

Signalling Scenarios for Number Portability

**Fixed to Fixed
Fixed to Mobile
Mobile to Fixed
Mobile to Mobile**

(TI_NTG2)

Version 1.6

October 2000

List of Contents

About this document	3
Reference:	3
Overview of the administrative information in Denmark for NP phase 2.....	4
Porting Cases	4
Call Cases.....	4
Call Cases for Porting Case 1	4
Call Cases for Porting Case 2	4
Special Call Cases.....	4
Porting Case 1	5
Call cases for porting case 1	6
Fix to Fix.....	6
Mobile to Fix.....	8
Porting Case 2	10
Call cases for porting case 2	11
Fix to Mobile.....	11
Mobile to Mobile	13
Mobile to Voice mail	15
Voice mail to Mobile	17
Voice mail to Voice mail	19
Special Call Cases.....	20
Mobile call to 70, 80, 90	20
Fix call to 70, 80, 90	22
SMS.....	23
112 Call.....	25
Glossary	27

About this document

This document describes the basic signalling scenarios of Number Portability at phase 2.

The document is showing the agreed signalling sequences between the operators, while the shown network internal signalling only serves as examples.

Direct routing (the interrogating network routes the signalling message directly to the subscription network) is used in all examples in this document

Reference:

APG documents:

- Rules and procedures for Number Portability (Administrative & IT Processes).
- Requirements/Transactions for Number Portability in the Kingdom of Denmark (Phase 2).

NTG documents:

- Addendum, Rules and procedures on Number Portability.
- Rules and procedures for Carrier Selection (Technical).

Overview of the administrative information in Denmark for NP phase 2

The administrative information sends from each operator to OCH, and from there distributed to each operator in NP phase 2 (refer to the rules & procedures in APG document):

OPID	Municipality	SPC	RI	CI	PC	DN
------	--------------	-----	----	----	----	----

- OPID: Identity of the operator to whom the telephone number is ported.
- Municipality: Where the telephone number is physically located (at recipient network).
- SPC: The Signalling Point Code of the Switch that services the telephone number (at recipient network).
- RI (Routing Information): The equivalent number range to which the telephone number belongs: This information is used to route the call.
- CI (Charging Information): The equivalent number range to which the telephone number belongs. This information is used for charging and accounting the call.
- PC (Porting Case): Indicates which information is required when porting the number. This can be 0, 1 or 2
- DN: The ported telephone number

Porting Cases

- PC 0 `non ported` indicates that the number is not ported, and that signalling shall be done as for any other number in the same number range.
- PC 1 `ported with Geo` indicates that the number is ported into a fixed network, and that the associated geographic information (Municipality and SPC) shall be used for charging and routing information.
- PC 2 `ported Non Geo` indicates that the number is ported into a non-fixed network, and that the information stored in Charging Info shall be used for charging purposes and Routing Info shall be used for routing purposes.

Call Cases

Call Cases for Porting Case 1

- Fixed to fixed
- Mobile to fixed

Call Cases for Porting Case 2

- Fixed to fixed
- Fixed to Mobile
- Mobile to Mobile
- Mobile to Voice mail
- Voice mail to Mobile
- Voice mail to Voice mail

Special Call Cases

- Mobile calls to 70,80, 90
- Fix calls to 70, 80,90

Porting Case 1

In this case the following information's needed:

The information received from OCH will be:

OPID	Municipality	SPC	RI	CI	PC 1	DN
------	--------------	-----	----	----	---------	----

The information needed to derive the routing of the call:

OPID	Municipality	SPC	PC 1	DN
------	--------------	-----	---------	----

The information needed to derive the charging of the call:

OPID	Municipality	SPC	PC 1	DN
------	--------------	-----	---------	----

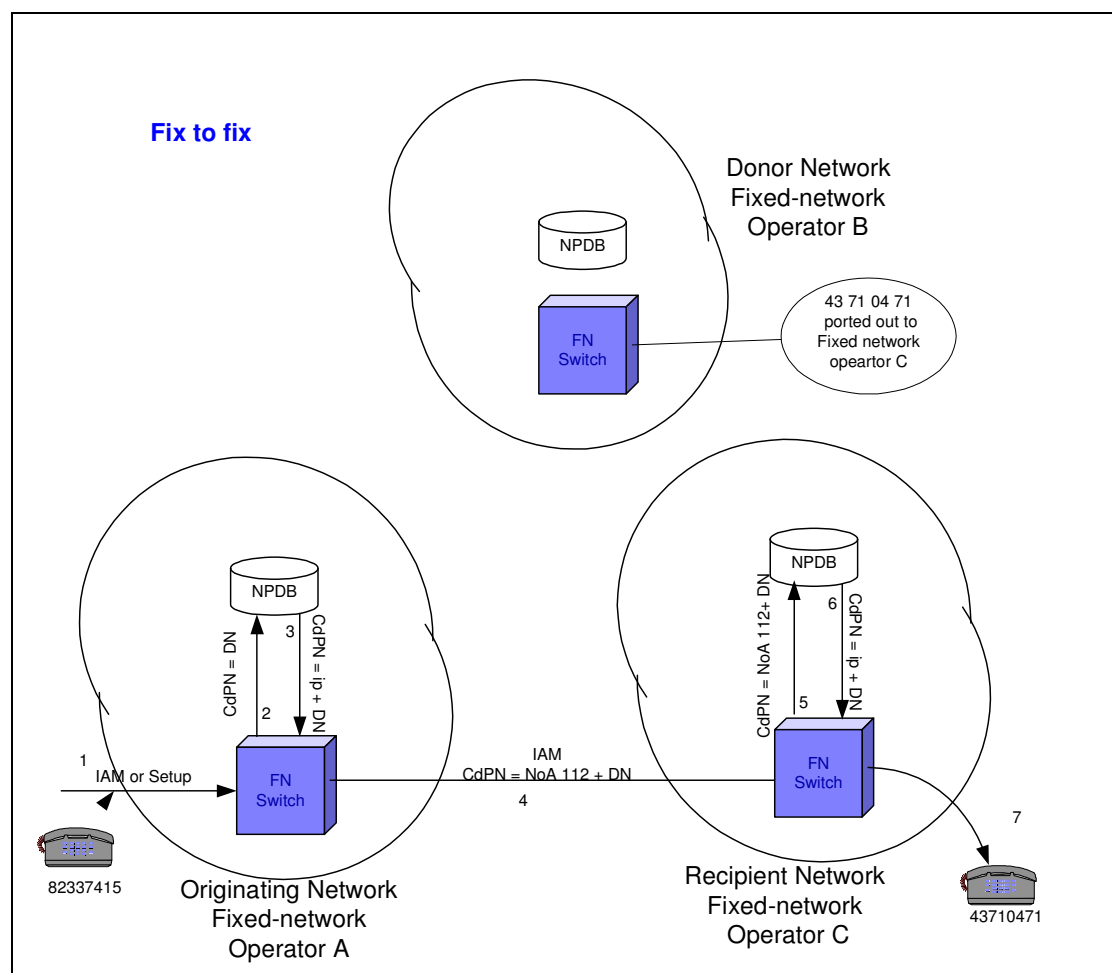
Note: In porting case 1 the fields RI and CI are not evaluated.

Call cases for porting case 1

Fix to Fix

In this case a number from fixed-network operator B (43 71 04 71) is ported to fixed-network operator C.

A subscriber from fixed-network operator A (82 33 74 15) tries to call this number.



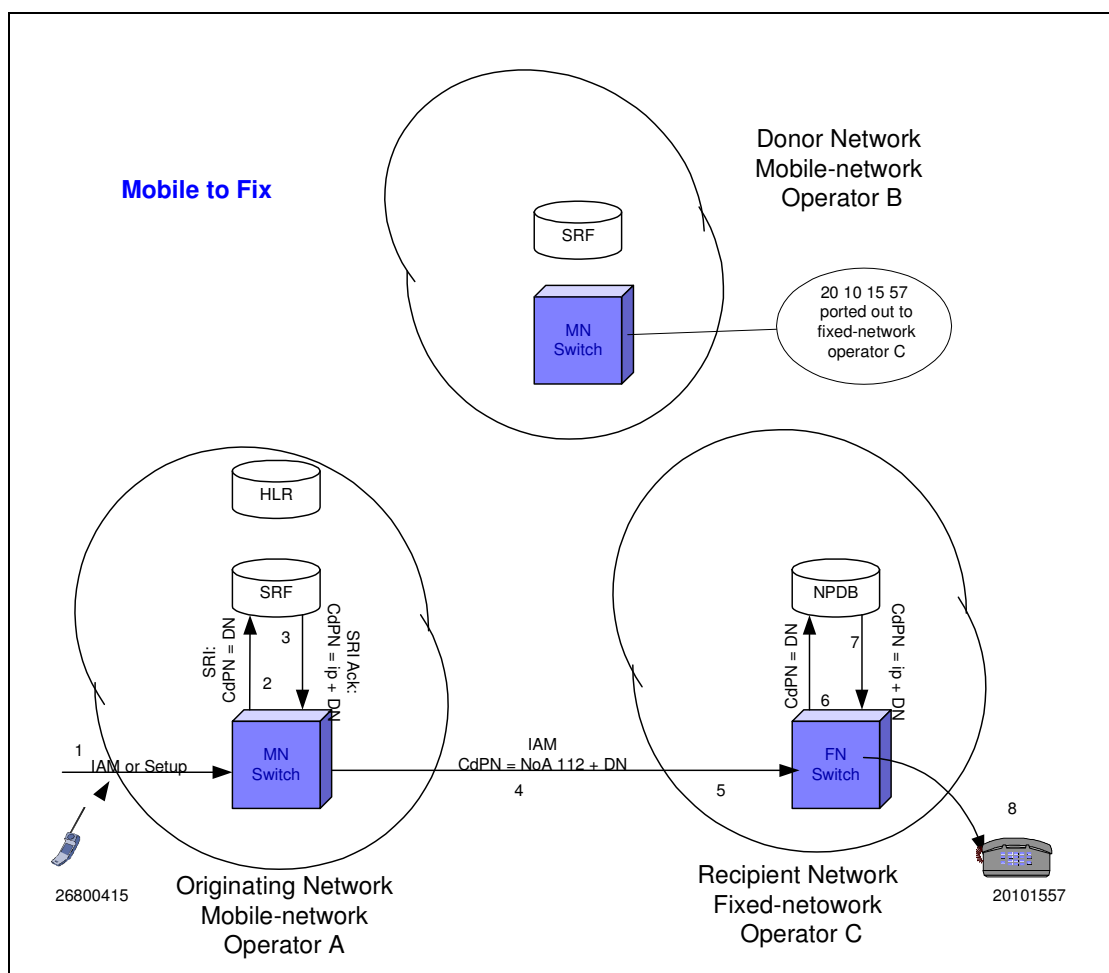
1. The originating network (fixed-network operator A) gets a setup or IAM.
2. The Originating Switch sends a query based on the DN to the NPDB.
3. The NPDB sends a response containing an internal- prefix to the called number. The internal-prefix is translated in the NP Routing Tables and determines an SS7 route out of the network, with NoA indicator of the CdPN = 112.
4. At the ISUP level the NoA indicator of the CdPN is 112 (ported number).
5. The Recipient Network (fixed-network operator C) receives the call, performs digit analysis, and sends a query based on the DN (NoA =112) to the NPDB.
6. The NPDB sends a response containing an internal-prefix to the called number. The recipient network receives the NPDB response and analyse the data.

7. The internal- prefix will be used for route the call to the customer B.

Mobile to Fix

In this case a number (20 10 15 57) from mobile-network operator B has ported to fixed-network operator C.

A mobile subscriber from mobile-network operator A (26 80 04 15) tries to call this number.



1. MN_Switch receives an IAM ISUP message (or setup).
2. MN_Switch generates a SRI (routing inquiry) based on the analysis of the called party number. The MAP SRI message is routed to SRF using the called party number as a global title. SRF determines that the message is addressed to a subscriber served by another network and that the message is a routing inquiry. The message is forwarded to the MAP level NP application for treatment.
3. The SRF responds (SRI Ack) to the MN_Switch by sending a routing number containing an internal- prefix plus CdPN.
4. At MN_Switch the internal-prefix is translated in the NP Routing Tables and determines an SS7 route out of the network, with NoA indicator of the CdPN sets to 112 (ported number). MN_Switch routes the call to the subscription/recipient network on the basis of the internal prefix.

5. The Recipient Network (fixed-network operator C) receives the call, performs digit analysis.
6. The Recipient Network sends a query based on the CdPN (NoA =112) to the NPDB.
7. The NPDB sends a response by sending a routing number containing an internal-prefix and DN.
8. The internal-prefix will be used for route the call to the customer B.

Porting Case 2

In this case the following information's needed:

The information received from OCH will be:

OPID	Municipality	SPC	RI	CI	PC 2	DN
------	--------------	-----	----	----	---------	----

The information needed to derive the routing of the call:

OPID	RI	PC 2	DN
------	----	---------	----

The information needed to derive the charging of the call:

OPID	CI	PC 2	DN
------	----	---------	----

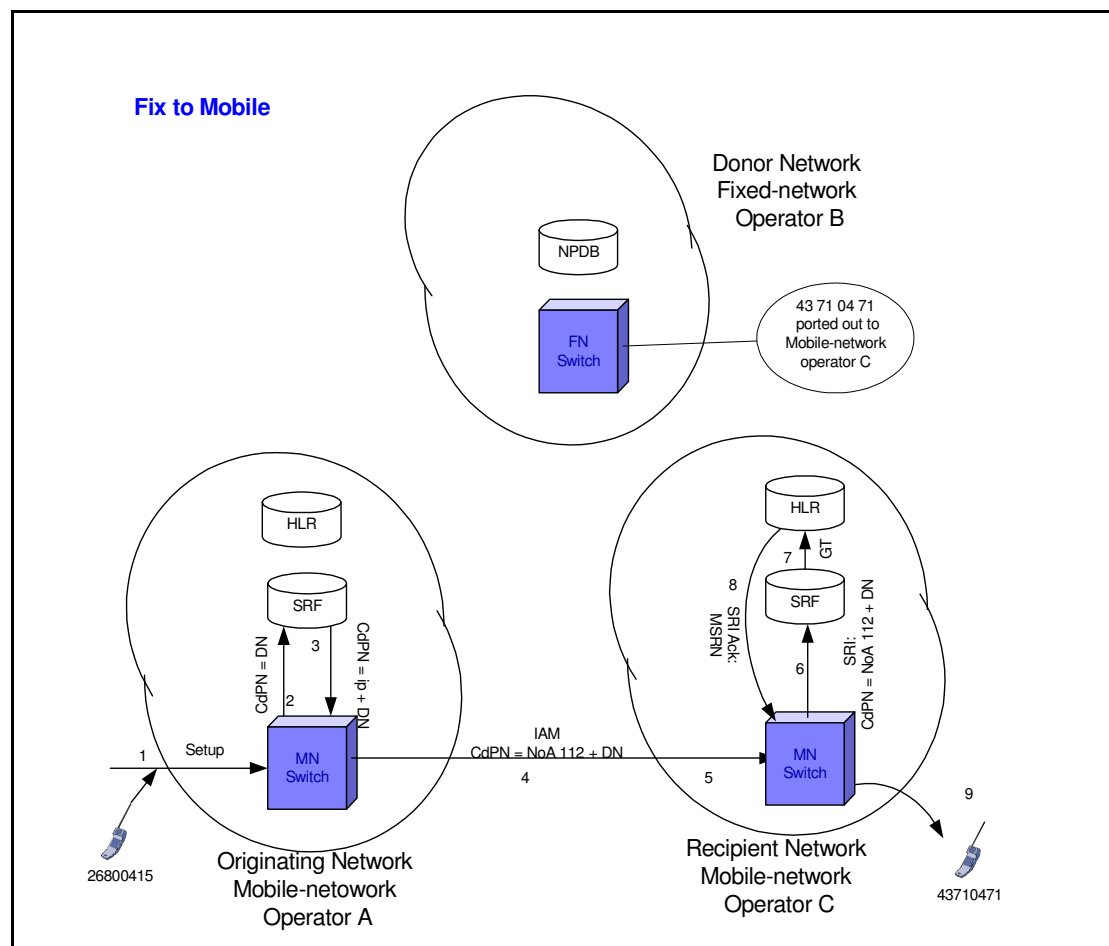
Note: in porting case 2 the fields Municipality and SPC are not evaluated.

Call cases for porting case 2

Fix to Mobile

In this case a number (43 71 04 71) from fixed-network operator B is ported as mobile number at mobile-network operator C.

A mobile subscriber (26 80 04 15) at mobile-network operator A tries to call this number.



1. MN_Switch receives a setup.
2. MN_Switch generates a SRI (routing inquiry) based on the analysis of the called party number. The MAP SRI message is routed to SRF using the CdPN as a global title. SRF determines that the message is addressed to a subscriber served by another network and that the message is a routing inquiry. The message is forwarded to the MAP level NP application for treatment.
3. The SRF responds (SRI Ack) to the MN_Switch by sending a routing number containing an internal- prefix to the CdPN.
4. At MN_Switch the internal-prefix is translated in the NP Routing Tables and determines an SS7 route out of the network, with NoA indicator of the CdPN sets to 112 (ported number). MN_Switch routes the call to the subscription/recipient network on the basis of the internal prefix.

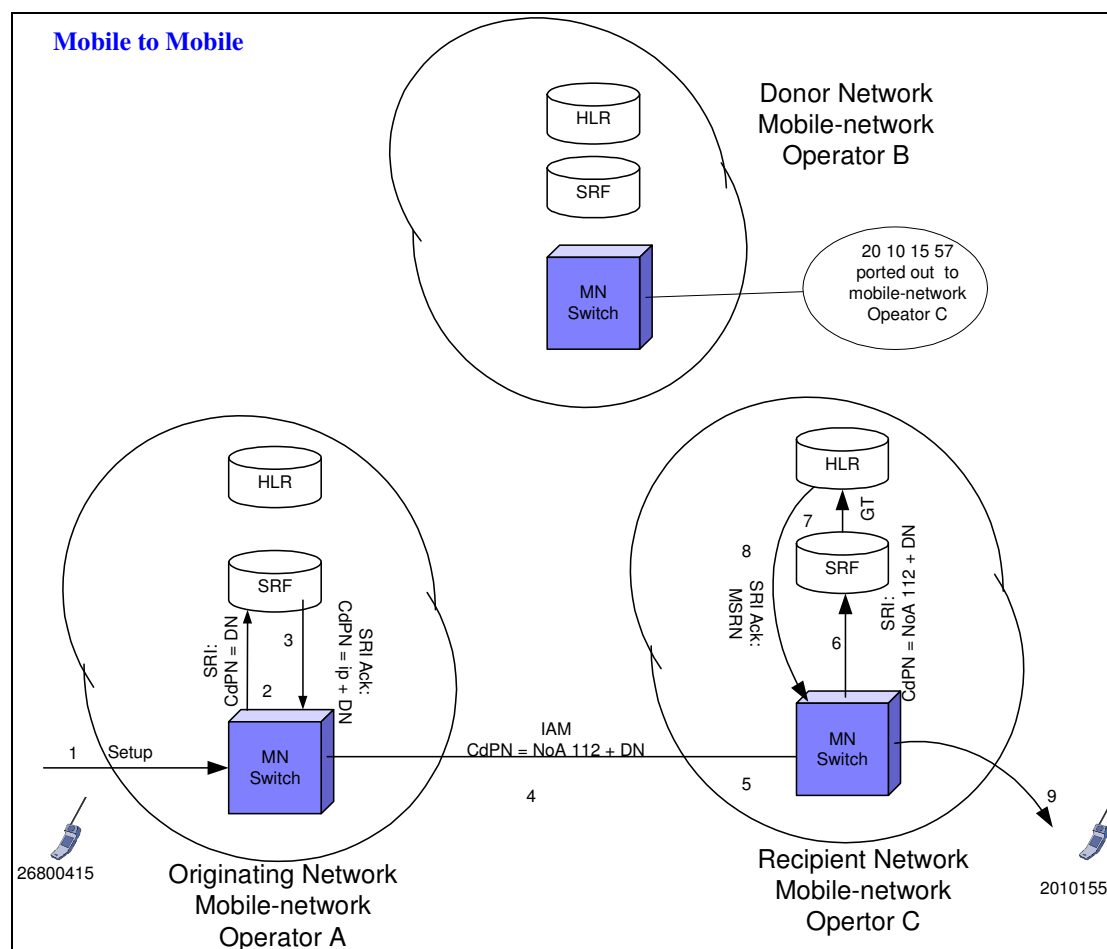
Telecommunication Industries Association in Denmark / Working Group TI_NTG2
Rules & Procedures / Signalling Scenarios for Number Portability

5. The Recipient Network (mobile-network operator C) receives the call, performs digit analysis, and generates a SRI (routing inquiry) based on the analysis of the CdPN (NoA =112) to the SRF.
6. SRF analyses the message's SCCP CdPN, and determines that it represents a subscriber in its own network. The message's SCCP CdPN is modified so that it points to the correct HLR. This is done by replacing the original CdPN with, for example, HLR's GT.
7. The MAP SRI message is routed to the correct HLR.
8. HLR enquires the roaming number, and returns it to the MN_Switch in a MAP SRI (SRI Ack) response message.
9. MN_Switch routes the call to the VMSC with MSRN.

Mobile to Mobile

In this case a number (20 10 15 57) from mobile-network operator B has ported to mobile-network operator C.

A mobile subscriber from mobile-network operator A (26 80 04 15) tries to call this number.



1. MN_Switch receives a setup.
2. MN_Switch generates a SRI (routing inquiry) based on the analysis of the called party number. The MAP SRI message is routed to SRF using the CdPN as a global title. SRF determines that the message is addressed to a subscriber served by another network and that the message is a routing inquiry. The message is forwarded to the MAP level NP application for treatment.
3. The SRF responds (SRI Ack) to the MN_Switch by sending a routing number containing an internal- prefix to the CdPN.
4. At MN_Switch the internal-prefix is translated in the NP Routing Tables and determines an SS7 route out of the network, with NoA indicator of the CdPN sets to 112 (ported number). MN_Switch routes the call to the subscription/recipient network on the basis of the internal prefix.

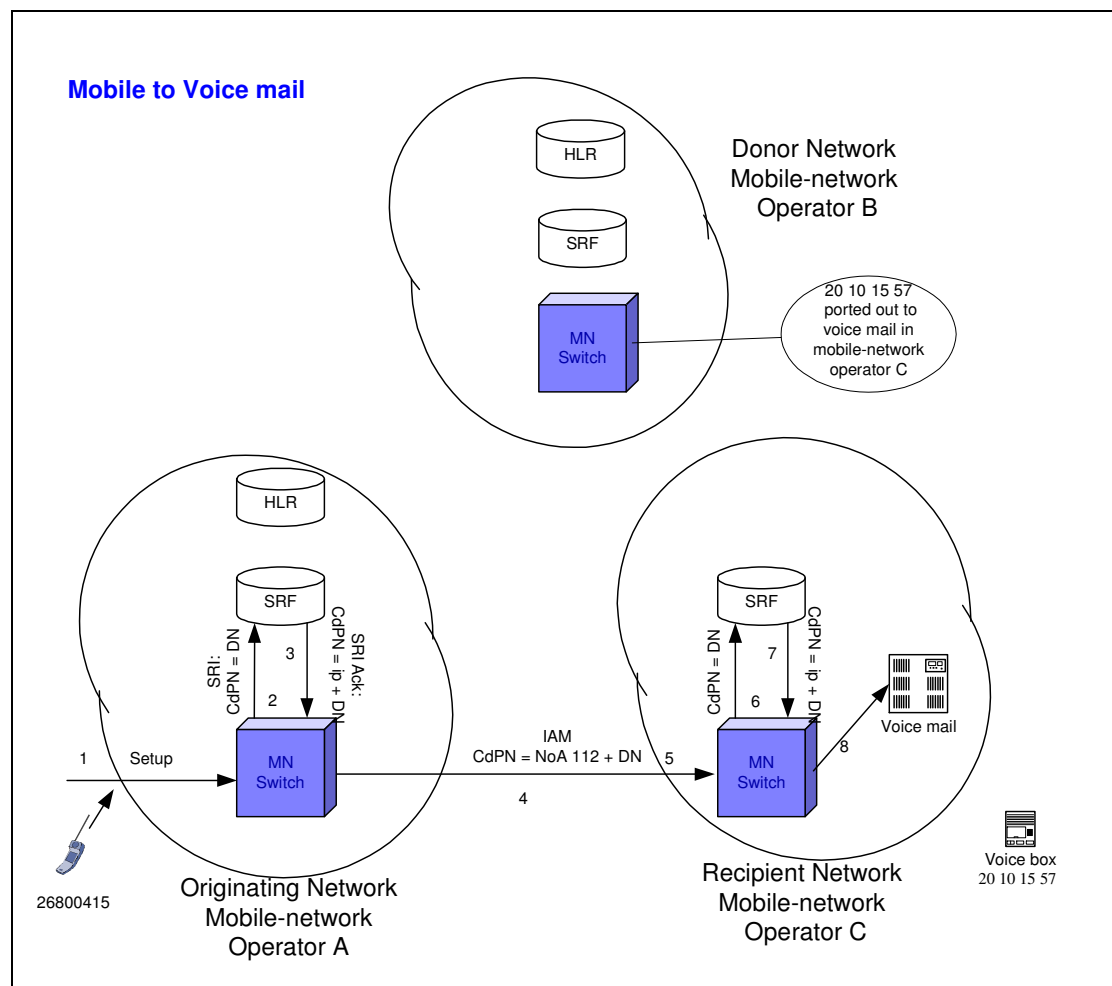
Telecommunication Industries Association in Denmark / Working Group TI_NTG2
Rules & Procedures / Signalling Scenarios for Number Portability

5. The Recipient Network (mobile-network operator C) receives the call, performs digit analysis, and generates a SRI (routing inquiry) based on the analysis of the CdPN (NoA =112) to the SRF.
6. SRF analyses the message's SCCP CdPN, and determines that it represents a subscriber in its own network. The message's SCCP CdPN is modified so that it points to the correct HLR. This is done by replacing the original CdPN with, for example, HLR's GT.
7. The MAP SRI message is routed to the correct HLR.
8. HLR enquires the roaming number, and returns it to the MN_Switch in a MAP SRI (SRI Ack) response message.
9. MN_Switch routes the call to the VMSC with MSRN.

10. Mobile to Voice mail

In this case a mobile number (20 10 15 57) from mobile-network operator B has ported to Voice mail in mobile-network operator C.

A mobile subscriber from mobile-network operator A tries to access a voice mail with this mail-box number.



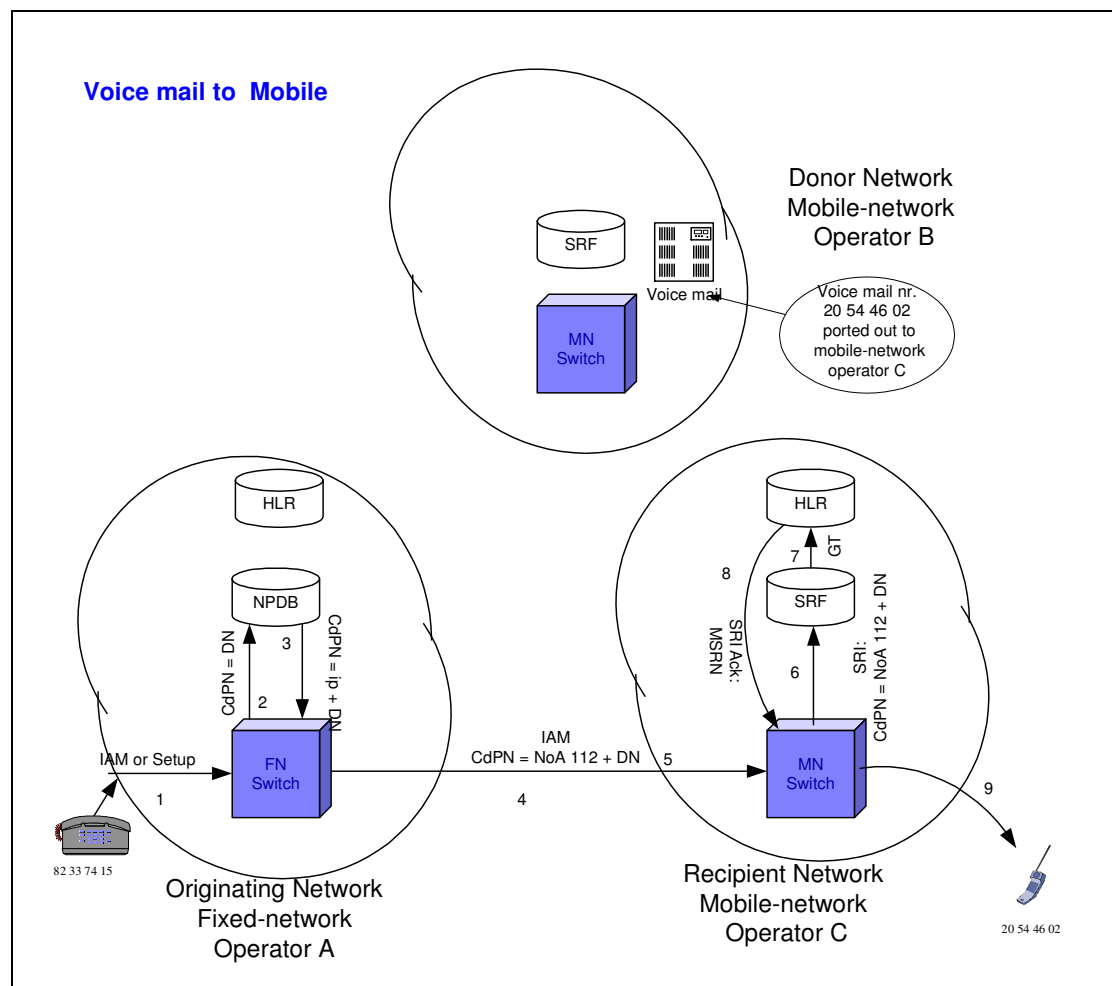
1. MN_Switch receives a setup.
2. MN_Switch generates a routing inquiry SRI based on the analysis of the CdPN. The MAP SRI message is routed to SRF using the CdPN as a global title. SRF determines that the message is addressed to a subscriber served by another network and that the message is a routing enquiry. The message is forwarded to the MAP level NP application for treatment.
3. The SRF sends a response containing an internal- prefix to the CdPN.
4. At MN_Switch the internal-prefix is translated in the NP Routing Tables and determines an SS7 route out of the network, with NoA indicator of the CdPN = 112 (ported number). MN_Switch routes the call to the subscription network on the basis of the internal prefix.
5. The Recipient Network (mobile-network operator C) receives the call, performs digit analysis.

6. The Recipient Network sends a query based on the CdPN (NoA =112) to the SRF.
7. The SRF sends a response containing an internal-prefix to the CdPN. The recipient network receives the SRF response and analyse the data.
8. The internal- prefix will be used for route the call to the voice mail.

Voice mail to Mobile

In this case a voice mail number (20 54 46 02) from mobile-network operator B has ported to mobile-network operator C as mobile number.

A fixed subscriber (82 33 74 15) from fixed-network operator A tries to call this number.



1. The originating network (fixed-network operator A) gets a setup or IAM.
2. The originating switch sends a query based on the CdPN to the NPDB.
3. The NPDB sends a response containing an internal- prefix to the CdPN. The internal- prefix is translated in the NP Routing Tables and determines an SS7 route out of the network, with NoA indicator of the CdPN = 112.
4. At the ISUP level the NoA indicator of the CdPN is 112 (ported number).
5. The Recipient Network (mobile-network operator C) receives the call, performs digit analysis, and generates a routing inquiry SRI base on the analysis of the CdPN (NoA =112) to the SRF.
6. SRF analyses the message's SCCP CdPN, and determines that it represents a subscriber in its own network. The message's SCCP CdPN is modified so that it

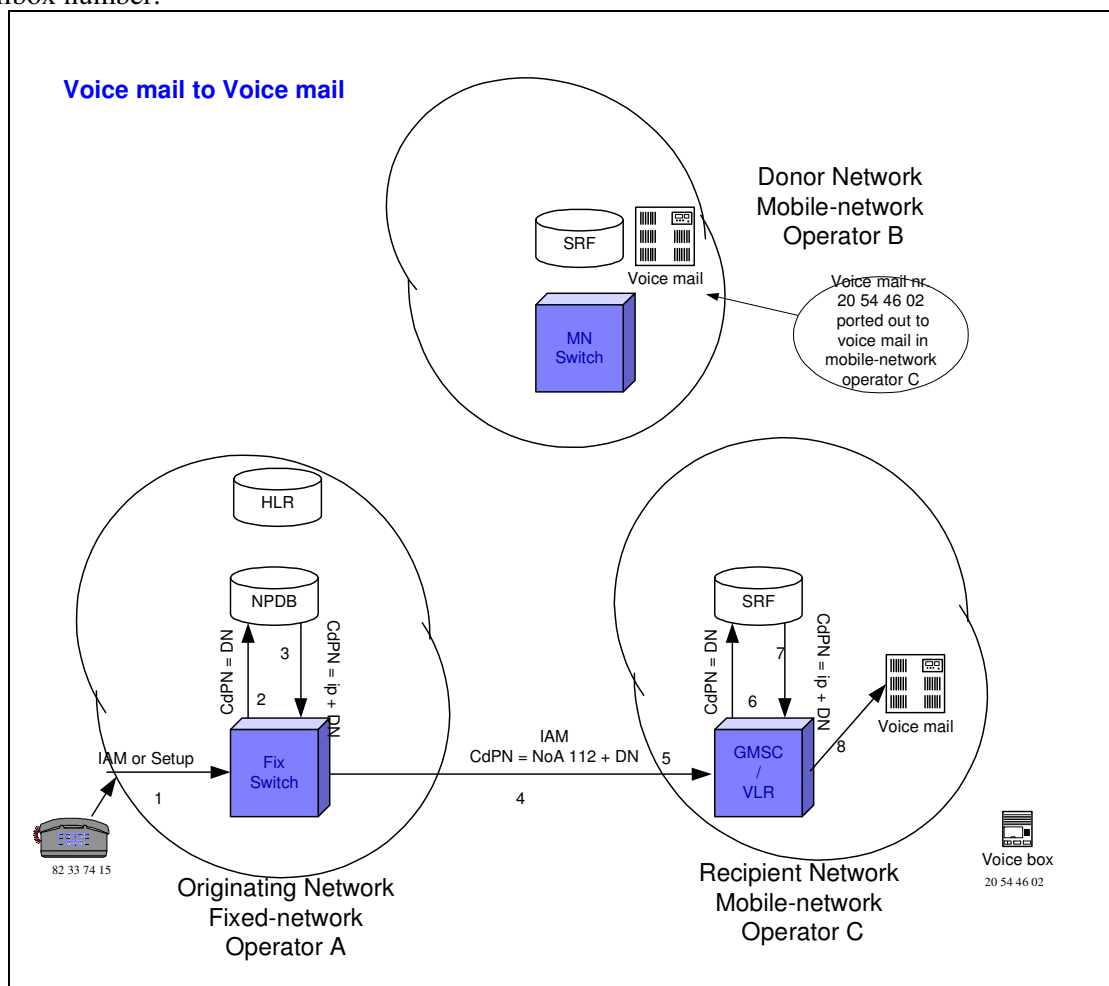
points to the correct HLR. This is done by replacing the original CdPN with, for example, HLR's GT.

7. The MAP SRI message is routed to the correct HLR.
8. HLR enquires the roaming number, and returns it to the MN_Switch in a MAP SRI (SRI Ack) response message.
9. MN_Switch routes the call to the VMSC with MSRN.

Voice mail to Voice mail

In this case a voice mail number (20 54 46 02) from mobile-network operator B has ported to voice mail at mobile-network operator C.

A fix subscriber (82 33 74 15) from fixed operator A tries to access a voice mail with this mailbox number.

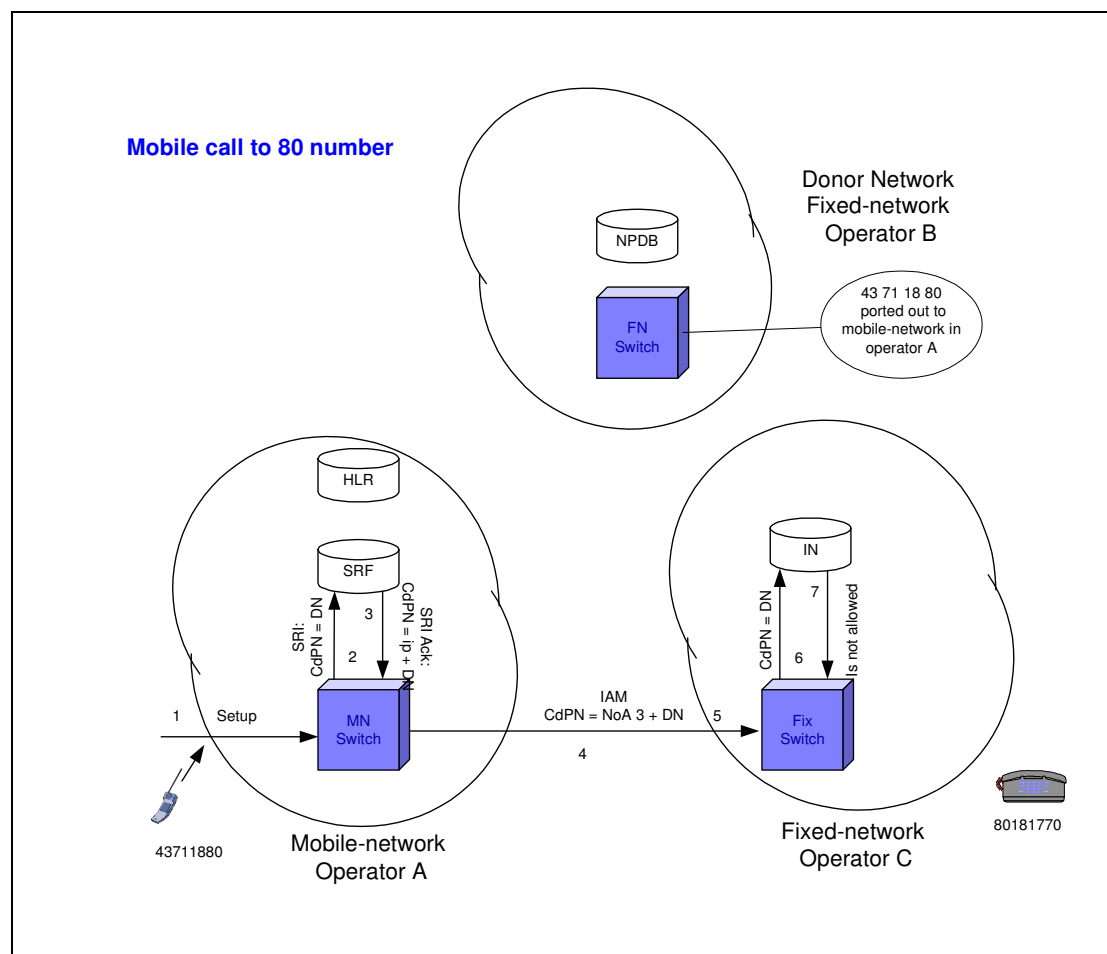


1. The originating network (fixed operator A) gets a setup or IAM.
2. The originating switch sends a query based on the CdPN to the NPDB.
3. The NPDB sends a response containing an internal- prefix to the called number. The internal-prefix is translated in the NP Routing Tables and determines an SS7 route out of the network, with NoA indicator = 112 of the CdPN (ported number).
4. At the ISUP level the NoA indicator of the CdPN is 112 (ported number).
5. The Recipient Network (mobile-network operator C) receives the call, performs digit analysis, and sends a query based on the CdPN (NoA =112) to the SRF.
6. The SRF sends a response containing an internal-prefix to the called number. The recipient network receives the SRF response and analyse the data.
7. The internal- prefix will be used for route the call to the Voice mail.

Special Call Cases

Mobile call to 70, 80, 90

In this case a mobile number 43 71 18 80 (this has been fixed before now it is ported as a mobile) from mobile-network operator A wants to make a call to an 80 number at fixed-network operator C. (This 80 number does not allow call from mobile).



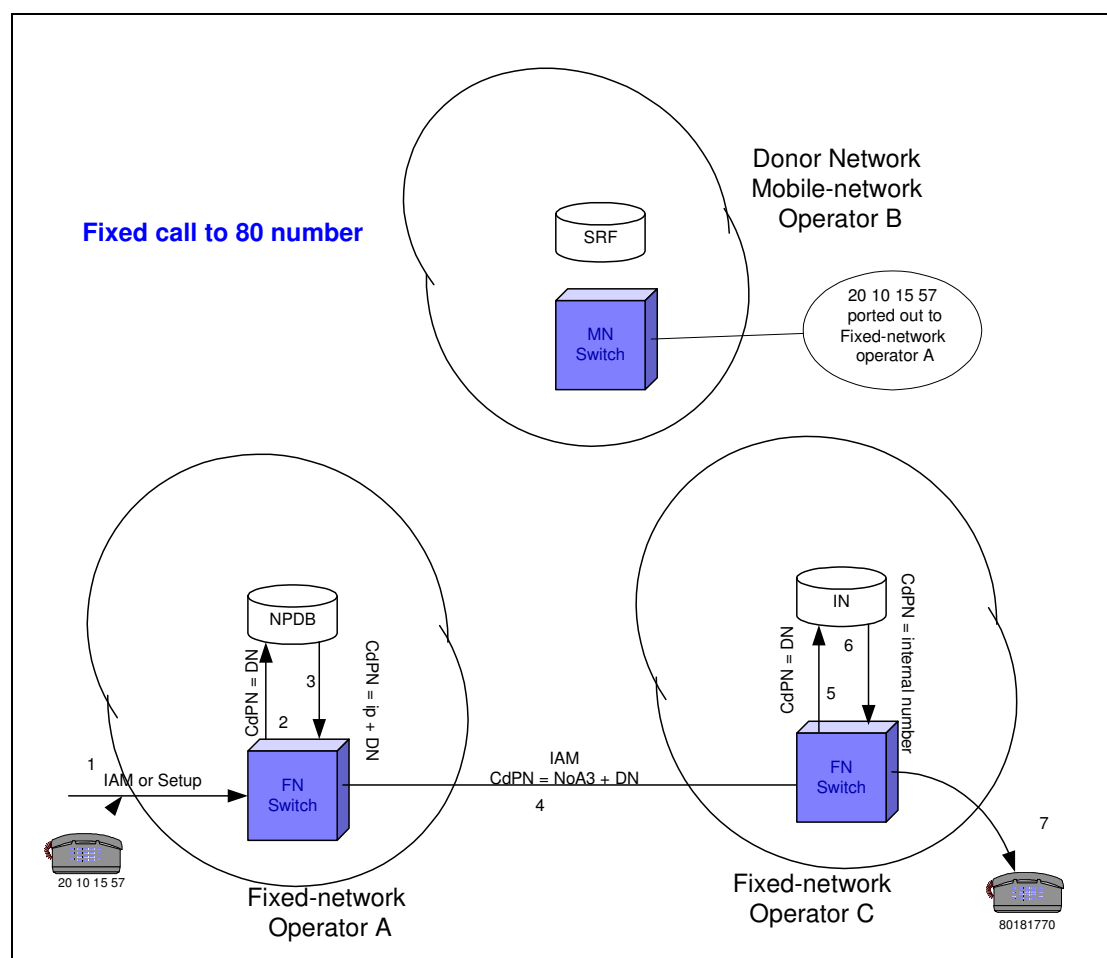
1. MN_Switch receives a setup.
2. MN_Switch generates a routing inquiry SRI base on the analysis of the CdPN. The MAP SRI message is routed to SRF using the CdPN as a global title. SRF determines that the message is addressed to a subscriber served by another network and that the message is a routing enquiry. The message is forwarded to the MAP level NP application for treatment.
3. The SRF sends a response (SRI Ack) containing an internal- prefix to the CdPN. The internal-prefix is translated in the NP Routing Tables and determines an SS7 route out of the network, with NoA indicator of the CdPN is 3.
4. MN_Switch routes the call to the subscription network base on the internal prefix.

Telecommunication Industries Association in Denmark / Working Group TI_NTG2
Rules & Procedures / Signalling Scenarios for Number Portability

5. The Recipient Network (fixed-network operator C) receives the call, performs digit analysis, and sends it to IN service.
6. The IN recognizes the call is from Mobile number based on Location Number (call is not allowed). Call will be rejected.

Fix call to 70, 80, 90

In this case a fix number 20 10 15 57 (this has been mobile before at mobile-network operator B, and now is ported as a fix number at fixed-network operator A) wants to make a call to an 80 number at fixed-network operator C. (This 80 number allows the call from fix).



1. The originating network (fixed operator A) gets a setup or IAM.
2. The originating switch sends a query based on the CdPN to the NPDB.
3. The NPDB sends a response containing an internal- prefix to the called number. The internal-prefix is translated in the NP Routing Tables and determines an SS7 route out of the network, with NoA indicator of the CdPN is 3 (national call).
4. The terminating network (fixed-network operator C) receives the call, performs digit analysis, and finds out that the call is to an IN-service and send it to IN.
5. The IN recognizes the call is from fix number based on Location Number(call is allowed). The IN converts the 80 numbers to an internal number and sends it to switch.
6. The internal- number will be used for route the call to the customer B (owner of 80 number).

4. The MN_Switch (SMS-GMSCA) sends a routing inquiry for SM delivery to SRF.
5. The SRF analyses the CdPN and identifies the number has been exported to another network and the message is non-call related.
The SRF forwards the request to the subscription/recipient network.
 - SRI_for_SM = NoA 3 + DN
 - CdPN GT = SRA + DN
 - CgPN GT = SCA(SMS_GMSCA address)
6. The MN_Switch at Recipient network's sends the message to the SRF
7. SRF analyses the CdPN and identifies the SRA of its own network and the DN representing a subscriber in it own network. The SRF forwards the message to the correct HLR, which stores the B-subscriber's information.
 - SRI_for_SM (DN)
 - CdPN = HLRC address
 - CgPN = SCA (SMS-GMSCA address)
8. HLR responds to the originating MN_Switch (SMS-GMSCA) by sending:
 - SRI_for_SM ack.(VMSC-C address)
 - CdPN GT = SCA(SMS-GMSCA address)
 - CgPN GT = HLRC address
9. The originating MN_Switch (SMS-GMSC) can now deliver the message to the recipient MN_Switch (VMSC-C) using a Forward_SMS message.
 - Forward_SM (VMSCC address)
 - CdPN GT = SCA (VMSCC address)
10. The recipient VMSC further delivers the message to the B-subscriber.

The A-subscriber gets a delivery report (*).

(A delivery reports which confirms the delivery of the short message to the recipient, or it may be a failure report, which informs the originator that the short message was never delivered and the reason why).

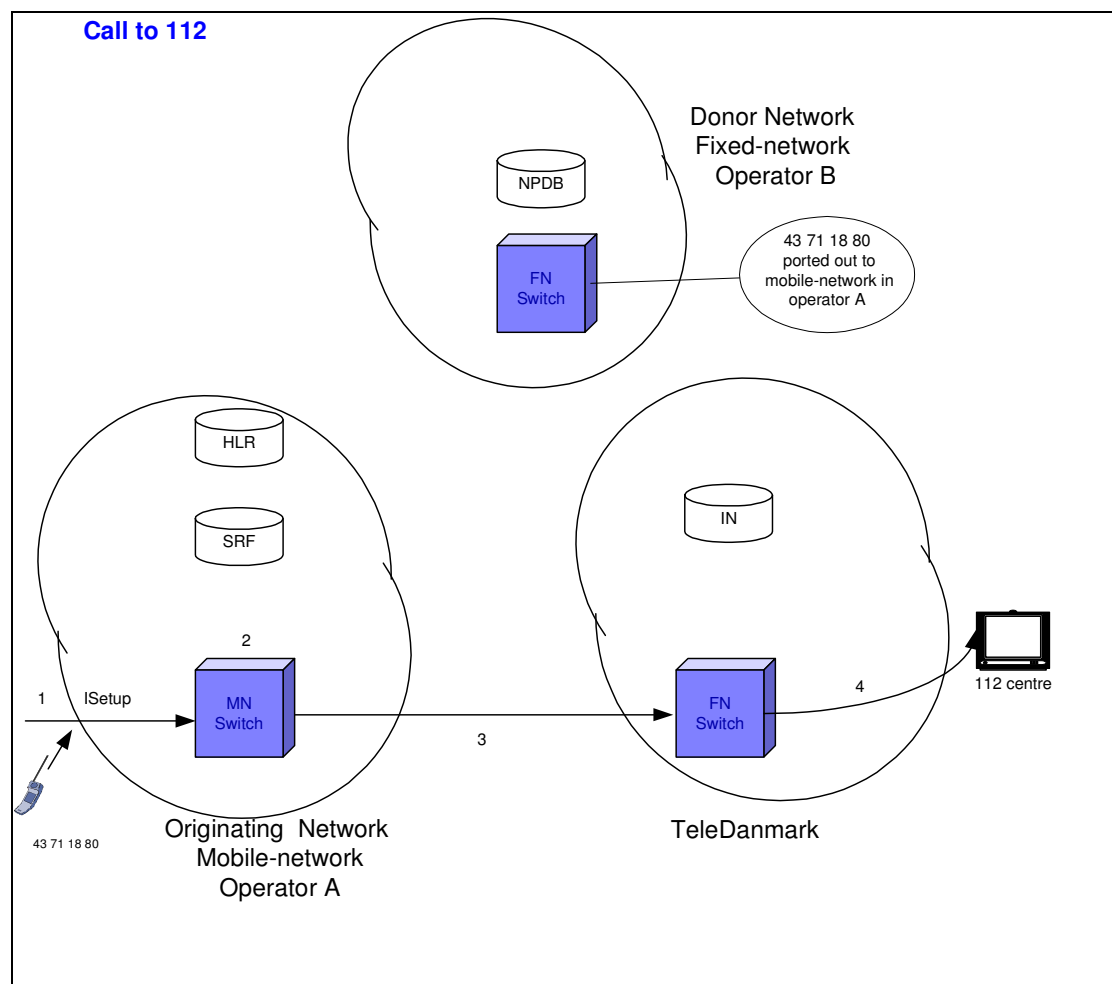
(*)

The mobile handset can be set to receive the delivery report. (e.g. in Nokia 6150 the delivery report can sets on at: Message setting, common, delivery report)

112 Call

A fix number (43 71 18 80) from fixed-network operator B is ported to a mobile number at mobile-network operator A.

43 71 18 80 now makes a call to 112.



1. MN_Switch receives a setup.
2. The switch analyse the B-number and finds out the call is to the emergency number. By analysing the A-number and by the information of Location Number on CgPN (whether is located at East or West of the "Store Belt" the B-number at switch converts to 80 62 00 16 or 80 62 00 29). Let say the customer is at East for Store Belt.
3. The call (B-number is 80 62 00 16) sends to Tele Danmark Emergency centres are registered by Tele Danmark.
4. Tele Danmark receives the call. By analysing the B-number the TDK forwards the call to the 112 centre (East Centre).

Telecommunication Industries Association in Denmark / Working Group TI_NTG2
Rules & Procedures / Signalling Scenarios for Number Portability

The East Centre, at TDK, asks the calling number the necessary information and route the call to the nearest 112 centres.

Note:

For Emergency calls the fixed to mobile portability might cause great confusion in the alarm centres receiving calls. As this is very sensitive it should be secured that the alarm centres are being informed well in advance of the implications of NP phase

Glossary

Ack.	Acknowledgment
CdPN	Called Party Number
CgPN	Calling Party Number
DN	Directory Number
FN Switch	Fixed Network Switch
GMSC	Gateway Mobile Switching Centre
GT	Global Title
HLR	Home Location Register
IAM	Initial Address Message
ip	Internal prefix
MAP	Mobile Application Part
MN Switch	Mobile Network Switch
NoA	Nature of Address
NPDB	Number Portability Data Base for fixed network
OCH	Operator Clearing House
OPID	Operator ID
PC	Porting Case
RC	Equivalent charging number range
RI	Equivalent routing number range
SCA	Service Centre Address
SCA(SMS-GMSC)	Service Centre Address of the Gateway MSC for Short Message Service Centre
SCA(VMSC)	Service Centre Address of the Visiting Mobile Service Switching Centre
SCCP	Signalling
SCCP	Signalling Control Connection Part
SM	Short Message
SM_MO	Short Message Mobile Originated Point to Point
SM_MT	Short Message Mobile Terminated Point to Point
SMSC	Short Message Centre
SMS-GMSC	Gateway MSC for Short Message Service
SPC	Signalling Point Code
SRA	SCCP Routing Address
SRF	Signalling Relay Function
SRI	Send Routing Information
SS7	Signalling System # 7
VMS	Voice Mail System
VMSC	Visitor Mobile Switching Centre