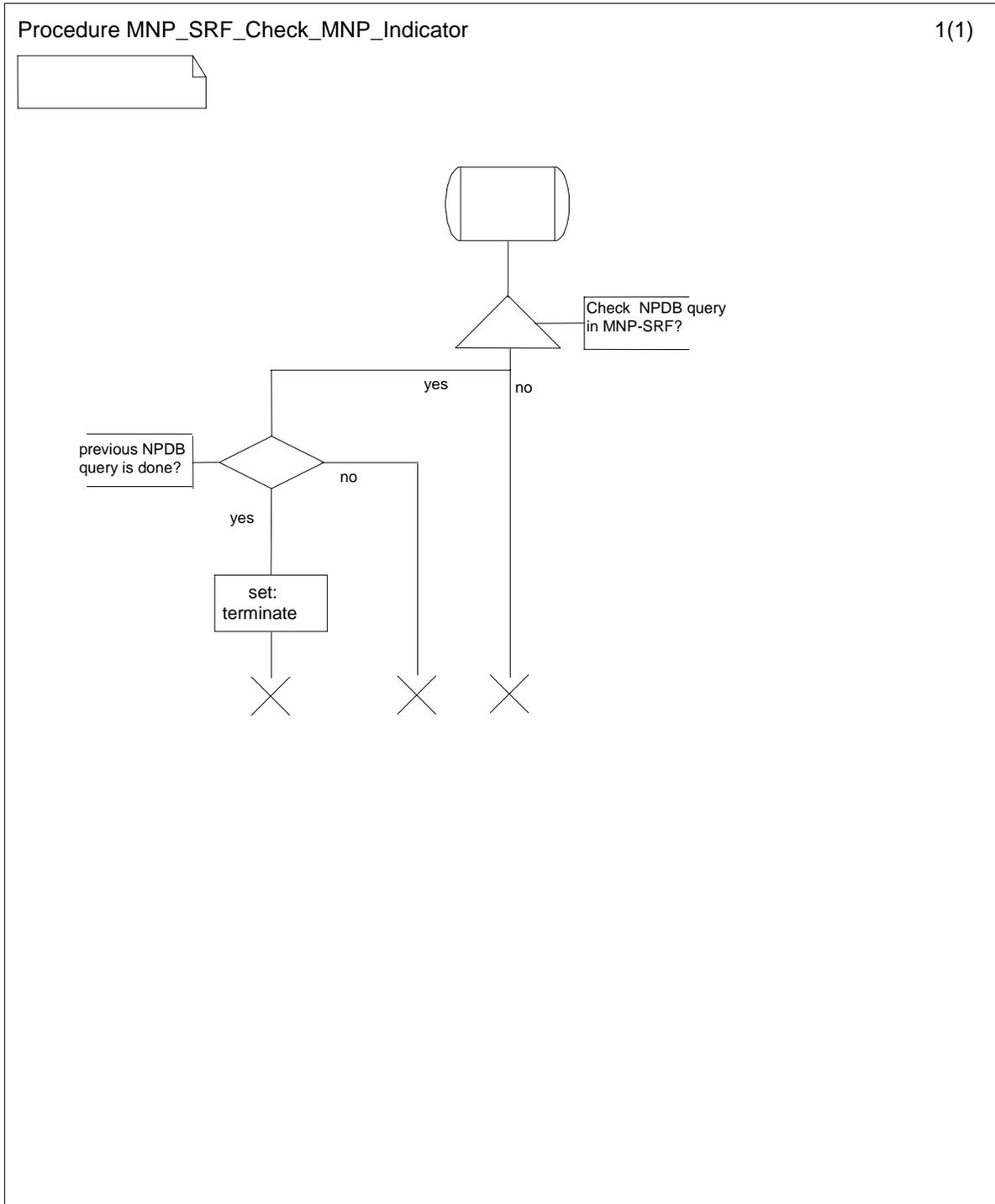


Figure 4: Procedure MNP\_SRF\_Check\_MNP\_Indicator

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## B.3 Functional Requirements of Network Entities

### B.3.1 Procedure MNP\_SRF\_Non\_Call\_Related

Figure B.3.1 shows the procedure MNP\_SRF\_Non\_Call\_Related. This procedure handles non-call related signalling messages. It is called from the process MNP\_SRF (see chapter 4.3).

The check “CdPA contains own number ported out?” identifies all mobile numbers from number ranges allocated to the network the MNP-SRF is located in and which are ported to other networks. In this case the message is relayed to the subscription network.

The check “CdPA contains own number not ported out?” identifies all mobile numbers from the number ranges allocated to the network the MNP-SRF is located in and which are still served by the network the MNP-SRF is located in, i.e. the numbers are not ported out. In this case the message is relayed to the HLR in the network.

The check “CdPA contains foreign number ported in?” identifies all mobile numbers from the number ranges not allocated to the network the MNP-SRF is located in and which are served by the network the MNP-SRF is located in, i.e. the numbers are ported in. In this case the message is relayed to the HLR in the network.

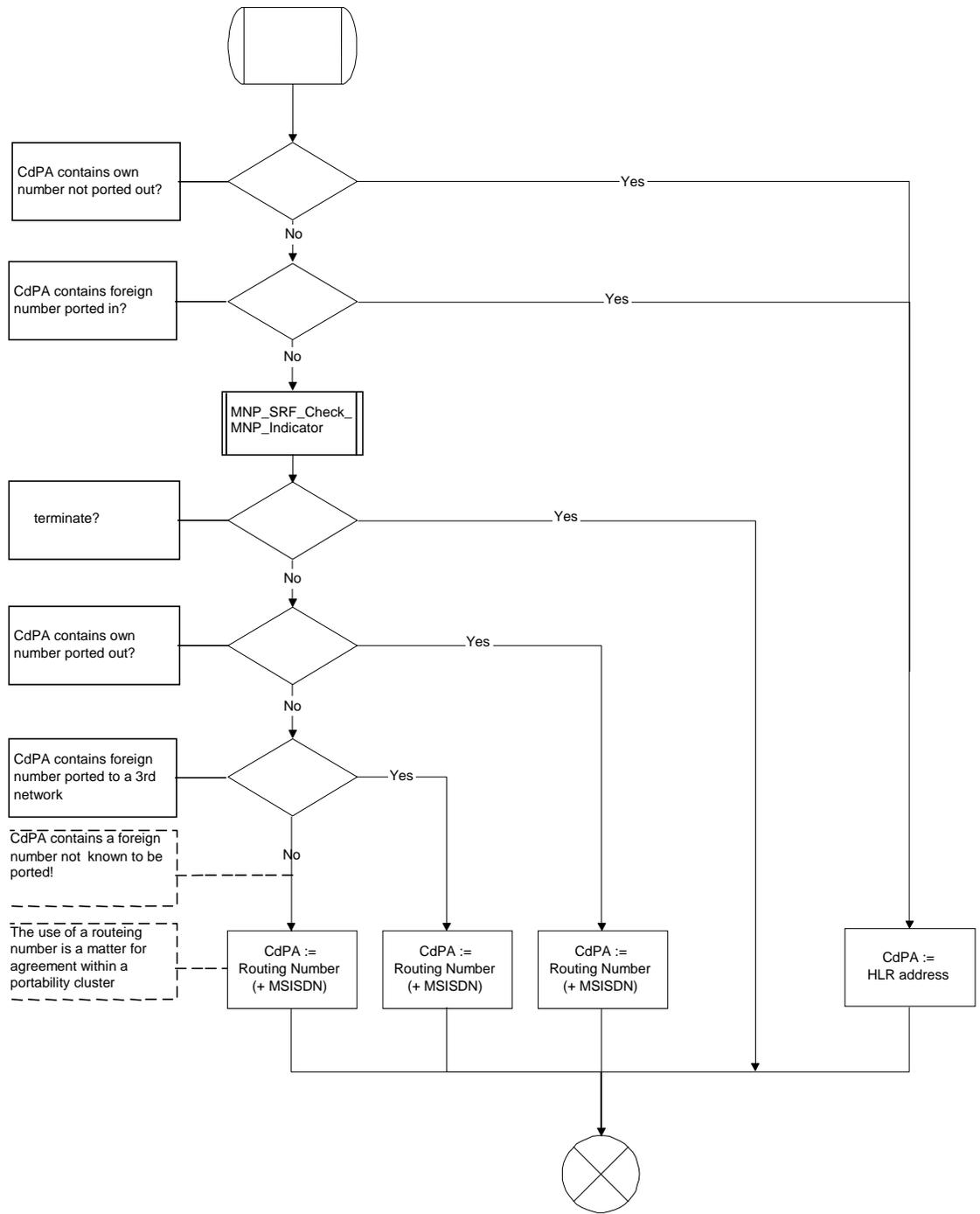
The check “CdPA contains foreign number ported to a foreign network?” identifies all mobile numbers from the number ranges not allocated to the network the MNP-SRF is located in and which are not served by the MNP-SRF is located in and not served by the network the number range is allocated to, i.e. the numbers are ported to a foreign network. In this case the message is relayed to the subscription network.

The remaining numbers “CdPA contains number not known to be ported ?” are mobile numbers from the number ranges not allocated to the network the MNP-SRF is located in and which are also not served by the network the MNP-SRF is located in. In this case the message is relayed to the number range owner network.

**Procedure MNP\_SRF\_Non\_Call\_Related**

Procedure in MNP\_SRF  
to handle the Signalling  
Routing of Mobile  
Number for Non Call  
Related

Procedure  
MNP\_SRF\_Non\_Call\_Related  
FPAR IN/OUT Called  
Address



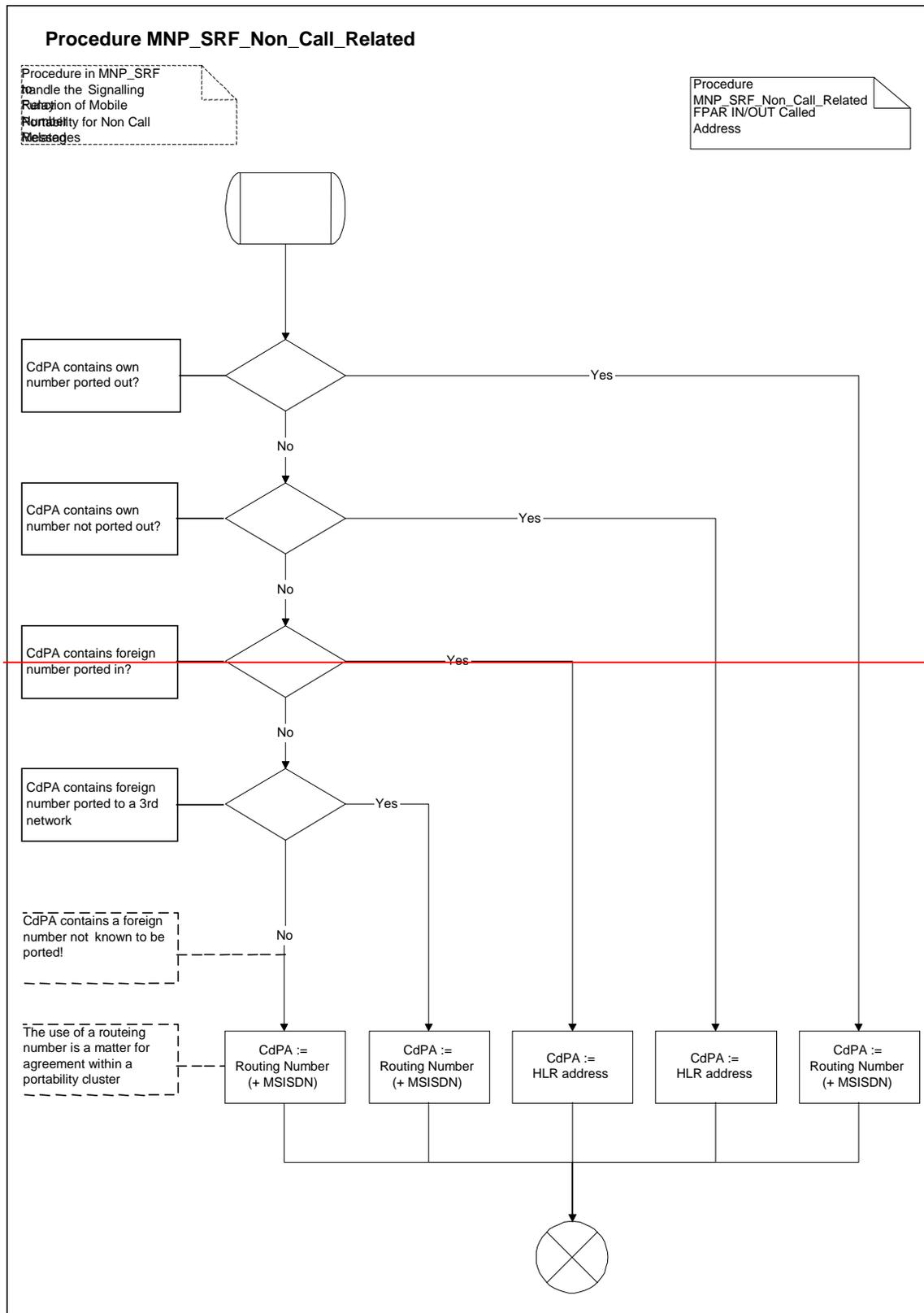


Figure B.3.1: Procedure MNP\_SRF\_Non\_Call\_Related

## C.2.2 Process SRI\_NPLR

Figure C.2.2 shows the process SRI\_NPLR.

The check “unknown subscriber” identifies a subscriber without any associated available information.

If the GMSC is in the database own network then a routing number is provided to route to the number range owner network.

If the GMSC is not in the database own network then the enquiry has been routed from the number range owner network, so the call should fail.

The database query uses the MSISDN received at the application level in the SRI, rather than the CdPA of the SCCP level.

[If an error must be set as a result of the check “terminate”, the user error “unknown subscriber” shall be used. If version 3 or higher of the MAP protocol is in use, then the diagnostic “NPDB mismatch” may be used.](#)

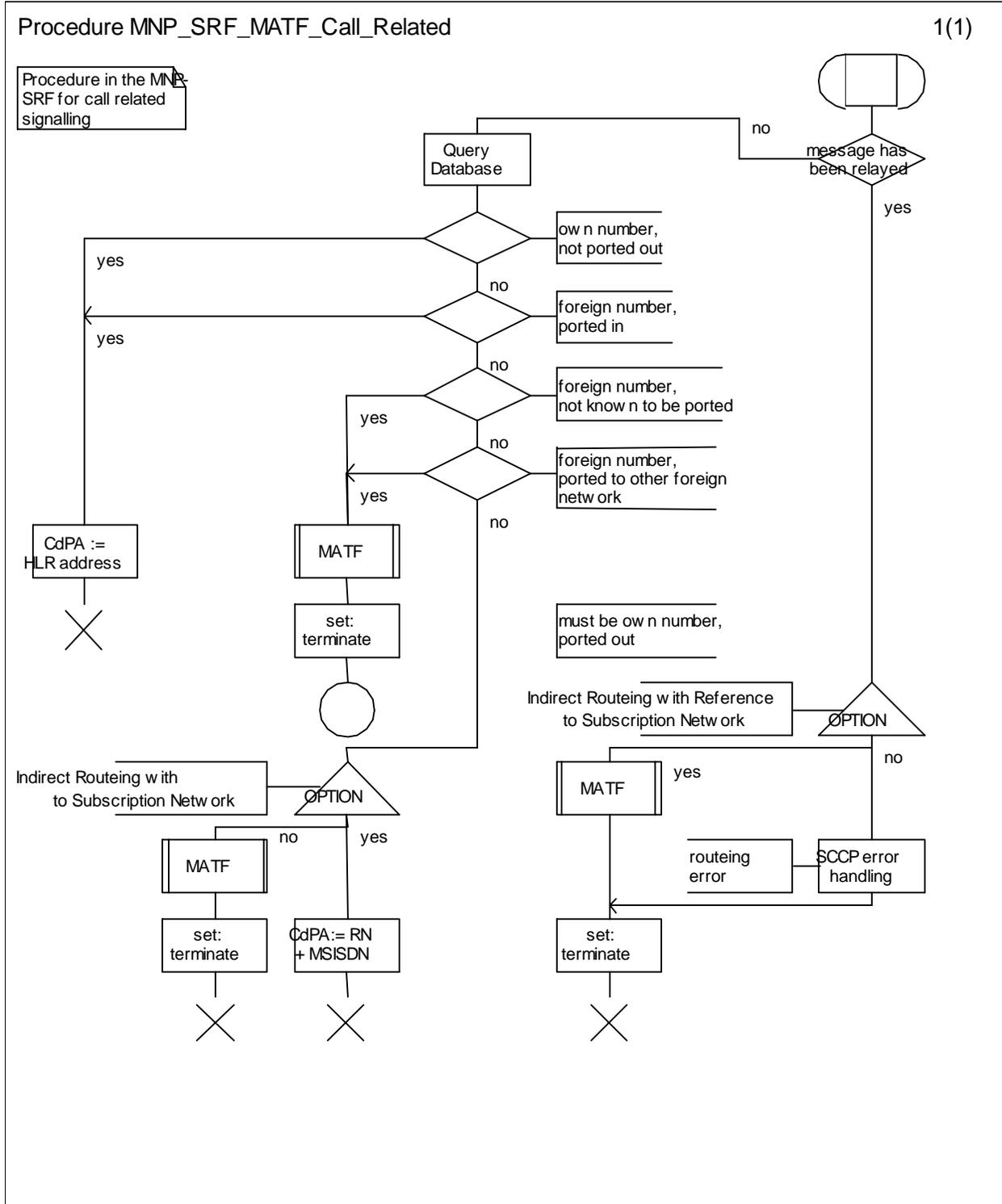


Figure C.2.1.1: Procedure MNP\_SRF\_MATF\_Call\_Related

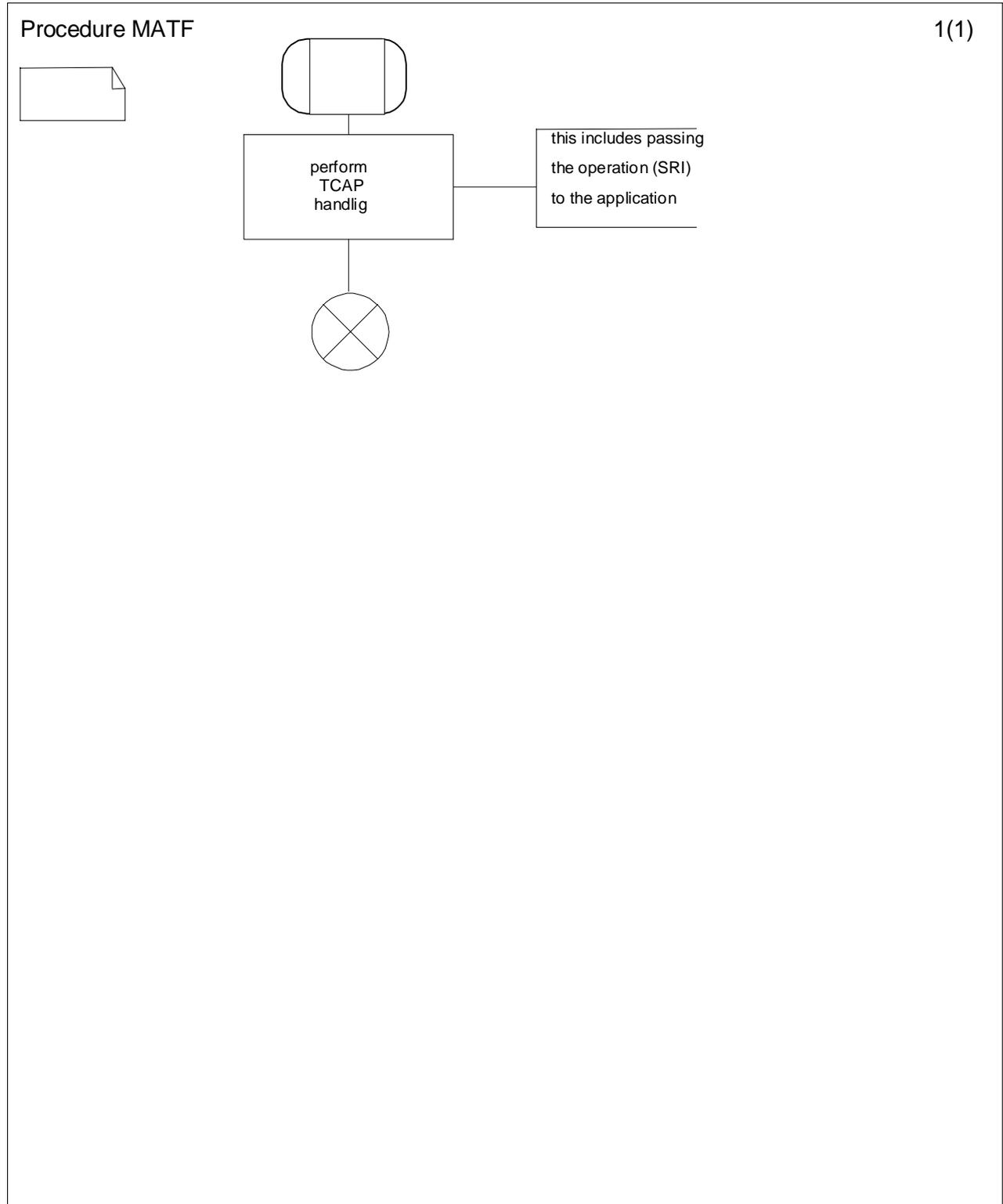
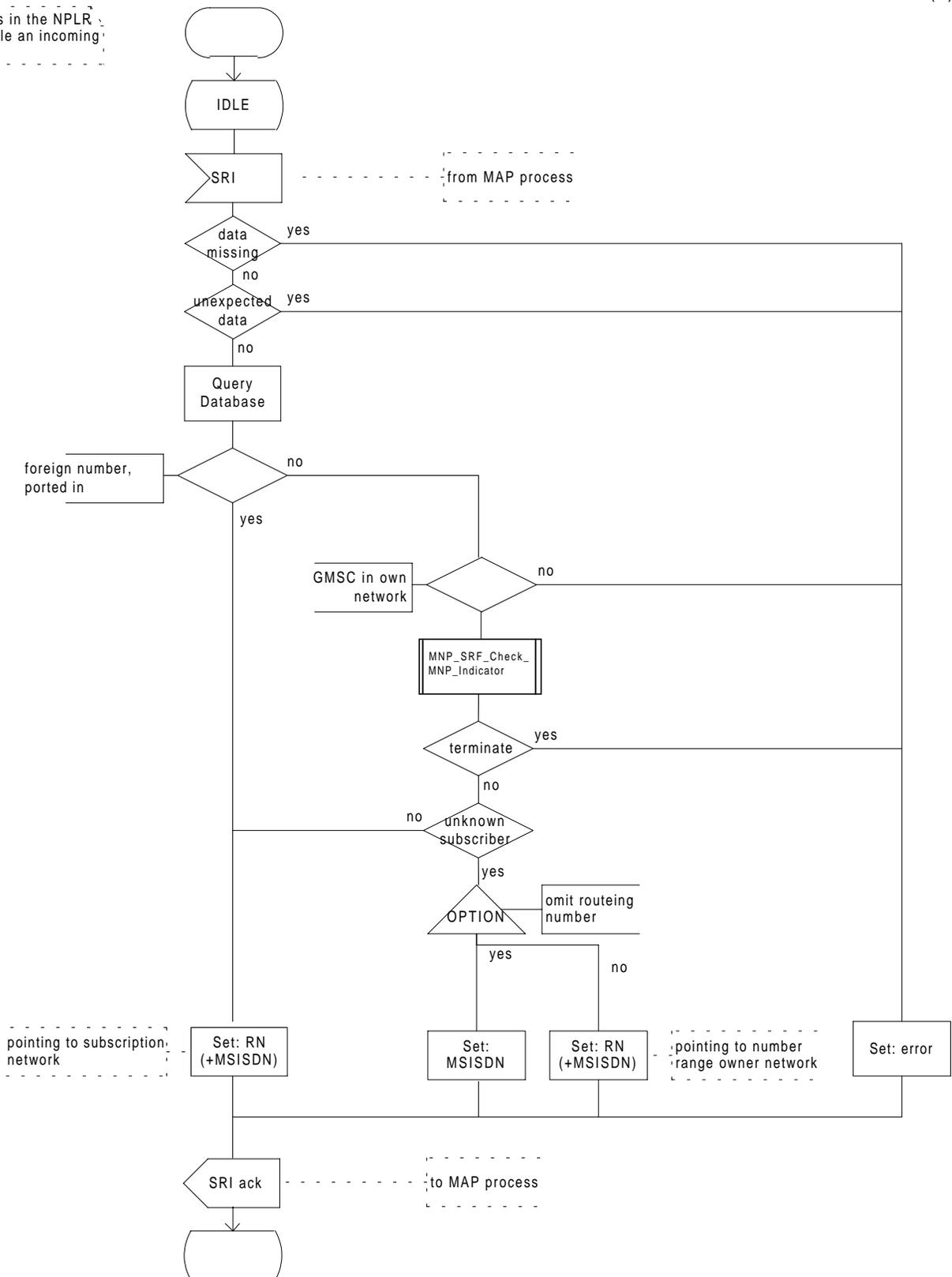


Figure C.2.1.2: Procedure MATF

Process SRI\_NPLR

1(1)

Process in the NPLR to handle an incoming SRI



Process SRI\_NPLR

1(1)

Process in the NPLR to handle an incoming SRI

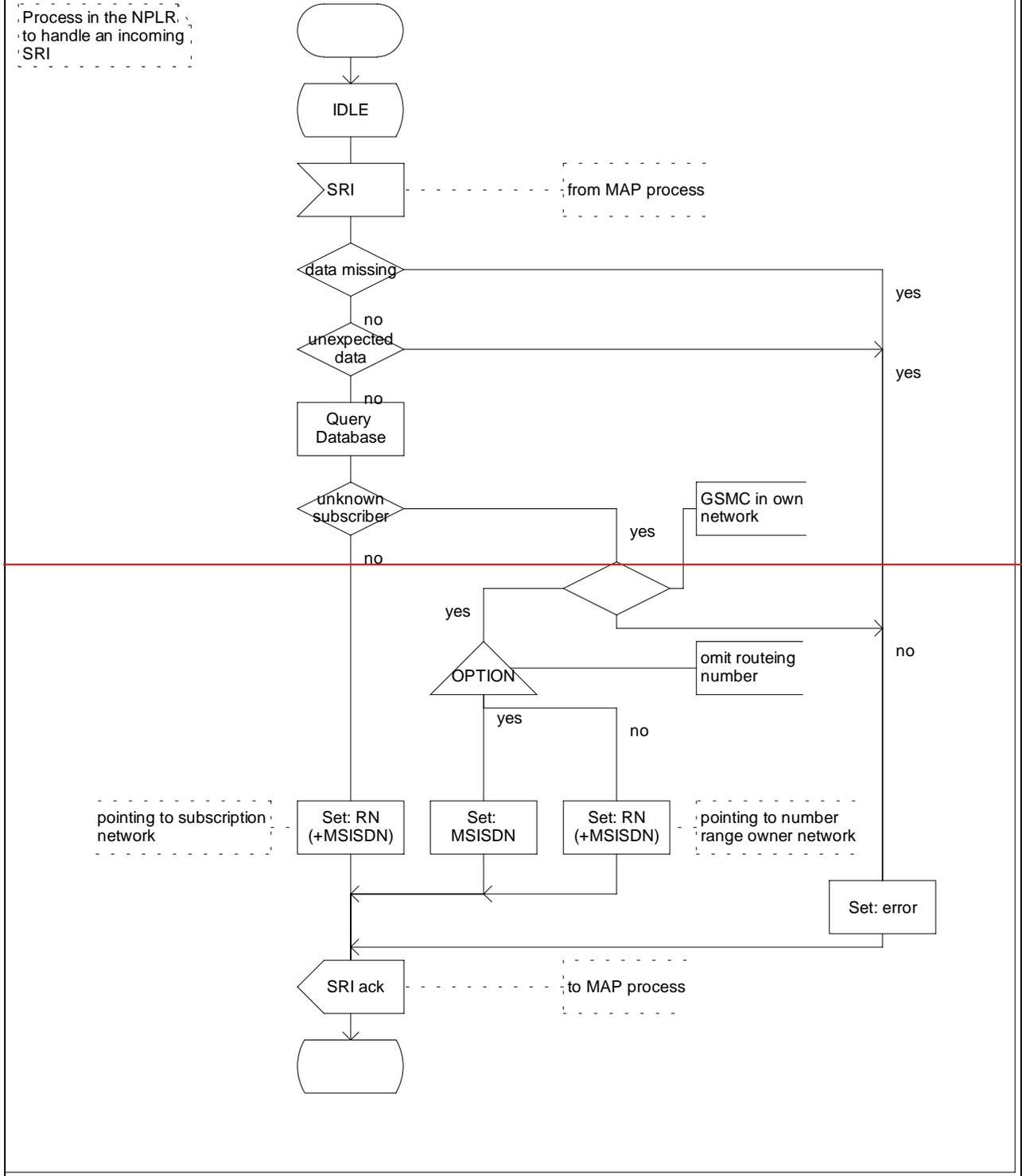


Figure C.2.2: Process SRI\_NPLR

# CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

**23.066 CR 015r1**

Current Version: **3.1.0**

GSM (AA.BB) or 3G (AA.BBB) specification number ↑

↑ CR number as allocated by MCC support team

For submission to: **CN#07**

list expected approval meeting # here ↑

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strategic   
non-strategic  (for SMG use only)

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

**Proposed change affects:**

(at least one should be marked with an X)

(U)SIM  ME  UTRAN / Radio  Core Network

**Source:**

**N2**

**Date:**

**16.2.2000**

**Subject:**

Clarification of NPDB error detection and MNP specific call handling

**Work item:**

Mobile Number Portability

**Category:**

(only one category shall be marked with an X)

F Correction   
A Corresponds to a correction in an earlier release   
B Addition of feature   
C Functional modification of feature   
D Editorial modification

**Release:**

Phase 2   
Release 96   
Release 97   
Release 98   
Release 99   
Release 00

**Reason for change:**

At the moment possible error situations due to NPDB synchronisation errors are not clearly identified. A mechanism to detect NPDB synchronisation errors in GMSC is introduced and MNP specific call handling for IN and signalling relay based call related solutions is clarified.

**Clauses affected:**

6 (new), 6.1 (new), 6.2 (new), A.3.1.1, A.3.1.2

**Other specs affected:**

Other 3G core specifications  → List of CRs: 23.018  
Other GSM core specifications  → List of CRs:  
MS test specifications  → List of CRs:  
BSS test specifications  → List of CRs:  
O&M specifications  → List of CRs:

**Other comments:**



help.doc

<----- double-click here for help and instructions on how to create a CR.

---

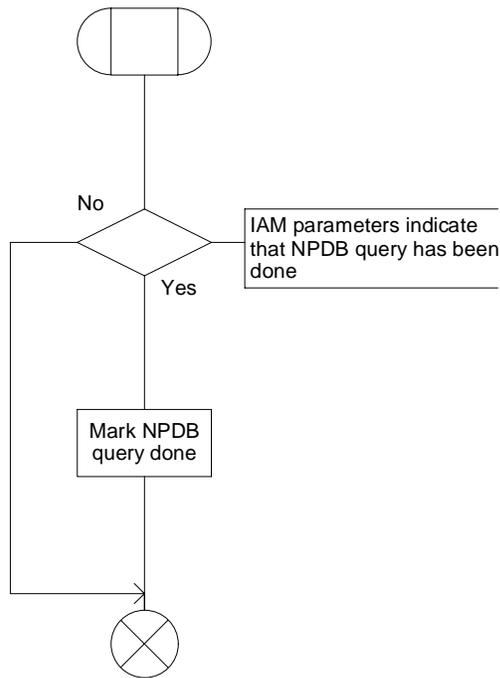
## 6 Functional requirements of network entities

### 6.1 Procedure MNP\_MT\_GMSC\_Set\_MNP\_Parameters

The procedure MNP\_MT\_GMSC\_Set\_MNP\_Parameters is shown in figure 4. It is called from the process MT\_GMSC defined in TS 23.018 [X].

Procedure MNP\_MT\_GMSC\_Set\_MNP\_Parameters

1(1)



**Figure 4: Procedure MNP\_MT\_GMSC\_Set\_MNP\_Parameters**

## 6.2 Procedure MNP\_MT\_GMSC\_Check\_MNP\_Indicators

The procedure MNP\_MT\_GMSC\_Check\_MNP\_Indicators is shown in figure 5. It is called from the process MNP\_MT\_GMSC defined in TS 23.018 [X].

Procedure MNP\_MT\_GMSC\_Check\_MNP\_Indicators

1(1)

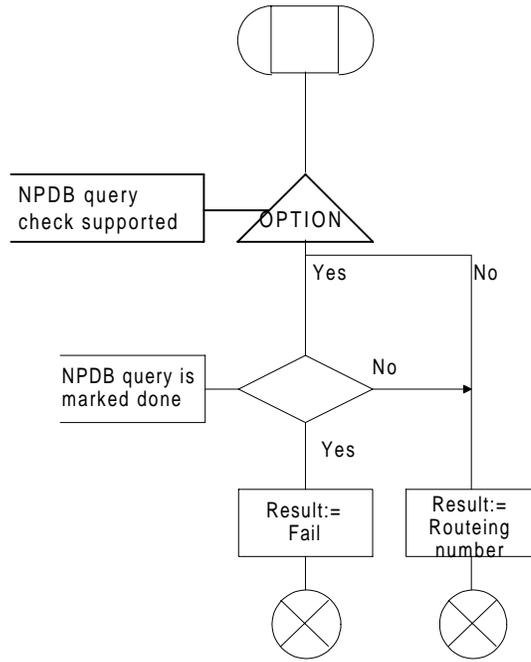


Figure 5: Procedure MNP\_MT\_GMSC\_Check\_MNP\_Indicators

### A.3.1.1 Procedure MOBILE\_NUMBER\_PORTABILITY\_IN\_QoHR

The procedure MOBILE\_NUMBER\_PORTABILITY\_IN\_QoHR is shown in figure A.1.3. It is called from the procedure Obtain\_Routeing\_Address defined in GSM 03.18 [4].

The text in this clause is a supplement to the definition in the SDL diagrams; it does not duplicate the information in the SDL diagrams.

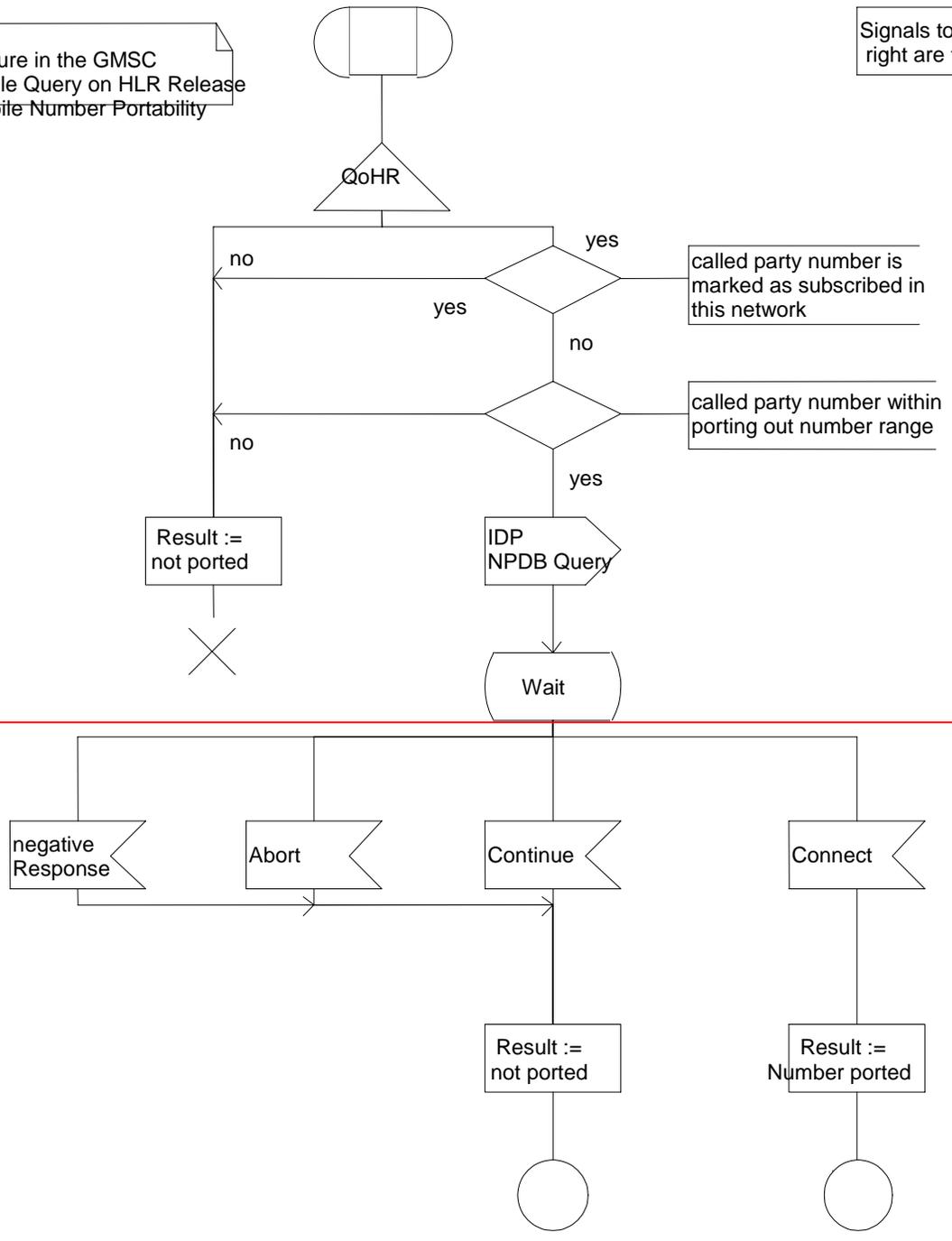
The IDP message contains the service key for MNP query and the called party's MSISDN.

# Procedure MOBILE\_NUMBER\_PORTABILITY\_IN\_QoHR

1(1)

Procedure in the GMSC to handle Query on HLR Release for Mobile Number Portability

Signals to/from the right are to/from the NPDB



### Procedure MOBILE\_NUMBER\_PORTABILITY\_QoHR

1(1)

Procedure in the GMSC  
to handle Query on HLR Release  
for Mobile Number Portability

Signals to/from the  
right are to/from the NPDB

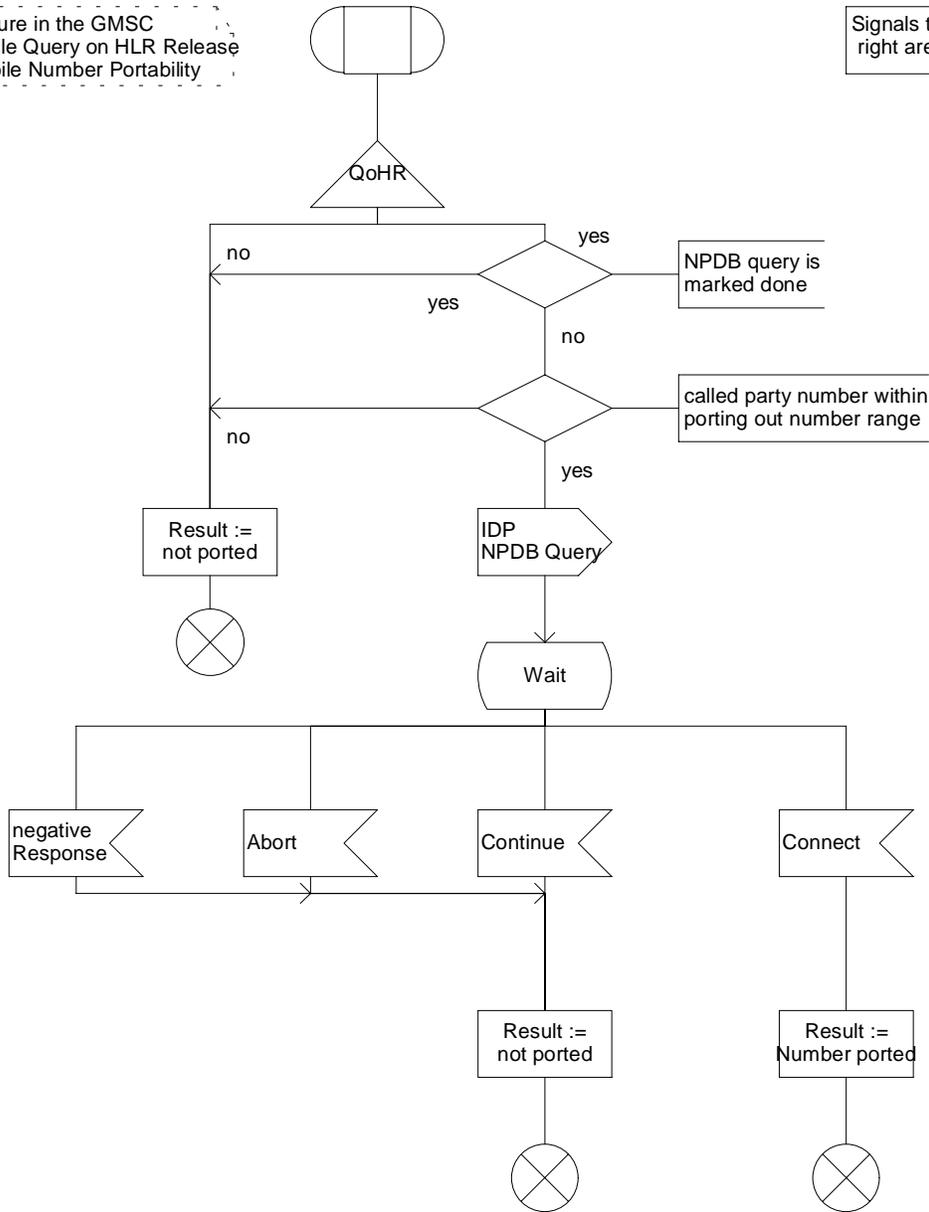


Figure A.13: Procedure MOBILE\_NUMBER\_PORTABILITY\_IN\_QoHR

### A.3.1.2 Procedure MOBILE\_NUMBER\_PORTABILITY\_IN\_TQoD

The procedure MOBILE\_NUMBER\_PORTABILITY\_IN\_TQoD is shown in figure A.14. It is called from the procedure Obtain\_Routeing\_Address defined in GSM 03.18 [4].

The text in this clause is a supplement to the definition in the SDL diagrams; it does not duplicate the information in the SDL diagrams.

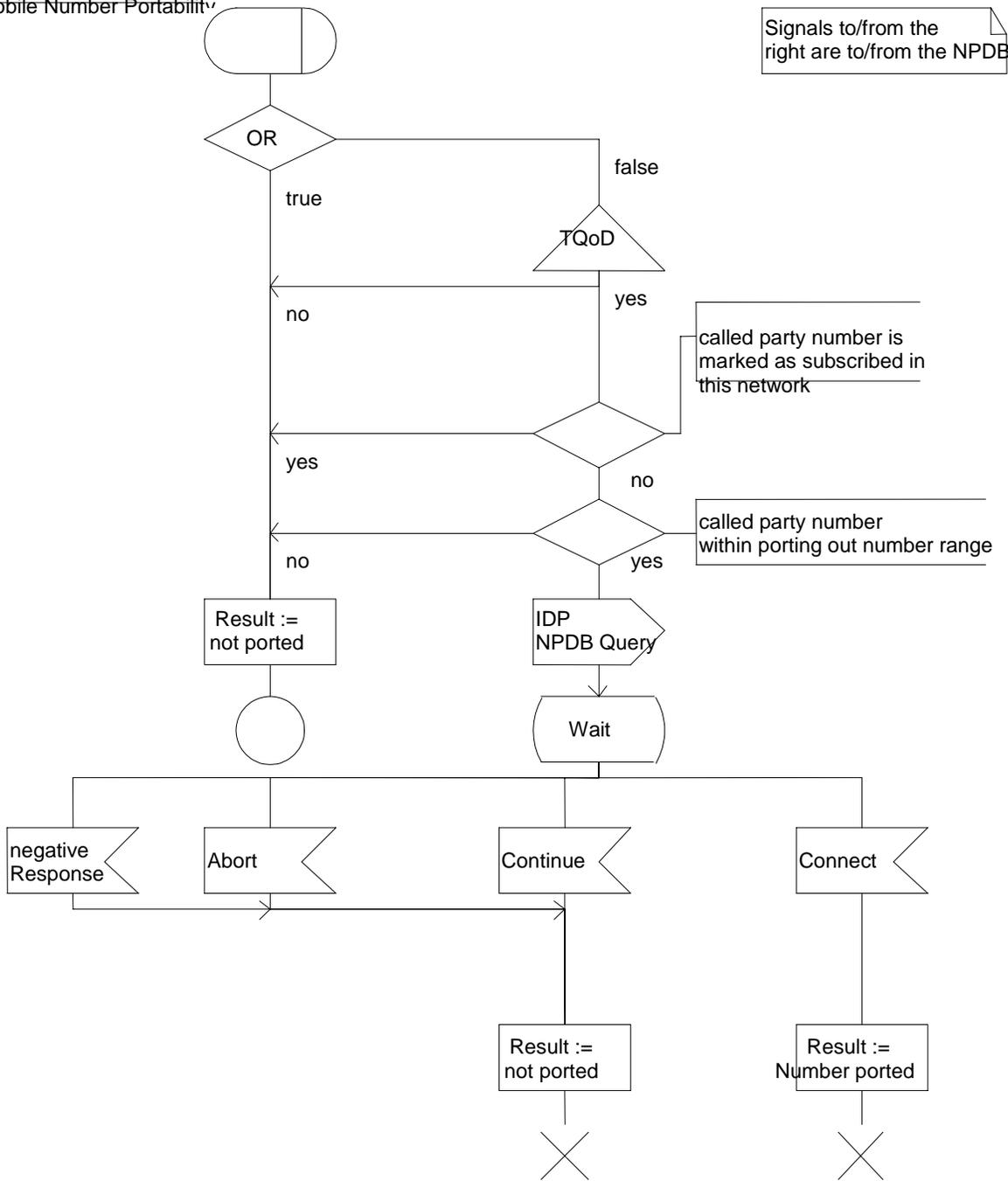
The IDP message contains the service key for MNP query and the called party's MSISDN.

# Procedure MOBILE\_NUMBER\_PORTABILITY\_IN\_TQoD

1(1)

Procedure in the GMSC to handle Terminating call Query on Digit Analysis for Mobile Number Portability

Signals to/from the right are to/from the NPDB



### Procedure MOBILE\_NUMBER\_PORTABILITY\_TQoD

1(1)

Procedure in the GMSC to handle  
Terminating call Query on Digit  
Analysis for Mobile Number Portability

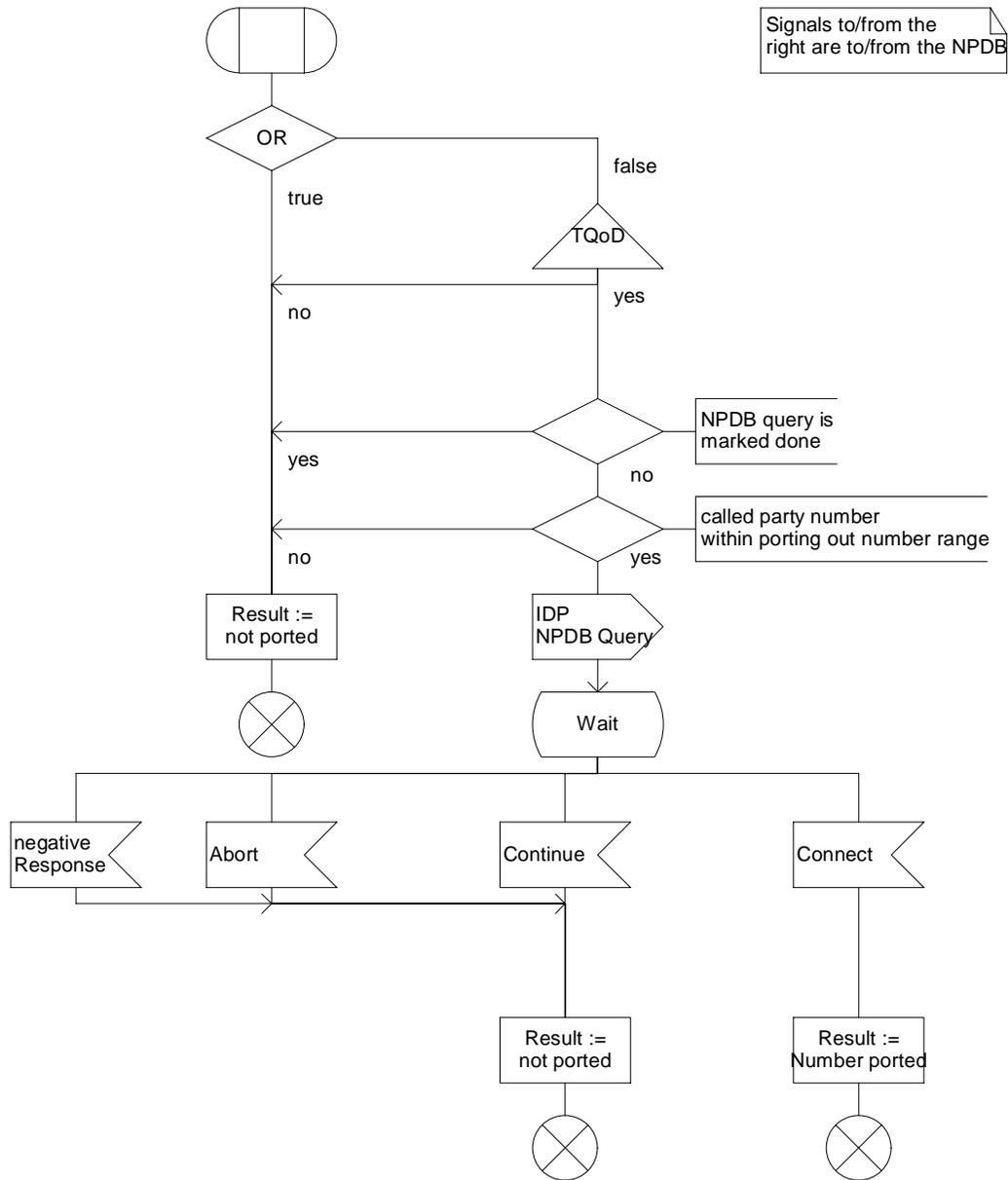


Figure A.14: Procedure MOBILE\_NUMBER\_PORTABILITY\_IN\_TQoD

**CHANGE REQUEST**

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

**29.002 CR 063r4**

Current Version: **3.3.1**

GSM (AA.BB) or 3G (AA.BBB) specification number ↑

↑ CR number as allocated by MCC support team

For submission to: **CN#07**  
list expected approval meeting # here ↑

for approval   
for information

strategic   
non-strategic  (for SMG use only)

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

**Proposed change affects:**

(at least one should be marked with an X)

(U)SIM  ME  UTRAN / Radio  Core Network

**Source:**

**N2**

**Date:**

**03.03.2000**

**Subject:**

**MNP Database Mismatch**

**Work item:**

**MNP**

**Category:**

(only one category shall be marked with an X)

- F Correction
- A Corresponds to a correction in an earlier release
- B Addition of feature
- C Functional modification of feature
- D Editorial modification

**Release:**

- Phase 2
- Release 96
- Release 97
- Release 98
- Release 99
- Release 00

**Reason for change:**

**A new user error is added in the SRI ack message to indicate that there is a mismatch error in the MNP databases**

**Clauses affected:**

**10.1.3, 17.7.7**

**Other specs affected:**

- Other 3G core specifications  → List of CRs: **23.066-009r3**
- Other GSM core specifications  → List of CRs:
- MS test specifications  → List of CRs:
- BSS test specifications  → List of CRs:
- O&M specifications  → List of CRs:

**Other comments:**



help.doc

<----- double-click here for help and instructions on how to create a CR.

## 10.1.3 Parameter use

See subclause 7.6 for a definition of the parameters used in addition to the following. Note that:

- a conditional parameter whose use is defined only in 3G TS 23.078 shall be absent if the sending entity does not support CAMEL;
- a conditional parameter whose use is defined only in GSM 03.79 shall be absent if the sending entity does not support optimal routing;
- a conditional parameter whose use is defined only in 3G TS 23.078 & GSM 03.79 shall be absent if the sending entity supports neither CAMEL nor optimal routing.

### Interrogation Type

See GSM 03.79 [99] for the use of this parameter.

### GMSC address

The E.164 address of the GMSC.

### MSISDN

This is the Mobile Subscriber ISDN number assigned to the called subscriber. In the Request & Indication it is the number received by the GMSC in the IAM. If the call is to be forwarded and the HLR supports determination of the redirecting number, the HLR inserts the basic MSISDN in the Response.

See GSM 03.66 [108] for the use of this parameter and the conditions for its presence in the response.

### OR Interrogation

See GSM 03.79 [99] for the use of this parameter and the conditions for its presence.

### OR Capability

See GSM 03.79 [99] for the use of this parameter and the conditions for its presence.

### CUG Interlock

See GSM 03.18 [97] for the use of this parameter and the conditions for its presence.

### CUG Outgoing Access

See GSM 03.18 [97] for the use of this parameter and the conditions for its presence.

### Number of Forwarding

See GSM 03.18 [97] for the use of this parameter and the conditions for its presence.

### Network Signal Info

See GSM 03.18 [97] for the conditions for the presence of the components of this parameter.

### Supported CAMEL Phases

The use of this parameter and the requirements for its presence are specified in 3G TS 23.078

### T-CSI Suppression

The use of this parameter and the requirements for its presence are specified in 3G TS 23.078

### Suppression Of Announcement

The use of this parameter and the requirements for its presence are specified in 3G TS 23.078

### Call Reference Number

The use of this parameter and the conditions for its presence are specified in 3G TS 23.078 [98] and GSM 03.79 [99].

#### Forwarding Reason

See GSM 03.79 [99] for the use of this parameter and the conditions for its presence.

#### Basic Service Group

See GSM 03.79 [99] for the use of this parameter and the conditions for its presence.

#### Alerting Pattern

See GSM 03.18 [97] for the use of this parameter and the conditions for its presence.

#### CCBS Call

See 3G TS 23.093 [107] for the use of this parameter and the conditions for its presence.

#### Supported CCBS Phase

#### Additional Signal Info

See 3G TS 23.081 [27] for the conditions for the presence of the components of this parameter.

This parameter indicates by its presence that CCBS is supported and the phase of CCBS which is supported.

#### IST Support Indicator

This parameter is used to indicate to the HLR that the GMSC supports basic IST functionality, that is, the GMSC is able to terminate the subscriber call activity that originated the IST Alert when it receives the IST Alert response indicating that the call(s) shall be terminated. If this parameter is not included in the Send Routing Information indication and the subscriber is marked as an IST subscriber, then the HLR may limit the service for the call (by barring the incoming call if it is not subject to forwarding, or suppressing Call Forwarding from the GMSC), or allow the call assuming the associated risk of not having the basic IST mechanism available.

This parameter can also indicate that the GMSC supports the IST Command, including the ability to terminate all calls being carried for the identified subscriber by using the IMSI as a key. If this additional capability is not included in the Send Routing Information indication and the subscriber is marked as an IST subscriber, then the HLR may limit the service for the subscriber (by barring the incoming calls if they are not subject to forwarding, or suppressing Call Forwarding from the GMSC), or allow the incoming calls assuming the associated risk of not having the IST Command mechanism available.

#### Pre-paging supported

See 3G TS 23.018 for the use of this parameter and the conditions for its presence.

#### Call Diversion Treatment Indicator

This parameter indicates whether or not call diversion is allowed.

#### IMSI

See GSM 03.18 [97] and GSM 03.66 [108] for the use of this parameter and the conditions for its presence.

#### MSRN

See GSM 03.18 [97], GSM 03.66 [108] and GSM 03.79 [99] for the use of this parameter and the conditions for its presence. If the NPLR returns only the MSISDN-number without Routeing Number to the GMSC, the MSISDN-number shall be returned as MSRN.

#### Forwarding Data

This parameter includes the forwarded-to number, the forwarding reason and the forwarding options Notification to calling party and Redirecting presentation, and can include the forwarded-to subaddress. See GSM 03.18 [97] and GSM 03.79 [99] for the conditions for the presence of its components.

### Forwarding Interrogation Required

See GSM 03.79 [99] for the use of this parameter and the conditions for its presence.

### VMSC address

See GSM 03.79 [99] for the use of this parameter and the conditions for its presence.

### GMSC CAMEL Subscription Info

The use of this parameter and the requirements for its presence are specified in 3G TS 23.078

### Location Information

The use of this parameter and the requirements for its presence are specified in 3G TS 23.078

### Subscriber State

The use of this parameter and the requirements for its presence are specified in 3G TS 23.078

### CUG Subscription Flag

The use of this parameter and the requirements for its presence are specified in 3G TS 23.078.

### North American Equal Access preferred Carrier Id

This parameter is returned to indicate the preferred carrier identity to be used to setup the call (i.e. forwarding the call or establishing the roaming leg).

### SS-List

This parameter includes SS-codes and will be returned as an operator option. The HLR shall not send PLMN-specific SS-codes across PLMN boundaries. However if the GMSC receives PLMN-specific SS-codes from a foreign PLMN's HLR the GMSC may ignore it. If the GMSC attempts to process the PLMN specific SS codes, this may lead to unpredictable behaviour but the GMSC shall continue call processing.

### Basic Service Code

The use of this parameter and the requirements for its presence are specified in 3G TS 23.078.

If the CAMEL service is not involved, this parameter includes the basic service code and will be returned as an operator option. The HLR shall not send a PLMN-specific Basic Service Code across PLMN boundaries. However if the GMSC receives a PLMN-specific Basic Service Code from a foreign PLMN's HLR the GMSC may ignore it. If the GMSC attempts to process the PLMN specific Basic Service codes, this may lead to unpredictable behaviour but the GMSC shall continue call processing.

### CCBS Target

See GSM 03.93 for the use of this parameter and the conditions for its presence.

### Keep CCBS Call Indicator

See GSM 03.93 for the use of this parameter and the conditions for its presence.

### IST Alert Timer

It includes the IST Alert timer value that must be used to inform the HLR about the call activities that the subscriber performs. This parameter is only sent to the GMSC in response to a Send Routing Information request which indicates the the GMSC supports IST.

### Number Portability Status

This parameter indicates the number portability status of the subscriber. This parameter may be present if the sender of SRIack is NPLR.

### User error

This parameter is sent by the responder when an error is detected and if present, takes one of the following values:

- Unknown Subscriber;

The diagnostic for the Unknown Subscriber error may indicate “NPDB Mismatch”.

- Number changed;
- Call Barred;

This error will indicate that either incoming calls are barred for this MS or that calls are barred due to Operator Determined Barring (see GSM 02.41 for a definition of this network feature).

- CUG Reject;

The value of this error cause will indicate the reason for CUG Reject.

- Bearer Service Not Provisioned;
- Teleservice Not Provisioned;

A subscription check has been performed and the call has not passed the check due to incompatibility with regard to the requested service. Depending on the nature of the incompatibility, either of these messages will be returned.

- Facility Not Supported;
- Absent Subscriber;

This indicates that the location of the MS is not known (either the station is not registered and there is no location information available or the Provide Roaming Number procedure fails due to IMSI detached flag being set), or the GMSC requested forwarding information with a forwarding reason of not reachable, and the call forwarding on MS not reachable service is not active.

- Busy Subscriber;

This indicates that Call Forwarding on Busy was not active for the specified basic service group when the GMSC requested forwarding information with a forwarding reason of busy.

The error may also indicate that the subscriber is busy due to an outstanding CCBS recall. In the error data it may then be specified that CCBS is possible for the busy encountered call.

- No Subscriber Reply;

This indicates that Call Forwarding on No Reply was not active for the specified basic service group when the GMSC requested forwarding information with a forwarding reason of no reply.

- OR Not Allowed;

This indicates that the HLR is not prepared to accept an OR interrogation from the GMSC, or that calls to the specified subscriber are not allowed to be optimally routed.

- Forwarding Violation;
- System Failure;
- Data Missing;
- Unexpected Data Value.

See subclause 7.6 for a definition of these errors.

#### Provider error

These are defined in subclause 7.6.

## 17.7.7 Error data types

```

MAP-ER-DataTypes {
    ccitt identified-organization (4) etsi (0) mobileDomain (0)
    gsm-Network (1) modules (3) map-ER-DataTypes (17) version6 (6)}

DEFINITIONS

IMPLICIT TAGS

::=

BEGIN

EXPORTS
    RoamingNotAllowedParam,
    CallBarredParam,
    CUG-RejectParam,
    SS-IncompatibilityCause,
    PW-RegistrationFailureCause,
    SM-DeliveryFailureCause,
    SystemFailureParam,
    DataMissingParam,
    UnexpectedDataParam,
    FacilityNotSupParam,
    OR-NotAllowedParam,
    UnknownSubscriberParam,
    NumberChangedParam,
    UnidentifiedSubParam,
    IllegalSubscriberParam,
    IllegalEquipmentParam,
    BearerServNotProvParam,
    TeleservNotProvParam,
    TracingBufferFullParam,
    NoRoamingNbParam,
    AbsentSubscriberParam,
    BusySubscriberParam,
    NoSubscriberReplyParam,
    ForwardingViolationParam,
    ForwardingFailedParam,
    ATI-NotAllowedParam,
    SubBusyForMT-SMS-Param,
    MessageWaitListFullParam,
    AbsentSubscriberSM-Param,
    AbsentSubscriberDiagnosticSM,
    ResourceLimitationParam,
    NoGroupCallNbParam,
    IncompatibleTerminalParam,
    ShortTermDenialParam,
    LongTermDenialParam,
    UnauthorizedRequestingNetwork-Param,
    UnauthorizedLCSCClient-Param,
    PositionMethodFailure-Param,
    UnknownOrUnreachableLCSCClient-Param,
    MM-EventNotSupported-Param,
    ATSI-NotAllowedParam,
    ATM-NotAllowedParam,
    IllegalSS-OperationParam,
    SS-NotAvailableParam,
    SS-SubscriptionViolationParam,
    InformationNotAvailableParam

;

IMPORTS
    SS-Status
FROM MAP-SS-DataTypes {
    ccitt identified-organization (4) etsi (0) mobileDomain (0)
    gsm-Network (1) modules (3) map-SS-DataTypes (14) version6 (6)}

    SignalInfo,
    BasicServiceCode,
    NetworkResource
FROM MAP-CommonDataTypes {
    ccitt identified-organization (4) etsi (0) mobileDomain (0)
    gsm-Network (1) modules (3) map-CommonDataTypes (18) version6 (6)}

    SS-Code

```

```

FROM MAP-SS-Code {
  ccitt identified-organization (4) etsi (0) mobileDomain (0)
  gsm-Network (1) modules (3) map-SS-Code (15) version6 (6)}

  ExtensionContainer
FROM MAP-ExtensionDataTypes {
  ccitt identified-organization (4) etsi (0) mobileDomain (0)
  gsm-Network (1) modules (3) map-ExtensionDataTypes (21) version6 (6)}
;

```

```

RoamingNotAllowedParam ::= SEQUENCE {
  roamingNotAllowedCause          RoamingNotAllowedCause,
  extensionContainer              ExtensionContainer          OPTIONAL,
  ...}

```

```

RoamingNotAllowedCause ::= ENUMERATED {
  plmnRoamingNotAllowed (0),
  operatorDeterminedBarring (3)}

```

```

CallBarredParam ::= CHOICE {
  callBarringCause          CallBarringCause,
  -- call BarringCause must not be used in version 3
  extensibleCallBarredParam ExtensibleCallBarredParam
  -- extensibleCallBarredParam must not be used in version <3
}

```

```

CallBarringCause ::= ENUMERATED {
  barringServiceActive (0),
  operatorBarring (1)}

```

```

ExtensibleCallBarredParam ::= SEQUENCE {
  callBarringCause          CallBarringCause          OPTIONAL,
  extensionContainer        ExtensionContainer          OPTIONAL,
  ... ,
  unauthorisedMessageOriginator [1] NULL              OPTIONAL }

```

```

CUG-RejectParam ::= SEQUENCE {
  cug-RejectCause          CUG-RejectCause          OPTIONAL,
  extensionContainer        ExtensionContainer          OPTIONAL,
  ...}

```

```

CUG-RejectCause ::= ENUMERATED {
  incomingCallsBarredWithinCUG (0),
  subscriberNotMemberOfCUG (1),
  requestedBasicServiceViolatesCUG-Constraints (5),
  calledPartySS-InteractionViolation (7)}

```

```

SS-IncompatibilityCause ::= SEQUENCE {
  ss-Code          [1] SS-Code          OPTIONAL,
  basicService     BasicServiceCode    OPTIONAL,
  ss-Status [4] SS-Status              OPTIONAL,
  ...}

```

```

PW-RegistrationFailureCause ::= ENUMERATED {
  undetermined (0),
  invalidFormat (1),
  newPasswordsMismatch (2)}

```

```

SM-EnumeratedDeliveryFailureCause ::= ENUMERATED {
  memoryCapacityExceeded (0),
  equipmentProtocolError (1),
  equipmentNotSM-Equipped (2),
  unknownServiceCentre (3),
  sc-Congestion (4),
  invalidSME-Address (5),
  subscriberNotSC-Subscriber (6)}

```

```

SM-DeliveryFailureCause ::= SEQUENCE {
  sm-EnumeratedDeliveryFailureCause SM-EnumeratedDeliveryFailureCause,
  diagnosticInfo                    SignalInfo          OPTIONAL,
  extensionContainer                ExtensionContainer      OPTIONAL,
  ...}

```

```
AbsentSubscriberSM-Param ::= SEQUENCE {
  absentSubscriberDiagnosticSM      AbsentSubscriberDiagnosticSM      OPTIONAL,
  -- AbsentSubscriberDiagnosticSM can be either for non-GPRS
  -- or for GPRS
  extensionContainer                ExtensionContainer                OPTIONAL,
  ...,
  additionalAbsentSubscriberDiagnosticSM [0] AbsentSubscriberDiagnosticSM OPTIONAL }
-- if received, additionalAbsentSubscriberDiagnosticSM
-- is for GPRS and absentSubscriberDiagnosticSM is
-- for non-GPRS
```

```
AbsentSubscriberDiagnosticSM ::= INTEGER (0..255)
-- AbsentSubscriberDiagnosticSM values are defined in ETS 300 536 (GSM 03.40)
```

```
SystemFailureParam ::= CHOICE {
  networkResource                  NetworkResource,
  -- networkResource must not be used in version 3
  extensibleSystemFailureParam     ExtensibleSystemFailureParam
  -- extensibleSystemFailureParam must not be used in version <3
}
```

```
ExtensibleSystemFailureParam ::= SEQUENCE {
  networkResource                  NetworkResource                  OPTIONAL,
  extensionContainer               ExtensionContainer               OPTIONAL,
  ...}
```

```
DataMissingParam ::= SEQUENCE {
  extensionContainer               ExtensionContainer               OPTIONAL,
  ...}
```

```
UnexpectedDataParam ::= SEQUENCE {
  extensionContainer               ExtensionContainer               OPTIONAL,
  ...}
```

```
FacilityNotSupParam ::= SEQUENCE {
  extensionContainer               ExtensionContainer               OPTIONAL,
  ...}
```

```
OR-NotAllowedParam ::= SEQUENCE {
  extensionContainer               ExtensionContainer               OPTIONAL,
  ...}
```

```
UnknownSubscriberParam ::= SEQUENCE {
  extensionContainer               ExtensionContainer               OPTIONAL,
  ...,
  unknownSubscriberDiagnostic     UnknownSubscriberDiagnostic OPTIONAL}
```

```
UnknownSubscriberDiagnostic ::= ENUMERATED {
  imsiUnknown (0),
  gprsSubscriptionUnknown (1),
  ......
  npdbMismatch (2)}
-- if unknown values are received in
-- unknownSubscriberDiagnostic they shall be discarded
```