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Supplement 5

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SERIES Q: SWITCHING AND SIGNALLING

**Number portability – Capability set 2
requirements for service provider portability
(Query on release and Dropback)**

ITU-T Q-series Recommendations – Supplement 5

(Previously CCITT Recommendations)

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SWITCHING AND SIGNALLING

SIGNALLING IN THE INTERNATIONAL MANUAL SERVICE	Q.1–Q.3
INTERNATIONAL AUTOMATIC AND SEMI-AUTOMATIC WORKING	Q.4–Q.59
FUNCTIONS AND INFORMATION FLOWS FOR SERVICES IN THE ISDN	Q.60–Q.99
CLAUSES APPLICABLE TO ITU-T STANDARD SYSTEMS	Q.100–Q.119
SPECIFICATIONS OF SIGNALLING SYSTEMS No. 4 AND No. 5	Q.120–Q.249
SPECIFICATIONS OF SIGNALLING SYSTEM No. 6	Q.250–Q.309
SPECIFICATIONS OF SIGNALLING SYSTEM R1	Q.310–Q.399
SPECIFICATIONS OF SIGNALLING SYSTEM R2	Q.400–Q.499
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INTERWORKING OF SIGNALLING SYSTEMS	Q.600–Q.699
SPECIFICATIONS OF SIGNALLING SYSTEM No. 7	Q.700–Q.849
DIGITAL SUBSCRIBER SIGNALLING SYSTEM No. 1	Q.850–Q.999
PUBLIC LAND MOBILE NETWORK	Q.1000–Q.1099
INTERWORKING WITH SATELLITE MOBILE SYSTEMS	Q.1100–Q.1199
INTELLIGENT NETWORK	Q.1200–Q.1999
BROADBAND ISDN	Q.2000–Q.2999

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SUPPLEMENT 5 TO ITU-T Q-SERIES RECOMMENDATIONS

NUMBER PORTABILITY – CAPABILITY SET 2 REQUIREMENTS FOR SERVICE PROVIDER PORTABILITY (QUERY ON RELEASE AND DROPBACK)

Summary

This Supplement describes the requirements to support Service Provider Portability in a Signalling System No. 7 network for Number Portability Capability Set 2 (NPCS-2) with the methods "Query on Release" and "Dropback".

Source

Supplement 5 to ITU-T Q-series Recommendations was prepared by ITU-T Study Group 11 (1997-2000) and was approved under the WTSC Resolution No. 5 procedure on the 15th of March 1999.

FOREWORD

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CONTENTS

	Page
1	Scope..... 1
2	Normative references 2
3	Terms and definitions 2
4	Abbreviations..... 2
5	General..... 2
5.1	Purpose..... 3
5.2	Application..... 4
6	Description of PNCC-SPP 4
6.1	Overview of Number Portability SS7 capabilities..... 4
6.1.1	Inter-exchange Portable Number Call Control (PNCC-SPP)..... 4
6.1.2	Configuration models 5
7	Query on Release (QoR)..... 6
7.1	Network architectures for Service Provider Portability of geographic numbers 6
7.1.1	Call rerouting initiated by "Query on Release (QoR)" principles from Donor network..... 7
7.1.2	Query on Release combined with query by Recipient network (two-step number translation principle)..... 8
7.2	Functional Entity model and Information Flow model..... 9
7.2.1	Functional Entity model 9
7.2.2	Information Flow Model..... 10
7.2.3	Allocation of functions to equipment 11
7.3	Generic Information Flows 12
7.3.1	Call rerouting initiated by "Query on Release (QoR)" principles from Donor network..... 12
7.3.2	Query on Release combined with query by Recipient network..... 13
7.4	SDL..... 14
7.5	Procedures for QoR method..... 16
7.5.1	Normal procedures..... 16
7.5.2	Exceptional procedures..... 16
7.5.3	Interworking considerations 17
7.5.4	Interactions 17
7.5.5	Procedures based on bilateral agreements 18
7.5.6	NP routing loop detection issues 19

	Page	
8	Dropback.....	19
8.1	Network architectures for Service Provider Portability of geographic numbers	19
	8.1.1 Call rerouted by Dropback principles from Donor network.....	19
	8.1.2 Dropback combined with query by Recipient network (two-step number translation principle).....	21
8.2	Functional Entity model and Information Flow model.....	21
	8.2.1 Functional Entity model	21
	8.2.2 Information Flow model	23
	8.2.3 Allocation of functions to equipment	24
8.3	Generic Information Flows	24
	8.3.1 Call rerouted by Dropback principles from Donor network.....	24
	8.3.2 Dropback combined with query by Recipient network	26
8.4	SDL.....	27
8.5	Procedures for Dropback method	28
	8.5.1 Normal procedures.....	28
	8.5.2 Exceptional procedures.....	28
	8.5.3 Interworking considerations	29
	8.5.4 Interactions	29
	8.5.5 Procedures based on bilateral agreements	30
	8.5.6 NP routing loop detection issues	30
9	Signalling requirements	31
Annex A – Intelligent Network Support for PNCC for Service Provider Portability using QoR		33
A.1	Scope.....	33
A.2	General description	34
	A.2.1 General assumptions.....	34
	A.2.2 Number portability data.....	34
	A.2.3 IN support for Service Provider Portability of geographic numbers	34
	A.2.4 Information Flows for PNCC-SSP using the IN architecture.....	35
Annex B – Intelligent Network support for PNCC for Service Provider Portability using Dropback.....		37
B.1	Scope.....	37
B.2	General description	38
	B.2.1 General assumptions.....	38
	B.2.2 Number Portability data.....	38
	B.2.3 IN support for Service Provider Portability of geographic numbers	39
	B.2.4 Information Flows for PNCC-SSP using the IN architecture.....	39

Supplement 5 to Q-series Recommendations

NUMBER PORTABILITY – CAPABILITY SET 2 REQUIREMENTS FOR SERVICE PROVIDER PORTABILITY (QUERY ON RELEASE AND DROPBACK)

(Geneva, 1999)

1 Scope

This Supplement describes the additions required to support Service Provider Portability in a Signalling System No. 7 network for Number Portability Capability Set 2 (NPCS-2). The definition for Service Provider Portability is given in this Supplement.

The Portability Number Call Control for Service Provider Portability (PNCC-SPP) in a Signalling System No. 7 network provides the core function to support portability for geographic numbers using the "Query on Release" and the "Dropback" methods. Both methods are considered as network options.

In addition, this Supplement describes Number Portability in terms of high-level network architectures and generic routing methods for NP Capability Set 2. These architectures and routing methods are not to be considered exhaustive; they just illustrate some of the options. Other alternatives do exist and may be covered by Capability Set 1 [1] or by future capability sets.

To support the routing methods identified, enhancements to signalling protocols are required (initially, not all the architectures and routing methods will be supported by the signalling protocols). These signalling enhancements will be phased in NP capability sets.

This Supplement describes:

- a) a set of network architectures to support Number Portability;
- b) the exchange of NP-related information between networks per architecture;
- c) routing issues with relation to NP and the described architecture;
- d) generic Information Flows for the described architectures.

For additional information concerning terminology, objectives for the study of Number Portability, classification and generic assumptions for Number Portability, refer to [1] – Number Portability Capability Set 1 Architecture. These principles apply to both Number Portability Capability Sets 1 and 2.

Additional NP architectures for routing of ordinary calls (circuit-related signalling) are included in this Supplement. NP architectures for routing of non-circuit-related supplementary services (e.g. CCBS) are included in [1].

Only Service Provider Portability (SPP) of geographic numbers is considered in detail; however, some text is included on SPP of non-geographic numbers, although this type of NP is still under study.

The signalling requirements for the support of NPCS-2 PNCC-SPP are contained in a cumulative list in this Supplement which supersedes previous lists.

Annexes A and B contain the additional requirements for the support of PNCC-SPP when Intelligent Network (IN) is involved.

2 Normative references

- [1] Supplement 3 to Q-series Recommendations (1998), *Number Portability – Scope and capability Set 1 architecture*.

The normative references for supplementary services are covered in the Q.73x and Q.76x series of Recommendations.

3 Terms and definitions

For a complete set of definitions, see reference [1]. Any additional definitions or modifications to existing definitions specific to this Supplement are provided in this clause.

3.1 rerouting network: A network, in the call path, that responds to a release or Dropback message in order to reroute a ported call to the Recipient network.

3.2 rerouting exchange: An exchange in the rerouting network call path, that responds to a release or Dropback message in order to route a ported call to the Recipient network.

4 Abbreviations

For a complete set of abbreviations, see reference [1]. Any additional abbreviations specific to this Supplement are provided below:

CC	Country Code
FE	Functional Entity
ISDN	Integrated Services Digital Network
NPA	Numbering Plan Administration
PBX	Private Branch Exchange
PNCC-SPP	Portable Number Call Control – Service Provider Portability
RN	Routing Number
ROA	Recognized Operating Agency
SDL	Specification and Description Language
TC	Transaction Capabilities

5 General

The PNCC-SPP network capability delivers the following information to each exchange in the call path, once routing information has been obtained:

- 1) the original dialled number;
- 2) the necessary routing information;
- 3) an indication that NP routing information has been obtained.

In addition, for calls originating from a ported number, PNCC-SPP delivers the portable number as the calling party number and location-related information about the calling party.

The capabilities of the PNCC-SPP build upon the existing SS7 capabilities. Backward compatibility is an important requirement. Only the new capabilities, not covered by existing ITU-T Recommendations, required for PNCC-SPP are described here.

Number Portability affects any service that makes an assumption that an E.164 directory number indicates the correct network address. NP supports the use of numbers that do not directly provide an indication of the network address. NP is used with numbers that have traditionally contained network location information (e.g. numbering plan).

To route a call dialled with a non-geographic number (e.g. 800), the dialled number is often translated to a geographic number. How to obtain such a translation is beyond the scope of this Supplement. If the resulting translated geographic number is portable, the PNCC-SPP network capabilities apply.

Deployment of NP may require other network capabilities and network interfaces related to:

- a) database architecture;
- b) exchange internal call processing;
- c) network operations and administration.

These network capabilities and interfaces are outside the scope of PNCC-SPP.

The functions described in this Supplement support Number Portability within the national domain and therefore should not be invoked for outgoing international calls.

5.1 Purpose

Number Portability (NP) allows end users of public switched networks to retain their E.164 telephone numbers when they change their service provider (service provider portability), location within a specific geographical area (location portability), or network service (service portability).

Table 1 shows the supported combinations between E.164 numbers and the types of Number Portability.

Table 1 – Scope of the Number Portability service

E.164	Type					
	Location Portability		Service Portability		Service Provider Portability	
	Between country code domain	Within country code domain	Between country code domain	Within country code domain	Between country code domain	Within country code domain
1) Country Code for geographic area	na	a	na	a	na	a
2) Country Code for global services	na	a	na	na	na	a
3) Country Code for networks	na	o	na	o	na	o
a Porting applicable na Porting not applicable o Network operator matter NOTE – Boxes with a double line border correspond to a capability supported in this Capability Set of Number Portability.						

- The number beginning with "Country Code for geographic area" [1] in the table] is the number that ITU assigns to each country (or countries in an integrated numbering plan). The number following the CC is administered by the Numbering Plan Administration (NPA).
- The number beginning with the "Country Code for global service" [2] in the table] is the number that ITU assigns to the global service.
- The number beginning with "Country Code for networks" [3] in the table] is the number that ITU assigns to two or more international networks (typically ROAs). The following digits identify each international network.

5.2 Application

PNCC-SPP is to support the implementation of Service Provider Number Portability in the competitive local service environment.

6 Description of PNCC-SPP

This subclause provides general descriptions of the new SS7 capability for the support of Service Provider Number Portability call control. The NP methods for this capability set are the "Query on Release" and the "Dropback" methods. These methods are described in this Supplement. This capability may be used within a single network or across network-interconnected interfaces based on bilateral agreements.

PNCC-SPP is a core NP capability which determines that the called number is portable, ascertains the routing information to route the call towards the Recipient network/exchange, and incorporates additional information into the call request to enable the Recipient network/exchange to connect the call to the called end user. For calls originating from a ported number, PNCC-SPP delivers the portable number as the calling party number and location-related information about the calling party.

6.1 Overview of Number Portability SS7 capabilities

Geographic numbers encode an identifier of the exchange that is serving the end users, this is contained in the numbering plan. Number Portability (NP) permits an end user to move from one exchange in a network to another exchange in the same or a different network while retaining his E.164 number. Networks will therefore require additional capabilities to determine the Recipient network or recipient exchange for a number when portability is involved.

The use of NP network capabilities is transparent both to the calling end user and to the called end user.

6.1.1 Inter-exchange Portable Number Call Control (PNCC-SPP)

The PNCC-SPP capability:

- Step 1: Determines whether or not the number dialled by the calling user is portable.
- Step 2: Obtains routing information for the initiating exchange to route the call towards the Recipient network.
- Step 3: Routes the call to the recipient exchange and completes call set-up to the portable end user.

The functions needed to realize steps 1, 2 and 3 can be implemented in various combinations of networks/exchanges.

When using the Query on Release method in step 2, the initiating exchange routes the call to the donor exchange with an optional indication that a QoR capability is possible. If the donor exchange is not the serving exchange, the call is released with an appropriate release indication. On receipt of the release indication, the initiating exchange determines the routing information. The initiating exchange may obtain the network routing number by initiating a query to an external database. The response message contains the network routing number.

6.1.2 Configuration models

The following three configuration models depict the more typical PNCC-SPP network scenarios. Other network scenarios are possible (see reference [1] for more information). The first configuration (Figure 1) shows separate originating and initiating networks/exchanges while the second figure (Figure 2) depicts a scenario in which the originating and initiating networks/exchanges are the same. The third scenario (Figure 3) shows a network scenario in which the donor and initiating networks/exchanges are the same.

Also, although not shown explicitly in these figures, there may be one or more Transit networks/exchanges between any of the originating, initiating, donor and Recipient networks/exchanges. The NP database may be internal to the initiating exchange or may be located at another node in the network¹. In each of these configurations, the exchanges may be in different networks but in the same country.

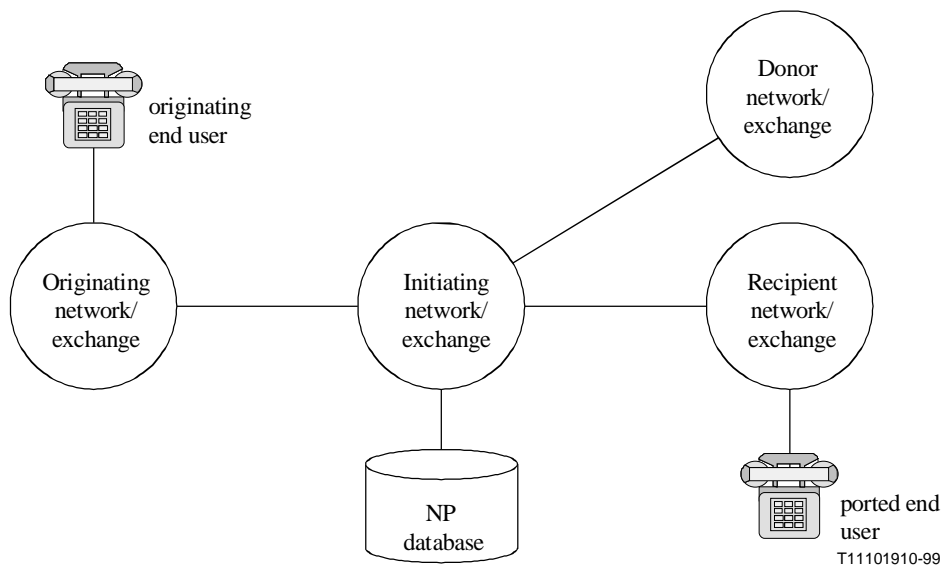


Figure 1 – PNCC-SPP configuration – Separate originating, initiating, donor networks/exchanges

¹ When a call spans interconnecting networks, the configuration applicable for the call depends on bilateral agreements between the concerned networks.

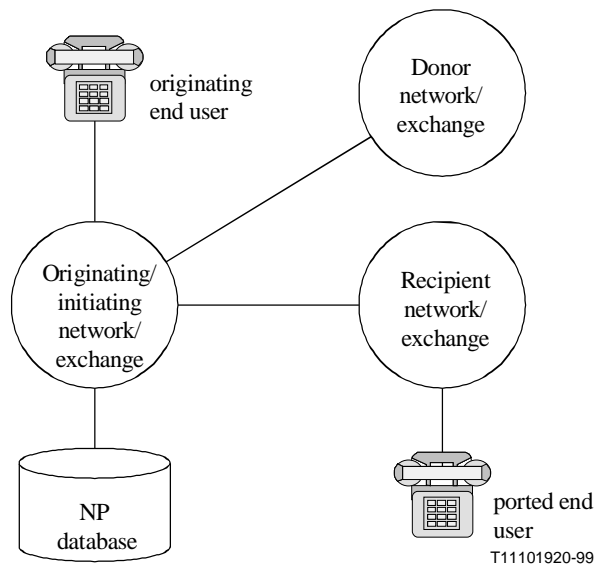


Figure 2 – PNCC-SPP configuration – Identical originating and initiating networks/exchanges

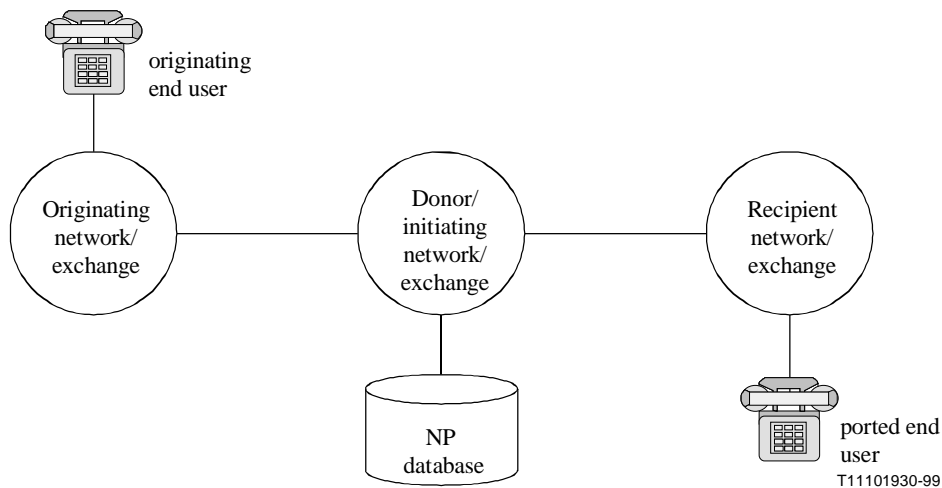


Figure 3 – PNCC-SPP configuration – Identical donor and initiating networks/exchanges

7 Query on Release (QoR)

7.1 Network architectures for Service Provider Portability of geographic numbers

This clause describes the network architectures to support portability for geographic numbers using the "Query on Release" method. This method is considered as a network option.

7.1.1 Call rerouting initiated by "Query on Release (QoR)" principles from Donor network

7.1.1.1 General description

When the Donor network does not perform an NP DB query for ported-out numbers, the preceding network initiates NP actions, i.e. an NP DB query; at reception of a release message, this case is referred to as "Query on Release (QoR)" (see Figures 4 and 5).

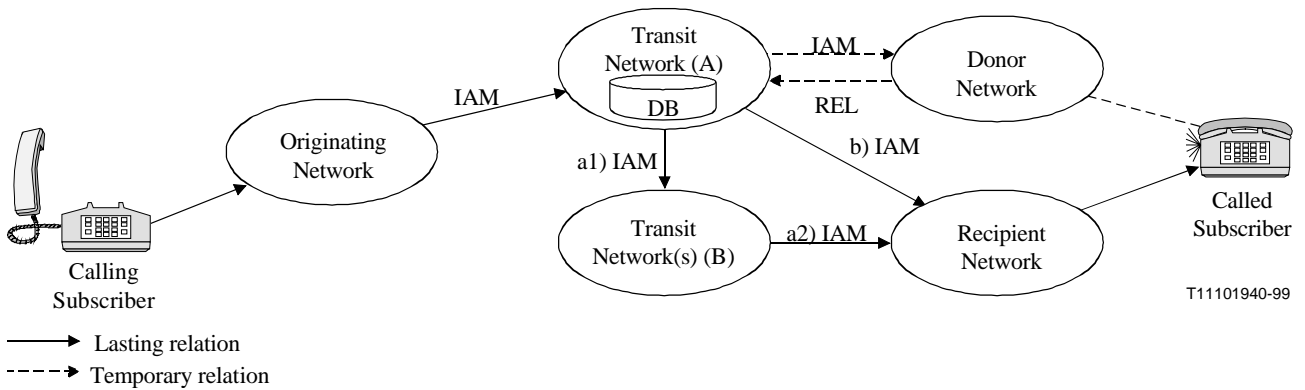


Figure 4 – Query on Release by Transit network

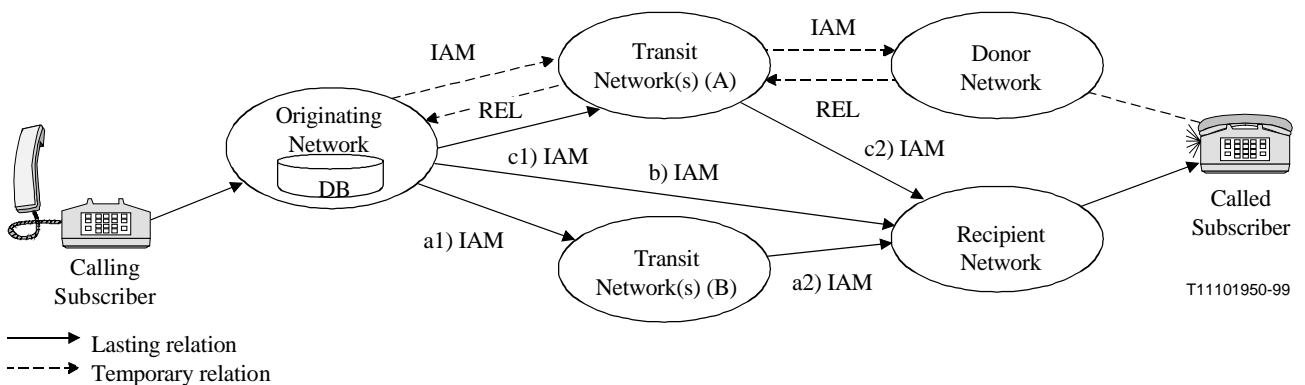


Figure 5 – Query on Release by Originating network

The release message contains an indication (e.g. special cause value or diagnostics information) which indicates that the called number is ported out. Therefore, the failure reason "destination incompatible" (and similar other failure reasons) must be used to trap such cases. The Transit/Donor network must initiate an NP DB query to determine if the number is ported-out; if so, the call is then redirected to the Recipient network; otherwise, the release message is handled in the normal way.

In Figure 4, the Donor network receives an incoming call. It then detects either that the called number has been ported out to another network or, optionally, that the number is just vacant in the network. The Donor network then determines that one of the preceding networks has QoR capability by looking at received signalling information. The call is then released with or without a special indication that the called number is ported out. The Transit network traps the Release, determines that the preceding network has no QoR capability, makes a NP database query and reroutes the call onward towards the Recipient network. In this scenario, the Transit network has access to an NP DB with the complete address to both Recipient network and exchange, for ported out numbers.

Options a1) and a2) in Figure 4 are valid either when Transit network A has no direct interconnection to Recipient network or when overflow traffic is placed via Transit network B.

Option b) in Figure 4 is valid when direct interconnection exists between Transit network A and the Recipient network.

Please note in this case that the DB query might take place also in the Originating network, i.e. that the DB could also exist in the originating network as described in Figure 5.

In Figure 5, the Transit network A either has no QoR capability or determines that the preceding network has QoR capability. It therefore lets the Release pass through to the Originating network. The Originating network, on reception of the Release, queries the NP database and reroutes the call towards Recipient network. In this scenario, the Originating network has access to an NP DB with the complete address to both Recipient network and exchange, for ported-out numbers.

It shall be noted that although the Number Portability Database (NP DB) is drawn within the domain of the Transit and Originating networks, the physical location of the DB may be within any of the networks or even outside the networks, e.g. maintained by a third party. The key issue is what triggers the query and in which of the networks the query is performed.

Options a1) and a2) in Figure 5 are valid either when Originating network has no direct interconnection to Recipient network or when overflow traffic is placed via Transit network B.

Option b) in Figure 5 is valid when direct interconnection exists between Originating and Recipient networks.

For carrier selection, the first exchange of the selected carrier effectively becomes the entry to the Originating network for routing purposes.

Options c1) and c2) in Figure 5 are required when carrier selection is valid for the call, i.e. the Originating network reuses the carrier selection information after querying NP DB.

7.1.2 Query on Release combined with query by Recipient network (two-step number translation principle)

7.1.2.1 General information

Figure 6 shows an NP solution where the Donor network detects that the called number has been ported out. The Donor network returns a release message, with a special indication "ported". The release message is sent all the way to Originating network. The Originating network makes an NP DB query on the CdPN to retrieve a partial Routing Number to address the Recipient network and then routes the call towards the Recipient network either via Transit network(s) or directly.

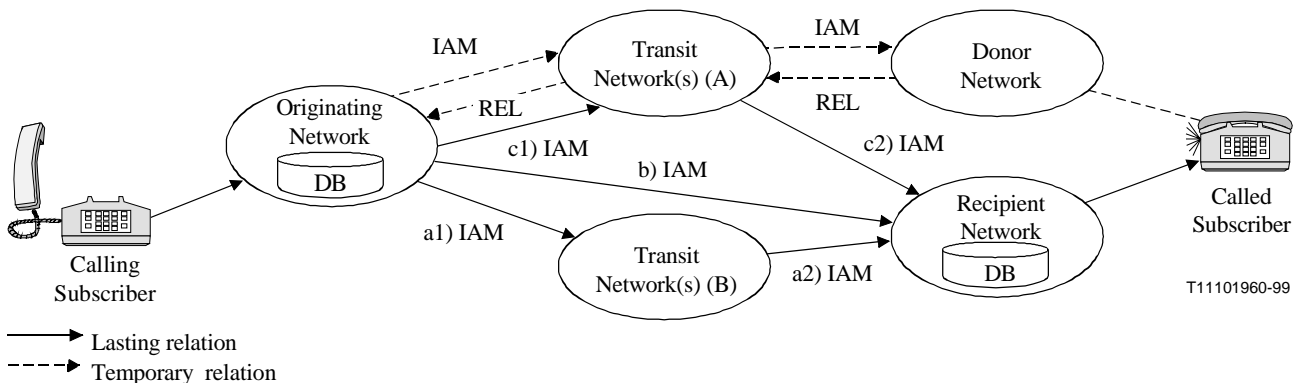


Figure 6 – Query on Release combined with query by Recipient network

In all the above solutions, the NP DB outside the Recipient network contains the Routing Number to address the Recipient network only.

The Routing Number is enclosed in the forward message to avoid NP DB query in Transit network(s) and to enable trapping of NP DB mismatch by Recipient network.

7.2 Functional Entity model and Information Flow model

7.2.1 Functional Entity model

A Functional Entity (FE) is a group of functions that cannot be split across multiple exchanges. Multiple functional entities can be implemented in a single exchange. Figure 7 shows the Functional Entity model for PNCC-SPP.

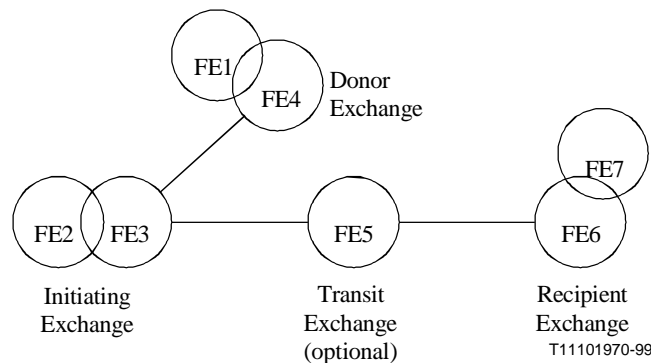


Figure 7 – FE model for PNCC-SPP

Below is a list of the functional entities:

- FE1: portable number detection Functional Entity.
- FE2: portable number query Functional Entity (QoR).
- FE3: basic call functional entities.
- FE4: QoR Functional Entity.
- FE5 and FE6: basic call functional entities.
- FE7: recipient exchange Functional Entity.

7.2.1.1 Description of portable number detection Functional Entity (FE1)

The portable number detection Functional Entity (FE1) determines whether the call set-up information specifies a connection request to a portable number. Otherwise, this Functional Entity shall return the call to FE3 for further call processing.

7.2.1.2 Description of portable number query Functional Entity (FE2)

FE2 invokes the QoR capability to obtain the network routing number. FE2 initiates QoR, sets the QoR capability indicator and sends the call to the donor exchange. If an appropriate release cause is received, then FE2 determines the network routing number. The portable number query Functional Entity (FE2) obtains the routing information based on the end user's number to route a call toward the recipient exchange. This information is used by FE3 to route toward the recipient exchange.

NOTE – FE2 may require internodal communication. Therefore, it may be necessary to distribute functionality equivalent to FE2 across multiple functional entities. Annex A provides a Functional Entity model when Intelligent Network functions are invoked to obtain the routing information. Annex A expands FE2 to include additional IN functional entities in the context of the other functional entities.

7.2.1.3 Description of FE3

FE3 represents the basic call functional entities. On instruction from FE2, FE3 modifies the call set-up information to include the routing information to access the recipient exchange, the called number and the NP status indication.

7.2.1.4 Description of FE4

FE4 represents the QoR functional entities. On instruction from FE2, FE4 analyzes the QoR capability, checks if the subscriber is ported and releases the call with an appropriate release cause.

7.2.1.5 Description of FE5 and FE6

FE5 and FE6 represent the basic call functional entities. On instruction from FE2, FE5 and FE6 modify the call set-up information to include the routing information to access the recipient exchange, the called number and the NP status indication.

7.2.1.6 Description of recipient exchange Functional Entity (FE7)

The recipient exchange Functional Entity (FE7) recognizes that the call can be completed at this exchange. FE7 will use the call set-up information to complete the call to the portable number.

7.2.2 Information Flow Model

Figure 8 shows the Information Flow model between the functional entities for PNCC-SPP. The initiating exchange will use the routing information to route the call through the network or networks to the recipient exchange. In addition, the initiating exchange will send the end user's ported public number along with the call set-up information. The recipient exchange will identify itself as the recipient exchange and use the call set-up information to connect to the correct end user.

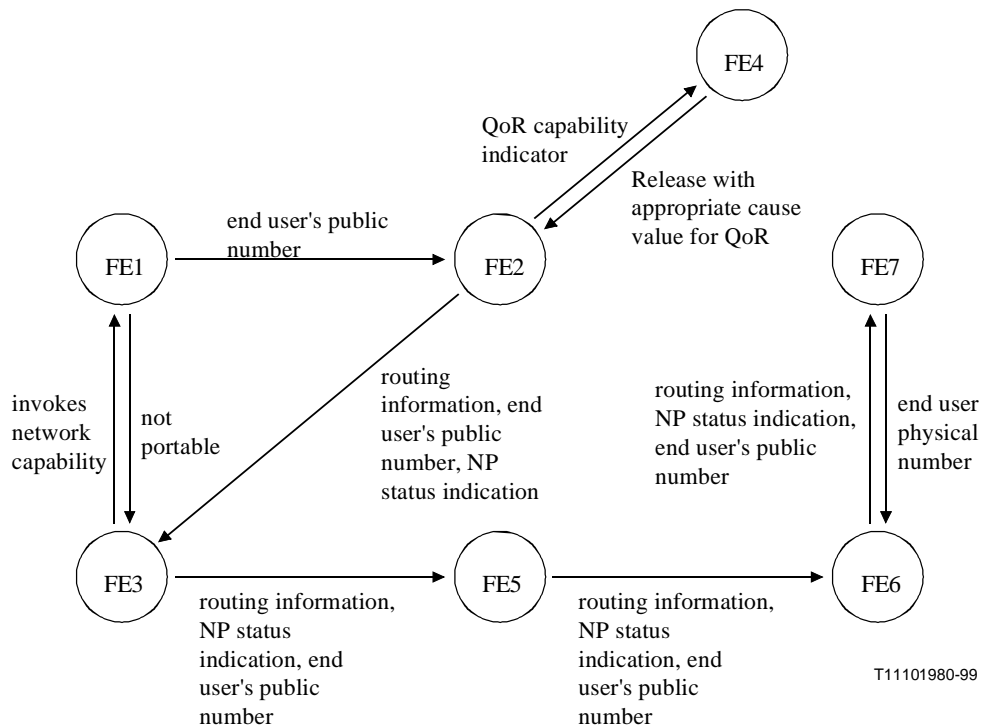


Figure 8 – Information Flow diagram

7.2.2.1 Invoking the portable number detection Functional Entity (FE1)

FE3 invokes FE1 as part of basic call processing.

7.2.2.2 Invoking the portable number query Functional Entity (FE2)

At the initiating exchange, FE1 invokes FE2. FE2 invokes FE4 in order to obtain the routing information. Annex A provides a Functional Entity model when Intelligent Network functions are invoked to obtain the routing number.

7.2.2.3 Invoking the recipient exchange Functional Entity (FE7)

FE6 invokes FE7 on receipt of PNCC-SPP information in an incoming call.

7.2.2.4 Activation and deactivation of PNCC-SPP network capability

Activation and deactivation of PNCC-SPP is done on a per-exchange or per-network basis.

7.2.2.5 Exceptional procedures

If FE2 cannot obtain routing information corresponding to a given called number, FE2 shall attempt to progress the call using the called number and normal call routing procedures.

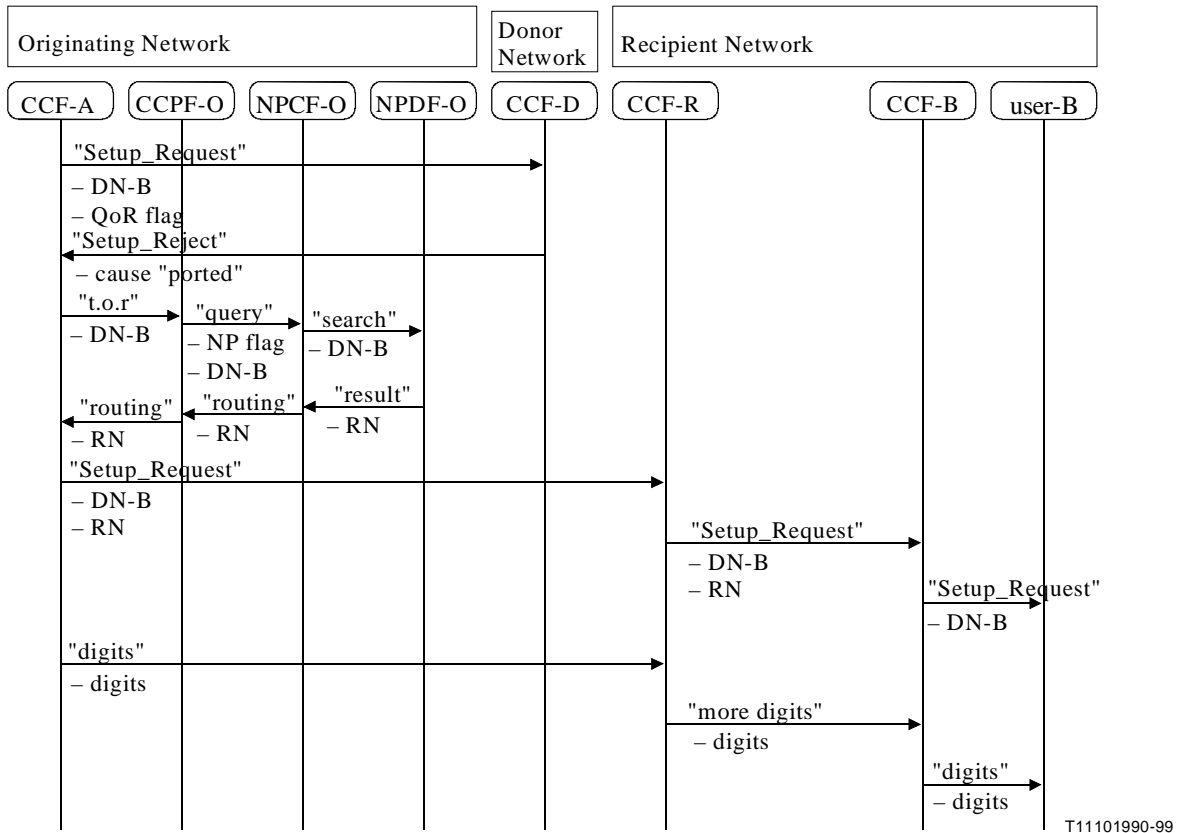
- 1) If the initiating exchange is the donor exchange for the called number, then the call cannot be routed to any other exchange and shall be released after appropriate treatment (tone or announcement).
- 2) At any exchange other than the donor exchange, the call should be routed on toward the donor exchange using the original called party number and with an NP status indication designating that the status of the portable number was not determined.

7.2.3 Allocation of functions to equipment

FE1, FE2 and FE3 could reside in the originating, transit, or donor exchange. FE4 resides in the donor exchange. FE5 resides in the transit exchange. FE6 and FE7 reside in the recipient exchange.

7.3 Generic Information Flows

7.3.1 Call rerouting initiated by "Query on Release (QoR)" principles from Donor network

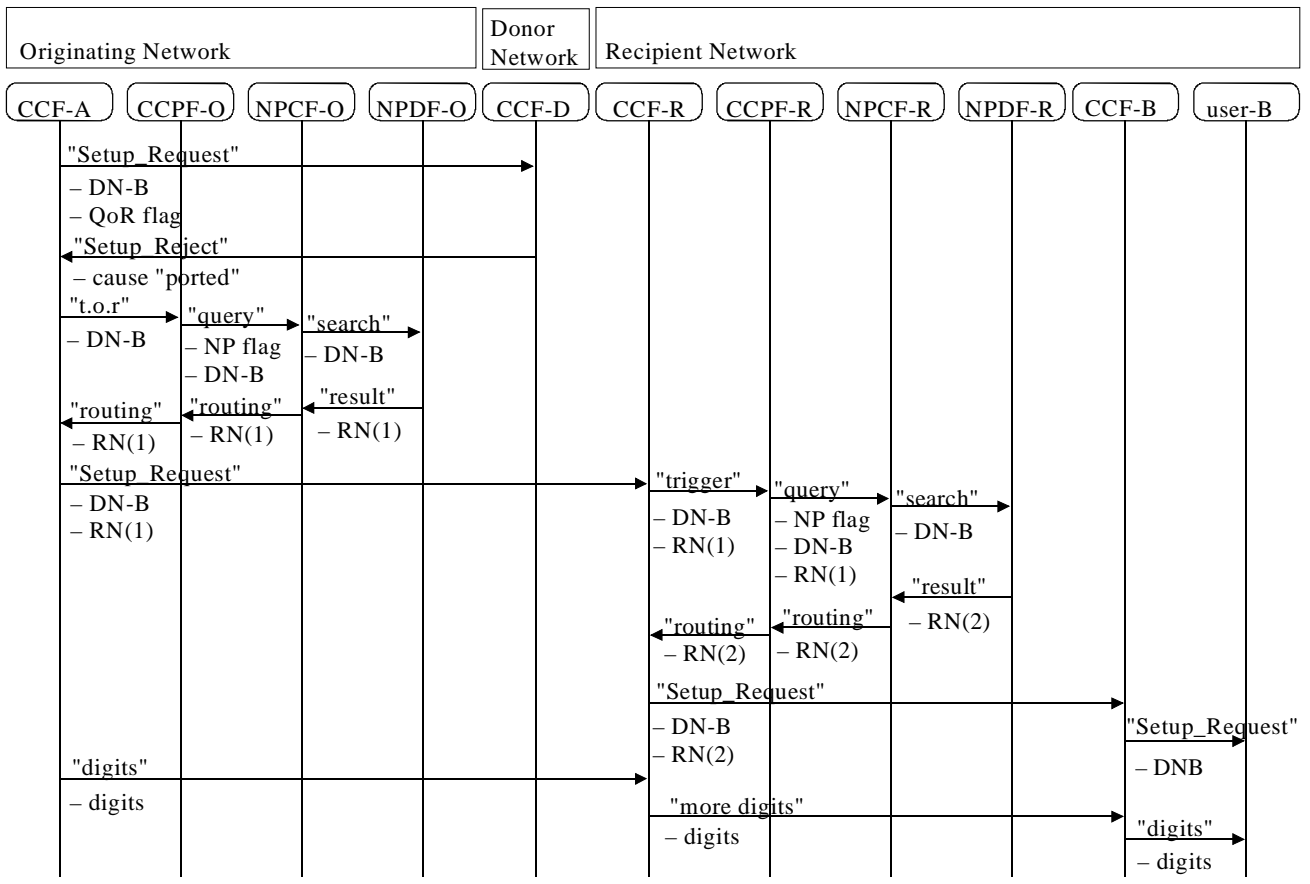


- CCF-A/B/D CCF calling pty/called pty/Donor ex.
- CCPF-O/R/D CCPF Originating/Recipient/Donor
- NPCF-O/R/D NPCF Originating/Recipient/Donor
- NPDF-O/R/D NPDF Originating/Recipient/Donor
- query An event sent from CCPF to NPCF to obtain instructions on how to proceed
- RN Routing Number (e.g. Recipient Network and Exchange ID)
- DN-B Directory Number, called party
- NP flag A flag indicating requested service is NP number translation
- t.o.r Trigger on Release, an event from CCF informing CCPF that a release indicating "ported" subscriber has been received
- routing An operation from CCPF storing a new routing number in CCF

NOTE – In some cases overlap sending of digits is needed.

Figure 9 – Information Flows for IN structured support of Figures 4 and 5

7.3.2 Query on Release combined with query by Recipient network



T11102000-99

- CCF-A/B/D CCF calling pty/called pty/Donor ex.
- CCPF-O/R/D CCPF Originating/Recipient/Donor
- NPCF-O/R/D NPCF Originating/Recipient/Donor
- NPDF-O/R/D NPDF Originating/Recipient/Donor
- query An event sent from CCPF to NPCF to obtain instructions on how to proceed
- RN(1) Routing Number (e.g. Recipient Network ID)
- RN(2) Routing Number (e.g. Recipient Network and Exchange ID)
- DN-B Directory Number, called party
- NP flag A flag indicating requested service is NP number translation
- t.o.r Trigger on Release, an event from CCF informing CCPF that a release indicating "ported" subscriber has been received
- routing An operation from CCPF storing a new routing number in CCF

Figure 10 – Information Flows for IN structured support of Figure 6 (i.e. a two-step "Query on Release" solution)

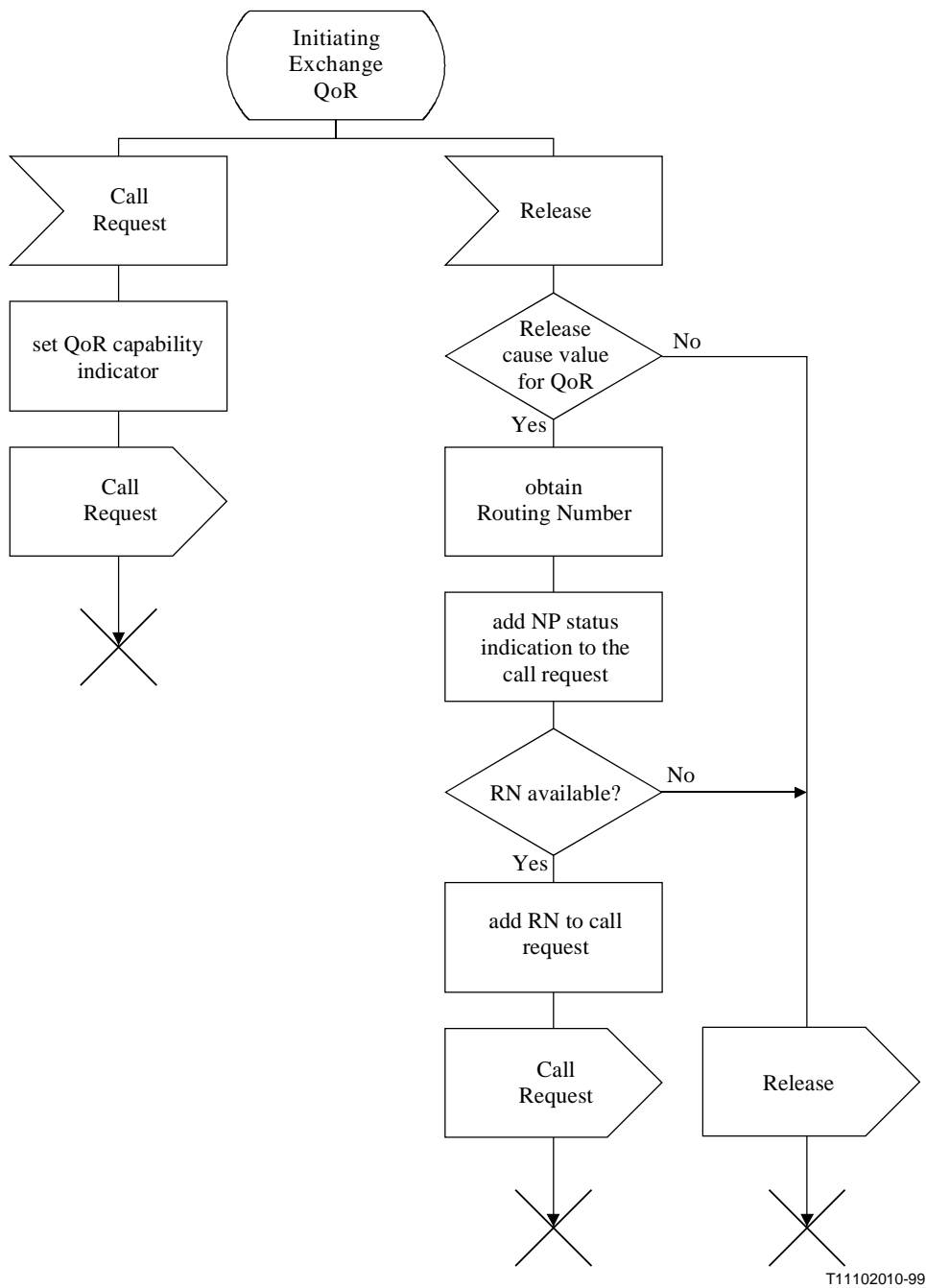
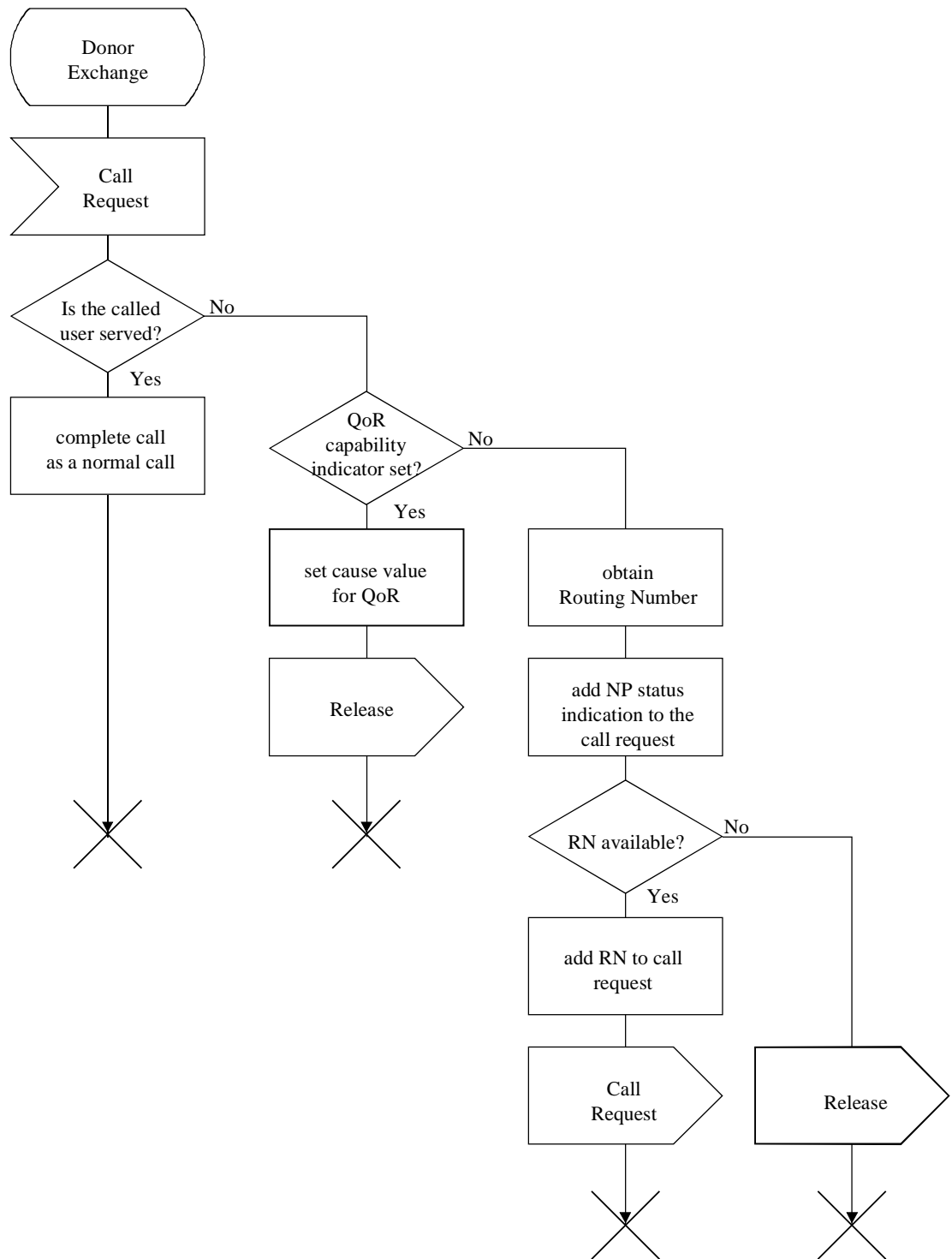


Figure 11 – PNCC-SPP procedures for QoR in the initiating exchange



T11102020-99

Figure 12 – PNCC-SPP procedures for QoR in the donor exchange

7.5 Procedures for QoR method

7.5.1 Normal procedures

7.5.1.1 Portable Number Call Control for Service Provider Portability

The QoR may be invoked by the initiating exchange to obtain the network routing number. The call is first routed to the donor exchange with an optional indication that QoR capability is possible. The donor exchange determines whether the intended called user is served by the exchange or not. If the called user is not served by the exchange, the donor exchange releases the call with the appropriate cause value. Based on the Release information, the initiating exchange then obtains the network routing number by invoking the Query-Response capability and proceeds with the PNCC-SPP capability. If the called user's number has not been ported, the call is completed normally.

When it is determined that the called number is portable, the initiating network/exchange determines whether the number is ported then uses the called end user's portable public number to obtain a Routing Number (RN). In addition, the initiating network/exchange may send an indication in the forward call set-up information that the NP database query of the portable number has been done. The RN is used by the initiating network/exchange and any Transit networks/exchanges to route the call.

As a minimum requirement, the address used as RN identifies either the recipient exchange or the Recipient network serving the ported number. See reference [1] for information related to routing and addressing.

When the routing on RN of a call to a ported number applies, both the RN and the end user's number shall be transferred along with the call to accomplish a two-level addressing scheme. Transfer of the RN shall provide for backward compatibility in routing. The end user's number shall be conveyed transparently. Sending of the RN and NP status indication between networks is optional and subject to bilateral agreements.

The recipient exchange uses the RN, NP status indication, and the user's portable public number to route the call to the end user.

Specific actions shall be applied in the SS7 signalling in order to cope with the potential looping problem of calls to ported numbers.

Some exchange functions provided by separate exchanges in Figure 1 are provided in common exchanges in the configurations in Figures 2 and 3. In these cases, references in the description above to routing the call between two exchanges that are the same exchange should be ignored.

The PNCC-SPP capability completes calls to a portable number regardless of where the call originated. There are no modifications required for the international SS7 capabilities. For handling incoming international calls to a portable number, the incoming International Switching Centre (ISC) may provide the functions of the initiating exchange.

7.5.2 Exceptional procedures

PNCC-SPP requires call routing information in order to direct calls to portable numbers to the exchange serving the called end user. When an exchange normally serving as a PNCC-SPP initiating exchange is unable to obtain this routing information its procedure depends on whether or not the exchange is the donor exchange for the call.

- 1) If the exchange is not the donor exchange for the call, it should route the call using normal procedures. As an option, the NP status indication may be sent indicating that the status of the portable number was not determined.

- 2) If the exchange is the donor exchange, it should always be able to determine if the called user's number is still located at this exchange or is not being served by this exchange.
 - a) If the exchange still serves the called user, the call shall be completed.
 - b) If the called user's number is not being served by this exchange, the call cannot be completed without the routing information. The call shall be released or connected to an appropriate tone or announcement.

7.5.3 Interworking considerations

PNCC-SPP uses the existing ISUP call set-up procedures and circuit selection procedures. PNCC-SPP assumes the use of ISUP between the initiating exchange and the recipient exchange to carry additional information, i.e. NP status indication and ported number. QoR requires the use of ISUP between the initiating and the donor exchange, in order to carry the additional information required, i.e. QoR capability indicator.

In some interworking scenarios, the interworking exchange continues in-band call set-up using the end user's number. In this case, PNCC-SPP functions end at the interworking exchange.

7.5.4 Interactions

7.5.4.1 Interaction with supplementary services

None of the supplementary services defined by ITU-T are affected by the PNCC-SPP network capability. The end user's number is unaffected by this network capability. Supplementary services relying on the end user's number may be impacted by this network capability due to this new routing method. Existing network and supplementary services will still be able to identify the calling end user.

Since the calling party number of the subscriber is retained for both ported and non-porting numbers, the services are preserved through the following:

- 1) The calling party number of a ported calling party shall identify the end user's number (i.e. the ported number).
- 2) The Calling Line Identification Presentation (CLIP) supplementary service and Connected Line Identification Presentation (COLP) supplementary service shall work in the same way as for subscribers that are not ported.
- 3) Calls to emergency services, courier services, taxis and other services using a nationwide called party number shall work in the same way as for subscribers that are not ported.

In addition, additional information associated with the ported calling party will need to be transported. This information may include:

- Geographic location of the calling subscriber.
- Unique Identifier of the network point (at least exchange ID) of the calling subscriber.

The "Release" must not be sent through the exchange that has performed a Call Forwarding service like CFU, CFB or CFNR, etc. This to avoid unwanted interference with these kinds of services. If the number is found out to be really vacant, after the DB query, then a special release indication should be sent to indicate this. This is to avoid DB query in preceding networks.

When the "QoR" mechanism is used, there may be a need to assure that when call forwarding is encountered, the diverting exchange shall act as the originating exchange. This may avoid adverse interactions between Number Portability and Call Forwarding supplementary services.

These interactions are also applicable to the two-step number translation principle.

7.5.4.2 Interaction with IN-based services

The "Release" must not be sent through the SSP that has performed an IN service like PN, UPT, VPN, UAN, etc. This to avoid unwanted interference with these kinds of IN-based services.

When the "QoR" mechanism is used, there may be a need to assure that when IN-based services (e.g. PN, UPT, VPN, UAN, etc.) are encountered, the SSP shall act as the originating exchange. This may avoid adverse interactions between Number Portability and IN-based services.

These interactions are also applicable to the two-step number translation principle.

7.5.4.3 Interaction with carrier selection

The carrier selection functions of the originating end user are not influenced by Number Portability.

For carrier selection, the first exchange of the selected carrier effectively becomes the entry to the Originating network for routing purposes.

An identified interaction with carrier selection is described as options c1) and c2) in Figure 5.

These interactions are also applicable to the two-step number translation principle.

7.5.4.4 Interaction with statistical counters

Standards for circuit quality counters/statistics must be modified to handle QoR conditions; otherwise, alarms might come for functioning circuits/destinations when number of calls to ported-out numbers are high, i.e. a release message should not be handled as an ordinary release before answer.

These interactions are also applicable to the two-step number translation principle.

7.5.5 Procedures based on bilateral agreements

7.5.5.1 Required forward information transfer between networks based on bilateral agreements

In the forward direction, there is a requirement to indicate whether or not Query on Release (QoR) is supported; this is to inform the succeeding network if it must perform the Query (and redirection) or if the release can be sent backwards. An option to this forward call indication is incoming route data according to bilateral agreements principles; this data would indicate whether or not the preceding network has the QoR capability.

For the two-step number translation principle, it is needed to send the Routing Number over network borders.

7.5.5.2 Required backward information transfer between networks based on bilateral agreements

New Rerouting Number "Ported-out number" is sent backwards (e.g. by use of a special cause value or diagnostics information), i.e. when the Donor network keeps some limited data for ported-out numbers so that differing (when compared to real vacant numbers) release information can be given when calls are made to these subscribers. This will reduce the number of NP DB queries made when only a few numbers are ported.

Optionally this backward information is not needed, i.e. when the Donor network keeps no data for ported-out numbers and only returns "vacant number" for calls to these numbers.

7.5.6 NP routing loop detection issues

No loop cases identified for the one-step number translation principle.

For the two-step number translation principle, some loop cases are identified, since this solution involves retrieval of the Routing Number twice.

Loop and NP DB mismatch detection can be performed by Recipient network by comparing received Routing Number (indicating Recipient network ID, i.e. own network) with the Routing Number received from the own NP DB, i.e. the retrieved Routing Number should not indicate other network than own.

8 Dropback

8.1 Network architectures for Service Provider Portability of geographic numbers

This clause describes the network architectures to support portability for geographic numbers using the "Dropback" method. This method is considered as a network option.

8.1.1 Call rerouted by Dropback principles from Donor network

8.1.1.1 General description

One possible alternative to the NPCS-1 Onward Routing solution (as described in reference [1]), is that the Donor network initiates the Rerouting of the call towards the Recipient network according to "Dropback" principles as outlined in Figures 13 and 14. Also, in this scenario, only the Donor network maintains NP information, e.g. the complete address to Recipient network, Exchange or Network Termination Point for ported-out numbers.

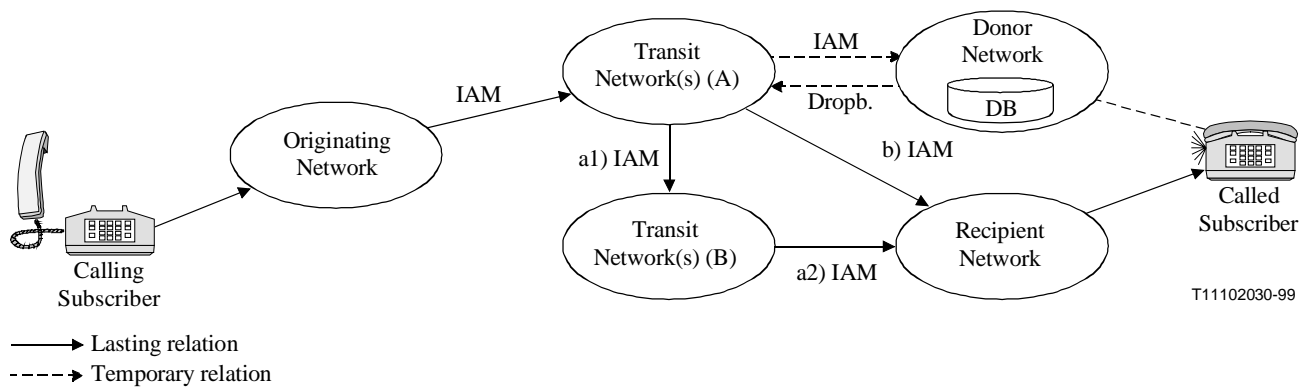


Figure 13 – Dropback with rerouting number and onward rerouting performed by a Transit network

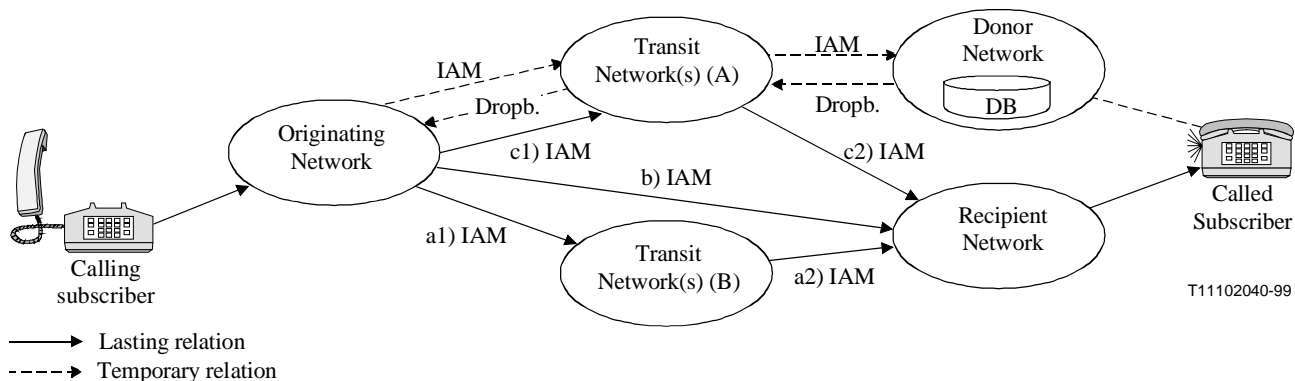


Figure 14 – Dropback with rerouting number and onward rerouting performed by the Originating network

In Figure 13, the Donor network receives an Incoming call. It then detects that the called number has been ported out to another network. Using the received signalling information, the Donor network determines that one of the preceding networks is capable of handling a "Dropback" request. An indication that number is ported out and a Rerouting Number are returned to the preceding network. The Transit network traps the "Dropback" request and reroutes the call onward towards the Recipient network using received backward information; the initial call to the Donor network is then released.

Options a1) and a2) are valid either when Transit network A has no direct interconnection to the Recipient network or when overflow traffic is placed via Transit network B.

Option b) is valid when direct interconnection exists between Transit network A and the Recipient network.

A further evolution of the "Dropback" principle outlined in Figure 13 is that the Dropback request is sent back to the Originating network as shown in Figure 14.

In Figure 14, the Transit network A either has no "Dropback" capability or determines that the preceding network has "Dropback" capability. The Transit network allows the "Dropback" request to pass through to the Originating network. The Originating network, on reception of the "Dropback" request reroutes the call towards Recipient network.

Although the Donor network acts as a "Dropback" network to preceding networks, it can use several of the NP techniques within its network; refer to NPC-1 Supplement [1] for further information.

The Transit networks are optional, i.e. direct connections between Originating network and Donor network may exist, but a Transit network may exist [cases a1) and a2)] between the Originating network and Recipient network.

Options a1) and a2) in Figure 14 are valid either when the Originating network has no direct interconnection to the Recipient network or when overflow traffic is placed via Transit network B.

Option b) in Figure 14 is valid when direct interconnection exists between Originating and Recipient networks.

Options c1) and c2) in Figure 14 are required when the Originating network reroutes the call toward the same Transit network A over which the initial call was established.

8.1.2 Dropback combined with query by Recipient network (two-step number translation principle)

8.1.2.1 General information

This clause describes alternative NP architectures when a two-step number translation principle is used. The first step includes a number translation to obtain partial Routing Number indicating Recipient network (optionally Point of Interconnection) and the second step obtains the complete Routing Number indicating the recipient exchange according to the following:

- 1) Retrieval of partial Routing Number indicating Recipient network only (optionally Point of Interconnection).

This step can either be initiated by:

- a) Dropback from Donor (only calls to ported-out numbers).
- b) Query on Release (only calls to ported-out numbers).

- 2) Retrieval of complete Routing Number indicating recipient exchange and/or Network Termination Point.

Performed by Recipient network either at reception of an incoming call with only partial Routing Number or for all incoming calls (to portable number blocks).

Figure 15 shows an NP solution where the Donor network detects that the called number has been ported out and makes an NP DB query on the received CdPN to retrieve a partial Routing Number to address the Recipient network. It then returns a release message which is sent all the way to Originating network which uses the received Routing Number and routes the call towards the Recipient network either via Transit network(s) or directly [as indicated by options a), b), c) and d)].

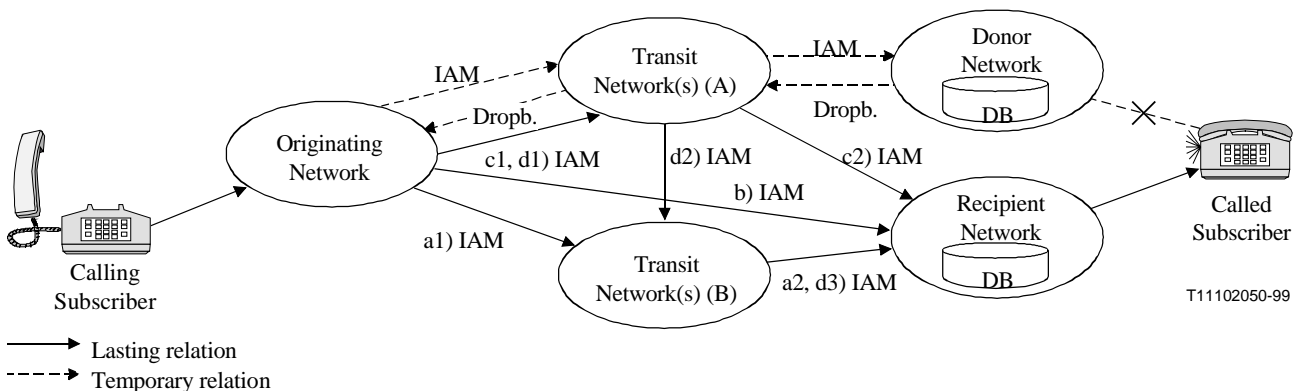


Figure 15 – Dropback combined with query by Recipient network

8.2 Functional Entity model and Information Flow model

8.2.1 Functional Entity model

A Functional Entity (FE) is a group of functions that cannot be split across multiple exchanges. Multiple functional entities can be implemented in a single exchange. Figure 16 shows the Functional Entity model for PNCC-SPP.

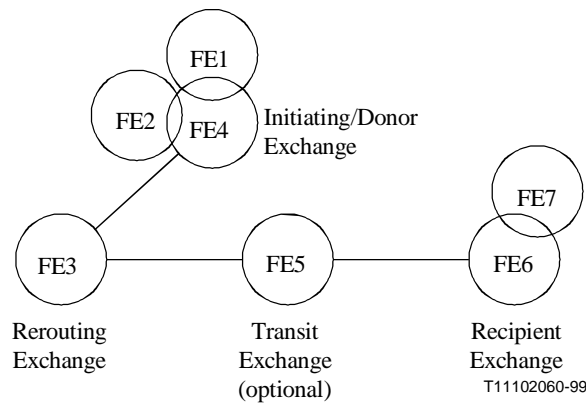


Figure 16 – FE model for PNCC-SPP

Below is a list of the functional entities:

- FE1: portable number detection Functional Entity.
- FE2: portable number query Functional Entity.
- FE3, FE4, FE5 and FE6: basic call functional entities.
- FE7: recipient exchange Functional Entity.

8.2.1.1 Description of portable number detection Functional Entity (FE1)

The portable number detection Functional Entity (FE1) determines whether the call set-up information specifies a connection request to a portable number. If so, this Functional Entity requests that the portable number query Functional Entity (FE2) obtain the routing information for routing the call towards the recipient exchange. Otherwise, this Functional Entity shall return the call to FE4 for further call processing.

8.2.1.2 Description of portable number query Functional Entity (FE2)

The portable number query Functional Entity (FE2) obtains the routing information based on the end user's number to route a call towards the recipient exchange. This information is used by FE3 to route towards the recipient exchange.

NOTE – FE2 may require internodal communication. Therefore, it may be necessary to distribute functionality equivalent to FE2 across multiple functional entities. Annex B provides a Functional Entity model when Intelligent Network functions are invoked to obtain the routing information. Annex B expands FE2 to include additional IN functional entities in the context of the other functional entities.

8.2.1.3 Description of FE3, FE4, FE5 and FE6

FE3, FE4, FE5 and FE6 represent the basic call functional entities. Especially, FE3 and FE4 contain the dropback capabilities. On instruction from FE2, FE4 sends "Dropback" information including RN to FE3. By receiving "Dropback" information from FE4, FE3 modifies the call set-up information to include the routing information to access the recipient exchange, the called number and the NP status indication.

8.2.1.4 Description of recipient exchange Functional Entity (FE7)

The recipient exchange Functional Entity (FE7) recognizes that the call can be completed at this exchange. FE7 will use the call set-up information to complete the call to the portable number.

8.2.2 Information Flow model

Figure 17 shows the Information Flow model between the functional entities for PNCC-SPP. The initiating exchange will use the routing information to route the call through the network or networks to the recipient exchange. In addition, the initiating exchange will send the end user's ported public number along with the call set-up information. The recipient exchange will identify itself as the recipient exchange and use the call set-up information to connect to the correct end user.

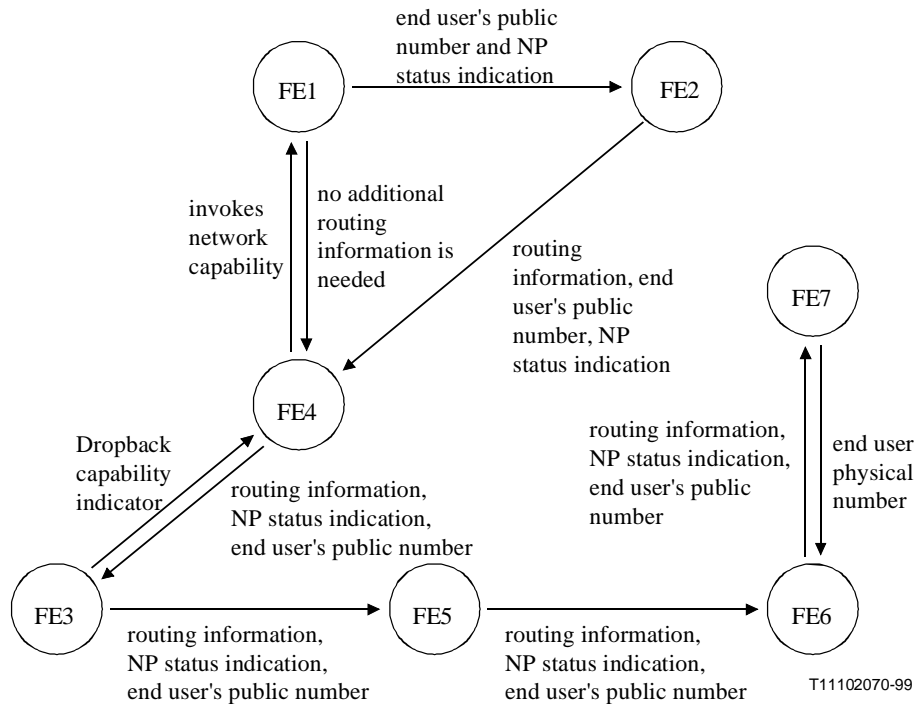


Figure 17 – Information Flow diagram

8.2.2.1 Invoking the portable number detection Functional Entity (FE1)

FE4 invokes FE1 as part of basic call processing.

8.2.2.2 Invoking the portable number query Functional Entity (FE2)

At the initiating exchange, on detection of a portable number, FE1 invokes FE2. FE2 can invoke additional functional entities in order to obtain the routing information. Annex B provides a Functional Entity model when Intelligent Network functions are invoked to obtain the routing number.

8.2.2.3 Invoking the recipient exchange Functional Entity (FE6)

FE6 invokes FE7 on receipt of PNCC-SPP information in an incoming call.

8.2.2.4 Activation and deactivation of PNCC-SPP network capability

Activation and deactivation of PNCC-SPP is done on a per-exchange or per-network basis.

8.2.2.5 Exceptional procedures

If FE2 cannot obtain routing information corresponding to a given called number, FE2 shall attempt to progress the call using the called number and normal call routing procedures.

- 1) If the initiating exchange is the donor exchange for the called number, then the call cannot be routed to any other exchange and shall be released after appropriate treatment (tone or announcement).
- 2) At any exchange other than the donor exchange, the call should be routed on towards the donor exchange using the original called party number and with an NP status indication designating that the status of the portable number was not determined.

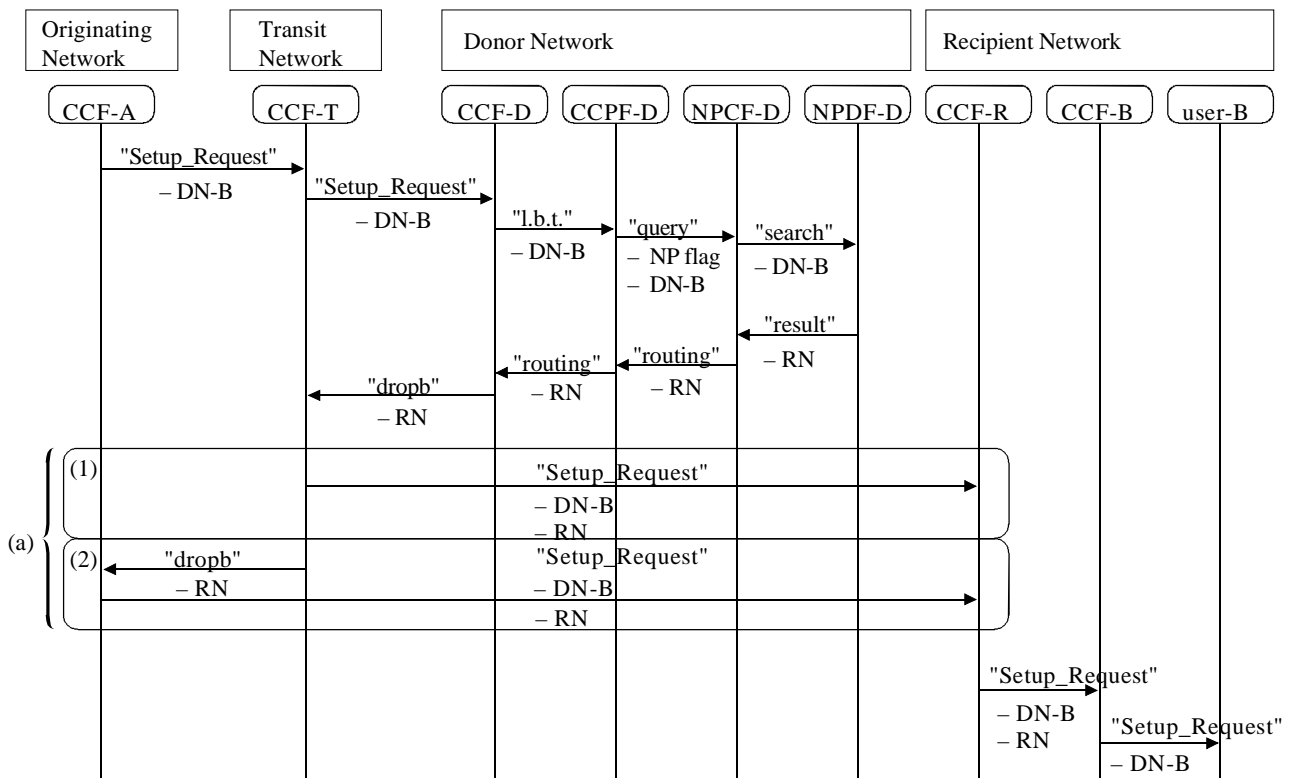
8.2.3 Allocation of functions to equipment

FE1, FE2 and FE4 must reside in the initiating exchange/donor exchange. FE3 resides in the rerouting exchange. FE5 resides in the transit exchange. FE6 and FE7 reside in the recipient exchange.

8.3 Generic Information Flows

8.3.1 Call rerouted by Dropback principles from Donor network

In Figure 18, the Originating network routes the call to the Recipient network based on the number block that contains the called party number. Also the Donor network has armed a "line-based trigger", stating the called number is ported out. It then makes an NP DB query, using INAP, to retrieve a Routing Number. The Routing Number is subsequently passed to the preceding network.



T11102080-99

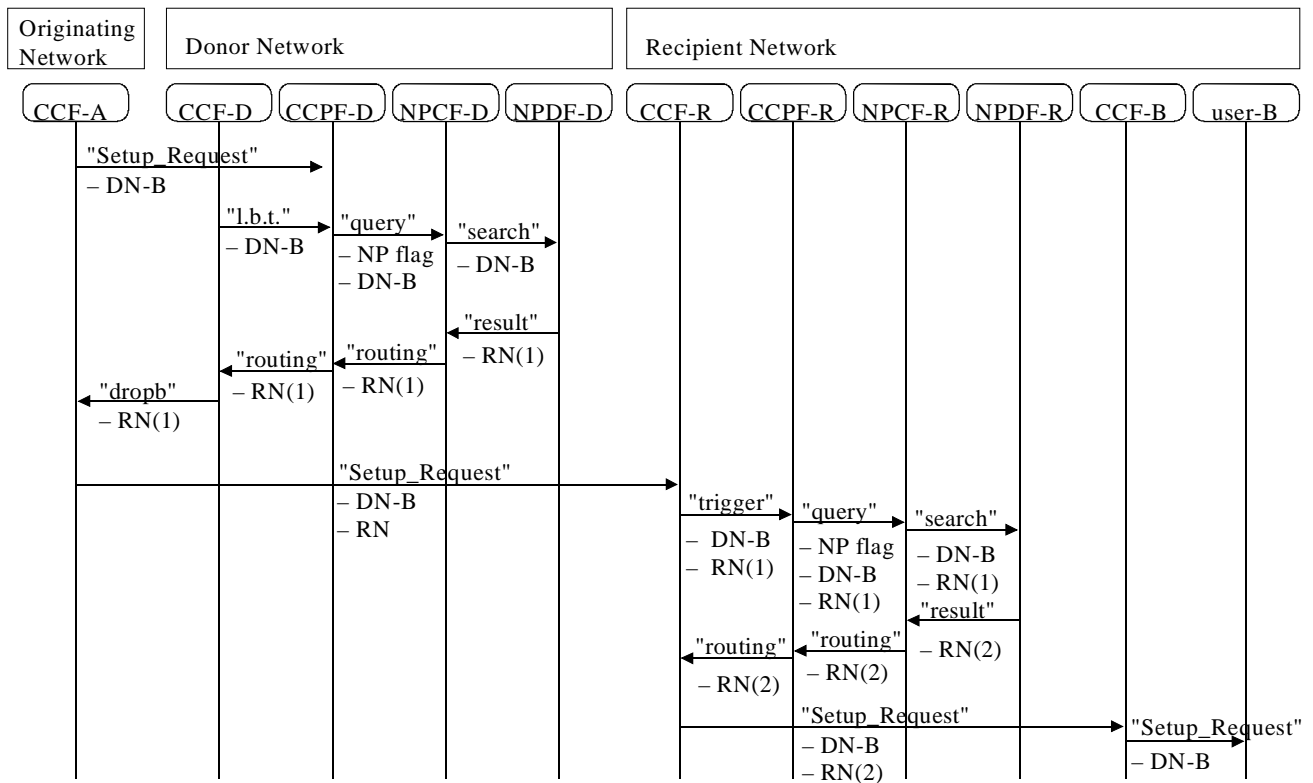
- CCF-A/B/D CCF calling party/called party/Donor network
- CCF-T/R CCF Transit network/Recipient network
- CCPF-R/D CCPF Recipient/Donor
- NPCF-R/D NPCF Recipient/Donor
- NPDF-R/D NPDF Recipient/Donor
- query An event sent from SSF to SCF to obtain instructions on how to proceed
- RN Routing Number (e.g. Network Termination Point)
- DN-B Directory Number, called party
- NP flag A flag indicating requested service is NP number translation.
- l.b.t Line-Based Trigger, an event from CCF informing SSF that a call to a number with an armed line-based trigger is received
- routing An operation from SSF storing a new routing number in CCF
- dropb Dropback of routing information

Notes (a) rerouting { (1) performed by Transit Network
 (2) performed by Original Network

Figure 18 – Generic Information Flows supporting Figures 13 and 14

8.3.2 Dropback combined with query by Recipient network

In the generic Information flows in Figure 19, when the call is received in the Recipient network a new query is performed, in a similar way, to obtain a routing number to address the recipient exchange and/or Network Termination Point.

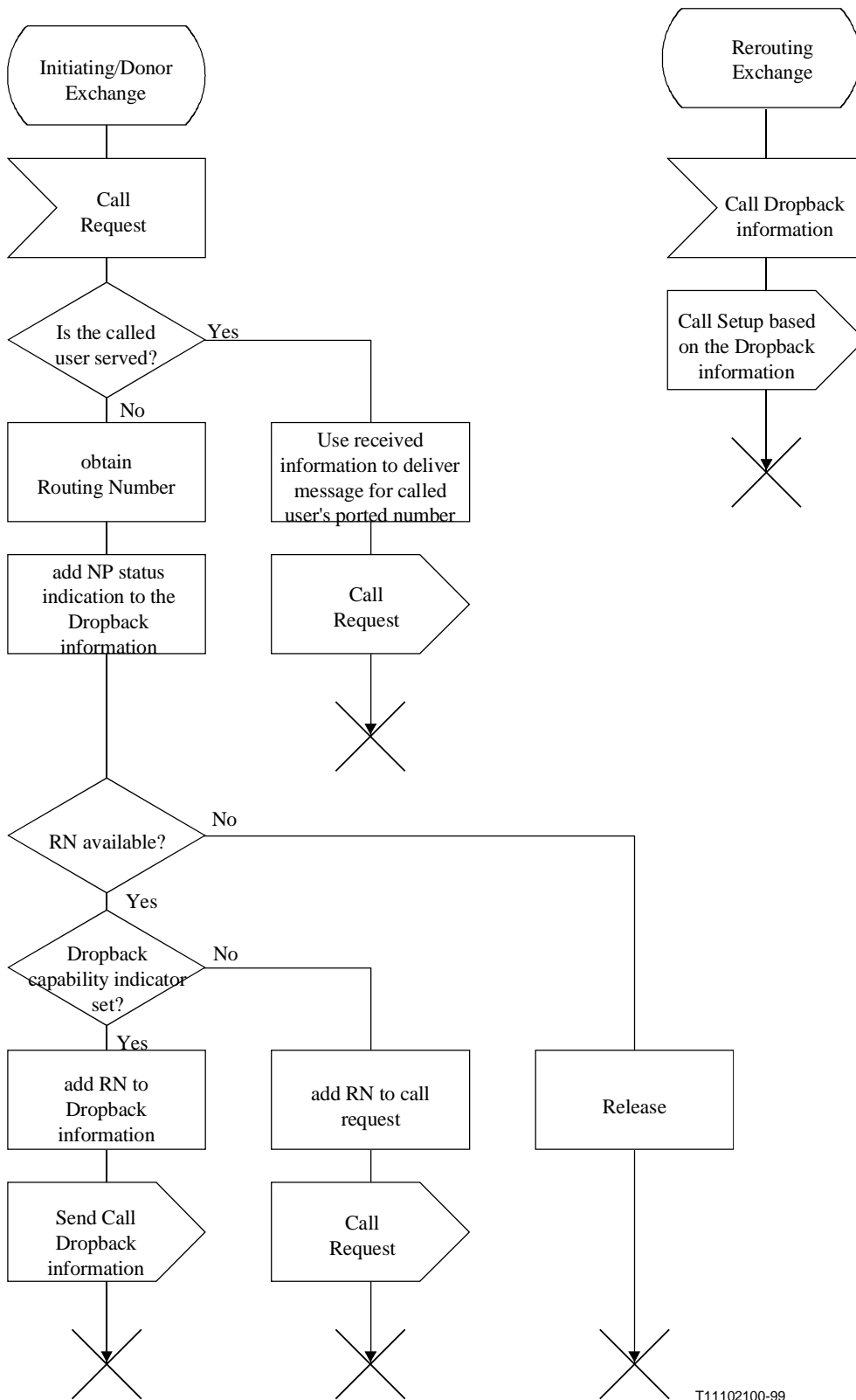


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- CCF-A/B/D/R CCF calling pty/called pty/Donor/Recipient network
- CCPF-R/D CCPF Recipient/Donor
- NPCF-R/D NPCF Recipient/Donor
- NPDF-R/D NPDF Recipient/Donor
- query An event sent from SSF to SCF to obtain instructions on how to proceed
- RN(1) Routing Number (e.g. Recipient Network)
- RB(2) Routing Number (e.g. Network Termination Point)
- DN-B Directory Number, called party
- NP flag A flag indicating requested service is NP number translation.
- I.b.t Line-Based Trigger, an event from CCF informing SSF that a call to a number with an armed line-based trigger is received
- routing An operation from SSF storing a new routing number in CCF
- dropb Dropback of routing information

Figure 19 – Generic Information flows supporting Figure 15

8.4 SDL



T11102100-99

Figure 20 – PNCC-SPP procedure for Dropback

8.5 Procedures for Dropback method

8.5.1 Normal procedures

8.5.1.1 Portable Number Call Control for Service Provider Portability

This description of PNCC-SPP uses the configuration shown in Figure 1 and assumes that the Originating network/exchange either terminates the call locally or routes the call to the initiating network/exchange using the called number. The initiating network/exchange will determine whether the called number is portable or not.

When it is determined that the called number is portable, the initiating network/exchange determines whether the number is ported, then uses the called end user's portable public number to obtain a Routing Number (RN). In the Dropback method, the information is sent in the backward direction to the rerouting network/exchange. The rerouting network/exchange makes a call set-up based on the information and the initial call between the initiating network/exchange and the rerouting network/exchange is released. In addition, the initiating network/exchange may send an indication that the NP database query of the portable number has been done. The RN is used by the initiating network/exchange and any Transit networks/exchanges to route the call.

As a minimum requirement, the address used as RN identifies either the recipient exchange or the Recipient network serving the ported number. See reference [1] for information related to routing and addressing.

When the routing on RN of a call to a ported number applies, both the RN and the end user's number shall be transferred along with the call to accomplish a two-level addressing scheme. Transfer of the RN shall provide for backward compatibility in routing. The end user's number shall be conveyed transparently. Sending of the RN and NP status indication between networks is optional and subject to bilateral agreements.

The recipient exchange uses the RN, NP status indication and the user's portable public number to route the call to the end user.

Specific actions shall be applied in the SS7 signalling in order to cope with the potential looping problem of calls to ported numbers.

Some exchange functions provided by separate exchanges in Figure 1 are provided in common exchanges in the configurations in Figures 2 and 3. In these cases, references in the description above to routing the call between two exchanges that are the same exchange should be ignored.

The PNCC-SPP capability completes calls to a portable number regardless of where the call originated. There are no modifications required for the international SS7 capabilities. For handling incoming international calls to a portable number, the incoming International Switching Centre (ISC) may provide the functions of the initiating exchange.

8.5.2 Exceptional procedures

PNCC-SPP requires call routing information in order to direct calls to portable numbers to the exchange serving the called end user. When an exchange normally serving as a PNCC-SPP initiating exchange is unable to obtain this routing information, its procedure depends on whether or not the exchange is the donor exchange for the call.

- 1) If the exchange is not the donor exchange for the call, it should route the call using normal procedures. As an option, the NP status indication may be sent indicating that the status of the portable number was not determined.

- 2) If the exchange is the donor exchange, it should always be able to determine if the called user's number is still located at this exchange or is not being served by this exchange.
 - a) If the exchange still serves the called user, the call shall be completed.
 - b) If the called user's number is not being served by this exchange, the call cannot be completed without the routing information. The call shall be released or connected to an appropriate tone or announcement.

8.5.3 Interworking considerations

PNCC-SPP uses the existing ISUP call set-up procedures and circuit selection procedures. PNCC-SPP assumes the use of ISUP between the initiating exchange and the recipient exchange to carry additional information, i.e. NP status indication and ported number. Dropback requires the use of ISUP between the initiating/the donor exchange and the rerouting exchange, in order to carry the additional information required, i.e. Dropback capability indicator.

In some interworking scenarios, the interworking exchange continues in-band call set-up using the end user's number. In this case, PNCC-SPP functions end at the interworking exchange.

8.5.4 Interactions

8.5.4.1 Interaction with supplementary services

None of the supplementary services defined by ITU-T are affected by the PNCC-SPP network capability. The end user's number is unaffected by this network capability. Supplementary services relying on the end user's number may be impacted by this network capability due to this new routing method. Existing network and supplementary services will still be able to identify the calling end user.

Since the calling party number of the subscriber is retained for both ported and non-porting numbers, the services are preserved through the following:

- 1) The calling party number of a ported calling party shall identify the end user's number (i.e. the ported number).
- 2) The Calling Line Identification Presentation (CLIP) supplementary service and Connected Line Identification Presentation (COLP) supplementary service shall work in the same way as for subscribers that are not ported.
- 3) Calls to emergency services, courier services, taxis and other services using a nationwide called party number shall work in the same way as for subscribers that are not ported.

In addition, additional information associated with the ported calling party will need to be transported. This information may include:

- Geographic location of the calling subscriber.
- Unique Identifier of the network point (at least exchange ID) of the calling subscriber.

The "Dropback" information must not be sent backwards through the Exchange that has performed a Call Forwarding service like CFU, CFB or CFNR, etc. This to avoid unwanted interference with these kinds of services.

When the "Dropback" mechanism is used, there may be a need to assure that when call forwarding is encountered, the diverting exchange shall act as the originating exchange. This may avoid adverse interactions between Number Portability and Call Forwarding supplementary services.

These interactions are also applicable to the two-step number translation principle.

8.5.4.2 Interaction with IN-based services

The "Dropback" information must not be sent through the SSP that has performed an IN service like PN, UPT, VPN, UAN, etc. This to avoid unwanted interference with these kind of IN-based services.

When the "Dropback" mechanism is used, there may be a need to assure that when IN-based services (e.g. PN, UPT, VPN, UAN, etc.) are encountered, the SSP shall act as the originating exchange. This may avoid adverse interactions between Number Portability and IN-based services.

These interactions are also applicable to the two-step number translation principle.

8.5.4.3 Interaction with carrier selection

The carrier selection functions of the originating end user are not influenced by Number Portability.

The "Dropback" solution shall not interfere with carrier selection.

8.5.4.4 Interaction with statistical counters

Standards for circuit quality counters/statistics must be modified to handle Dropback conditions, otherwise alarms might come for functioning circuits/destinations when number of calls to ported-out numbers are high, i.e. a Dropback information should not be handled as an ordinary release before answer.

These interactions are also applicable to the two-step number translation principle.

8.5.5 Procedures based on bilateral agreements

8.5.5.1 Required Forward information transfer between networks based on bilateral agreements

In the Forward direction (IAM), towards the Donor network, an indicator is required to confirm whether or not "Dropback" is supported. This is to inform succeeding networks if it must do the Rerouting or if the Dropback information can be sent backwards, i.e. "Dropback" can only be performed when a preceding network has the functionality to perform Rerouting based on returned Routing Number.

An option, not requiring the indication, is the use of bilateral agreements, e.g. a route indicator which indicates if preceding network has the Dropback capability.

Another option, not requiring the indicator, is a homogenous network, i.e. all interconnection exchanges have "Dropback" capability.

8.5.5.2 Required Backward information transfer between networks based on bilateral agreements

Routing Number must be sent in the backward direction, from Donor network, to inform preceding networks about the routing number of the ported user.

For the two-step number translation principle, the transfer of the Routing Number in the Dropback indication is mandatory in the backward direction, from Donor network. The information is needed for Transit network or Originating network to perform rerouting to the Recipient network and Recipient exchange.

8.5.6 NP routing loop detection issues

No loop cases identified.

9 Signalling requirements

The following list is a cumulative list of Number Portability signalling requirements and supersedes previous lists.

Based on the preceding clauses of this Supplement, these requirements are relevant to circuit-related and/or non-circuit-related signalling:

- 1) The signalling mechanisms that support Number Portability should not place any restrictions on the PSTN and ISDN services, including basic, supplementary and non-circuit-related-based services.
- 2) Number Portability solutions shall allow that Transit network(s) be used between Originating and Donor/Initiating networks.
- 3) Number Portability solutions shall allow that Transit network(s) be used between Donor/Initiating and Recipient networks.
- 4) Number Portability solutions shall not interfere with carrier selection.
- 5) Interoperability of the various methods must be provided, e.g. the signalling must be capable of providing interworking between onward routing and other methods.
- 6) NP should not result in the looping of calls or messages.
- 7) Outgoing international calls or messages shall be unaffected.
- 8) It shall be possible to signal an indication that the NP status, if available, of the portable number has been determined. The indication may be included for either ported or non-portable numbers.
- 9) Only the E.164 number (not including prefixes, etc.) should be considered eligible to be ported.
- 10) The entire E.164 number and not only part of it should be ported.
- 11) Single numbers within an MSN can only be ported if a different access is provided to the ported number.
- 12) Groups of contiguous numbers (e.g. DDI/multiline groups) can be ported.
- 13) Porting of single numbers within a DDI range is not allowed.
- 14) The privacy of the user which has ported his/her number should be guaranteed. That means that the calling/called party should not be informed that the called/calling party has ported his number.
- 15) Number Portability should not affect the dialling procedures for calls incoming to the ported number.
- 16) The dialling procedures for calls outgoing from the ported customer should be the same as those of non-portable customers served by the same Service Provider.
- 17) Introducing service provider portability must not adversely affect conformance with national or international propagation and echo standards.
- 18) Calling Line Identification Presentation (CLIP) supplementary service and Calling Line Identification Restriction (CLIR) supplementary service shall work in same way as for subscribers not porting the number. For the CLIP supplementary service, if the call is originated by a calling user which has been ported, the calling line identification is the ported number. This is valid for both PSTN and ISDN subscribers.
- 19) Connected Line Identification Presentation (COLP) supplementary service and Connected Line Identification Restriction (COLR) supplementary service shall work in the same way as for subscribers not porting the number. For the COLP supplementary service, if the called user's number has been ported, the connected line identity presented to the calling user is the ported number. This is valid for both PSTN and ISDN subscribers.

- 20) Calls from a ported number to the emergency services should be supported by the same functionality as are calls from non-ported numbers to the emergency services.
- 21) Variable number length must be supported.
- 22) Overlap signalling must be supported before and after obtaining the routing number.
- 23) The redirection counter, used for the Diversion services, must not be stepped at redirection by a Number Portability procedure.
- 24) There shall be transparent support for NP at transit nodes.
- 25) It shall be possible to transfer both an Unchanged Called Party Number (CdPN) and a Routing Number (RN) unambiguously.
- 26) It shall be possible to indicate one or all of the following destinations with the Routing Number (RN):
 - i) Recipient Network ID (RNID); and/or
 - ii) Point of Interconnection (POI); and/or
 - iii) Recipient Exchange (REX); and/or
 - iv) Network Termination Point (NTP).
- 27) An indication in the forward direction to indicate a call to a ported number.
- 28) In an environment of Number Portability, calls from ported numbers must convey both logical and physical calling party information.
- 29) RN need not be in E.164 format. However, the format must be specified for the RN.
- 30) For incoming international calls, the incoming gateway in the network should be considered as the Originating network for Number Portability.
- 31) The Number used to route the call is constructed as one of the following:
 - i) Concatenated Address = Routing Number + DN (as a single piece of information).
 - ii) Separated Address = Routing Number and DN (as two separate pieces of information).
 - iii) DN only.
- 32) SCCP addressing based on RN for the called party should be supported.
- 33) The sum total of the networks involved in addressing and routing non-circuit-related messages pertaining to a ported number shall be able to detect that the number has been ported and derive the identity of the appropriate destination of the message. The division of responsibilities of this among the networks depends on the architecture chosen.
- 34) Number Portability solutions should be backward compatible with nodes and services not updated for NP (it is likely that backward compatibility will not extend to some prior versions of some Signalling System No. 7 protocols).
- 35) To support "Query on Release (QoR)" principles, there should be a network option allowing Donor network/Exchange to indicate in the backward direction that the dialled Number is:
 - Ported-out

This case is used when the Donor network also keeps track of status for all numbers that are part of dialled Number Series and therefore can differentiate between ported-out and vacant numbers. Number Portability Database (NP DB) look up shall be done if this indication is set.
 - It shall be possible to transfer "ported-out" indication, transparently through network elements without QoR support

The "ported-out" indication for QoR must not be sent beyond the initiating exchange to avoid interference.

- 36) To support "Query on Release (QoR)" principles, there is a requirement that as an option, an indication about support of QoR mechanism can be transported through the network in the forward direction.
- between networks the absence of indication shall be treated as "no support".
- It shall be possible to transfer the indication, transparently through network elements without QoR support.
- 37) To support "Dropback" principles, it should be possible as a network option to transfer an RN in the Backward direction.
- 38) To support "Dropback" principles, there is a requirement that as a network option, an indication about support of Dropback mechanism can be transported through the network in the Forward direction.
- Between networks the absence of indication shall be treated as "no support".
- It shall be possible to transfer the indication, transparently through network elements without Dropback support.
- 39) Depending on the Number Portability mechanism used, there may be a need to assure that when call forwarding is encountered, the diverting exchange shall act as the originating exchange. This may avoid adverse interactions between Number Portability and Call Forwarding supplementary services.
- 40) Depending on the Number Portability mechanism used, there may be a need to assure that when IN-based services (e.g. PN, UPT, VPN, UAN, etc.) are encountered, the SSP shall act as the originating exchange. This may avoid adverse interactions between Number Portability and IN-based services.
- 41) Standards for circuit quality counters/statistics must be modified to handle Number Portability conditions to avoid unnecessary alarms being generated (e.g. Dropback message).

NOTE 1 – The following signalling requirements are not applicable for the non-circuit-related signalling: 4, 15, 16, 17, 18, 19, 22, 23, 25, 27, 28, 31, 35, 36, 37, 38, 39, 40, 41.

NOTE 2 – The following signalling requirements are not applicable for the circuit-related signalling: 32, 33.

ANNEX A

Intelligent Network Support for PNCC for Service Provider Portability using QoR

A.1 Scope

This annex covers Intelligent Network (IN) requirements, taking account of current and emerging Intelligent Network standards, to support Number Portability for geographic numbers as defined in PNCC-SPP. The annex defines an approach for an IN solution for obtaining the routing number for Number Portability. The IN capabilities may exist in the originating, donor, transit or recipient networks or exchanges. This annex identifies and defines functions that may be needed by IN to support PNCC-SPP. Additional mechanisms for obtaining the routing number are not excluded by this annex.

Intelligent Network (IN), with respect to Number Portability, provides the capability to obtain routing information for ported/portable numbers to support routing of incoming calls to the Recipient network and to the recipient exchange. Specifically, this annex addresses the IN capabilities needed to support the "Query on Release" principle.

See the Q.12xx series of Recommendations for the general IN definitions, terms and functions.

A.2 General description

This subclause describes the functions for IN support of Portable Number Call Control for Service Provider Portability (PNCC-SPP) for geographic numbers. For general information related to the definitions, terms and architecture, see reference [1].

A.2.1 General assumptions

The following list outlines the assumptions for the IN requirements:

- a) Support for overlap signalling before and after the routing number is obtained.
- b) Triggering on "release"-based trigger can be initiated from originating, transit and donor networks.
- c) Triggering from the Recipient network may be initiated only on number blocks or individual end user numbers-based trigger.
- d) IN queries from the exchanges access a real-time database system which responds with the routing information back to the exchange.

A.2.2 Number portability data

PNCC-SPP requires additional information in order to route the call from the Originating network to the Recipient network. Signalling protocols used by IN already support the transfer of the called party's end user number but separate transfer of routing information (i.e. Routing Number) require signalling enhancements. This subclause outlines additional information that may need to be transferred between an exchange and a number portability database.

A.2.2.1 Calling party information

In order to obtain the location of the calling party, e.g. for emergency calls or for a local weather forecast, there is a need to transfer Geographic Location information together with the Calling Party Number.

A.2.2.2 Routing numbers

In addressing the Recipient network or/and Recipient Exchange the following addressable entities, depending on the structure for the Routing Number, are identified:

- 1) *Recipient network*
Here, the routing number identifies the network where the customer is now located.
- 2) *Point of interconnection*
Here, the routing number identifies a gateway or Point of Interconnection (POI) to the next network in the routing process.
- 3) *Recipient exchange*
Here, the routing number identifies the exchange where the customer's number is now being served.

A.2.3 IN support for Service Provider Portability of geographic numbers

The requirement for IN support of PNCC-SPP incorporates triggering of called end user in a portable number range and performing an IN Number Portability database query. If the number has been ported, the response will be a routing number and an indication that the number has been ported. INAP (Intelligent Network Application Protocol) is the protocol used between the switching network and database.

A special function is needed to support the case where DDI ranges have variable length (within a number range). This requires overlap signalling even after number translation all the way to the PBX, since the number length (per unique number) is controlled by the PBX owner.

The IN queries, to obtain a routing number, are applicable both for circuit-related signalling (call set-up) and for non-circuit-related signalling (TC-based services).

The overlap signalling is only applicable for circuit-related signalling, since the complete destination must be reached (i.e. all digits received) before the calling subscriber is able to activate, e.g. CCBS and CCNR services.

A.2.3.1 IN trigger conditions for circuit-related signalling to geographic numbers

Triggering of an IN NP DB query, during call set-up, can be due to:

- Query on Release: This solution could incorporate IN triggering based on a "release"-based trigger.

The trigger is applicable to originating, transit exchanges and donor network.

- A received call to "portable number" with a "number block"-based trigger.

The trigger is applicable to Recipient network.

A.2.3.2 IN trigger conditions, non-circuit-related signalling to geographic numbers

Triggering of an IN DB query, during non-circuit-related signalling, can in principle be due to:

- a) an end user's number being identified as ported-out, i.e. a single number-based trigger or a number block-based trigger;
- b) a received call to "portable number", i.e. a number block-based trigger.

The triggers are applicable to originating, donor, transit and recipient exchanges in addition to the Signalling Relay Points.

NOTE – It is possible that an IN DB query could lead to violation of the transit time requirements in Table 2/Q.716.

A.2.4 Information Flows for PNCC-SSP using the IN architecture

The following description gives an example of the scenario for Geographic Number Portability Solutions where IN architecture is used to support NP-related number translation and call control. The example/solution focuses on actions required by IN functional/physical entities.

The special actions required for variable number length and variable DDI length is shown in some scenarios only, but is applicable to all scenarios.

The location of NP database is not the critical issues in the figures; instead, the point where query is made and what caused the IN triggering are the important issues.

The variations of interconnections are only examples since the actual interconnection is network dependent.

Transit networks are optional and included to depict interconnection topologies when routing calls/services towards ported/portable geographic numbers.

High-level network models for service provider portability of geographic numbers are described in reference [1].

A.2.4.1 Query on Release combined with query by Recipient network

Figure A.1 shows an NP solution where the Donor network detects that the called number has been ported out. It then returns a release message, with a special indication "ported" The release message is sent all the way to the Originating network. The Originating network makes a NP DB query on the CdPN to retrieve a partial Routing Number to address the Recipient network, routes the call towards the Recipient network either via Transit network(s) or directly.

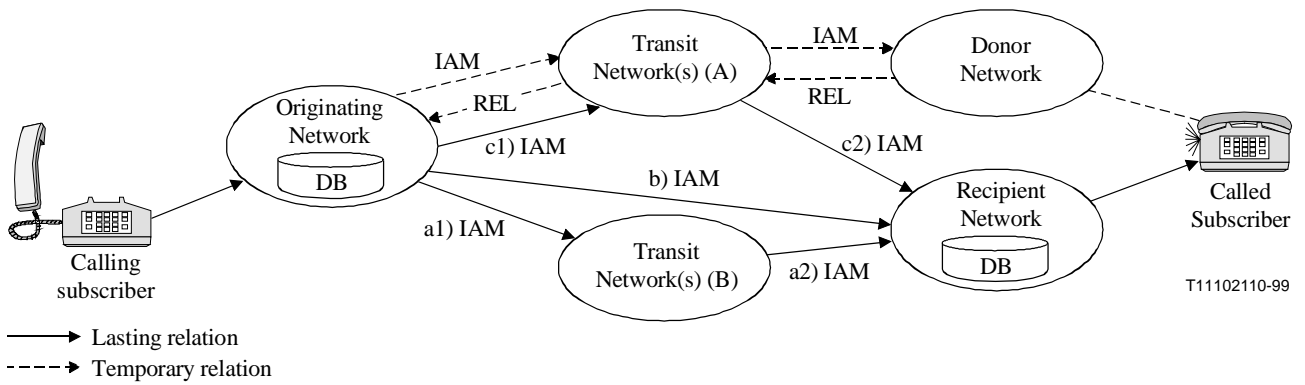


Figure A.1 – Query on Release combined with query by Recipient network

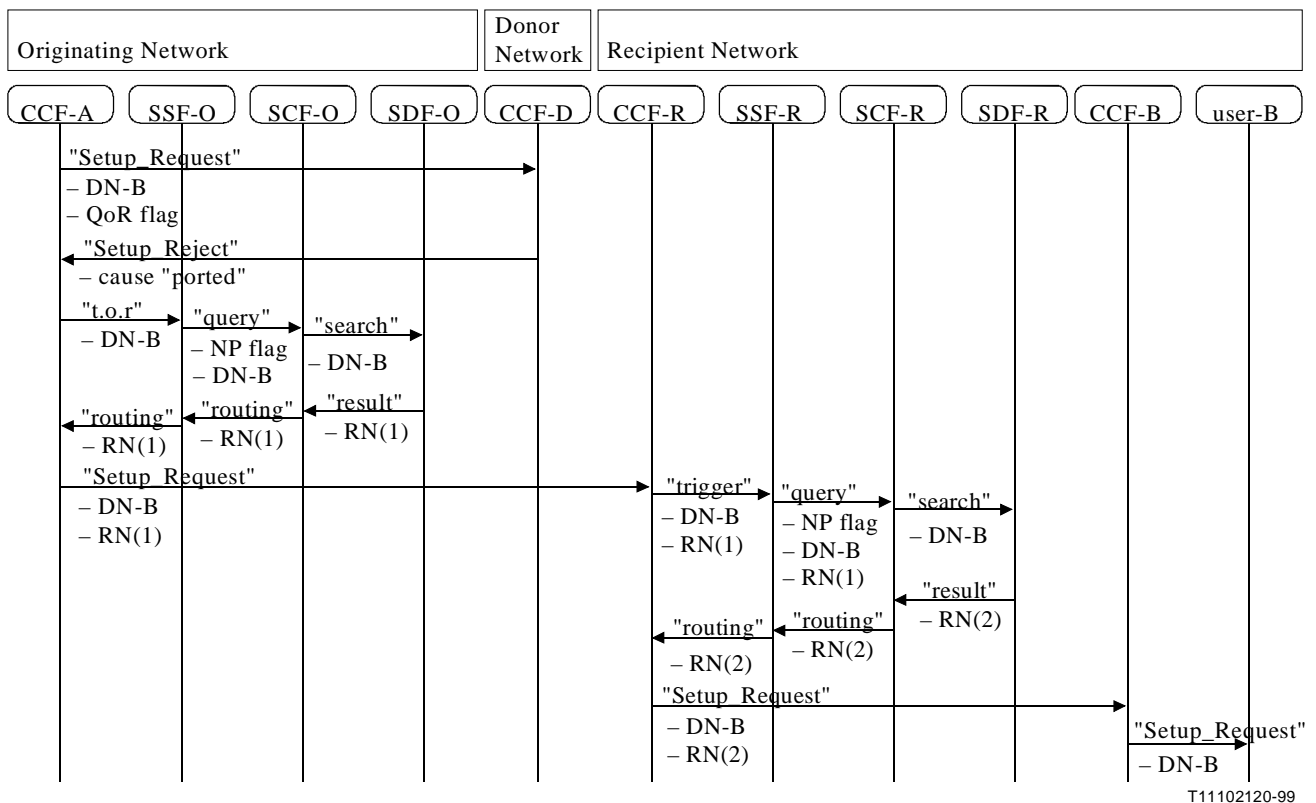
In all the above solutions, the NP DB outside the Recipient network contains routing number to address the Recipient network only.

The routing number can be enclosed in the forward message to avoid NP DB query in Transit networks(s) and to enable trapping of NP DB mismatch by the Recipient network.

A.2.4.2 Generic information flows

As can be read from the flows in Figure A.2, the Originating network is considered as the Serving network since it performs the NP trap function and obtains the RN towards the Recipient network.

The second query, in the Recipient network, is not required in the case that the first step obtains the complete address to the Recipient Exchange.



T11102120-99

- CCF-A/B/D CCF calling party/called party/Donor ex.
- SSF-O/R/D CCPF Originating/Recipient/Donor
- SCF-O/R/D SCF Originating/Recipient/Donor
- SDF-O/R/D SDF Originating/Recipient/Donor
- query An event sent from CCPF to NPCF to obtain instructions on how to proceed
- RN(1) Routing Number (e.g. Recipient Network ID)
- RN(2) Routing Number (e.g. Recipient Network and Exchange ID)
- DN-B Directory Number, called party
- NP flag A flag indicating requested service is NP number translation
- t.o.r Trigger on Release, an event from CCF informing CCPF that a release indicating "ported" subscriber has been received
- routing An operation from CCPF storing a new routing number in CCF

Figure A.2 – Information Flows for IN-structured support of Figure 1 (i.e. a two-step "Query on Release" solution)

ANNEX B

Intelligent Network support for PNCC for Service Provider Portability using Dropback

B.1 Scope

This annex covers Intelligent Network (IN) requirements, taking account of current and emerging Intelligent Network standards, to support Number Portability for geographic numbers as defined in PNCC-SPP. This annex defines an approach for an IN solution for obtaining the routing number for Number Portability. The IN capabilities may exist in the Donor networks or exchanges. This annex identifies and defines functions that may be needed by IN to support PNCC-SPP. Additional mechanisms for obtaining the routing number are not excluded by this annex.

Intelligent Network (IN), with respect to Number Portability, provides the capability to obtain routing information for ported/portable numbers to support routing of incoming calls to the recipient

network and to the recipient exchange. Specifically, this annex addresses the IN capabilities needed to support the "Dropback" principles.

See the Q.12xx series of Recommendations for the general IN definitions, terms and functions.

NOTE – IN solution is not mandatory for Dropback method.

B.2 General description

This subclause describes the functions for IN support of Portable Number Call Control for Service Provider Portability (PNCC-SPP) for geographic numbers. For general information related to the definitions, terms and architecture, see reference [1].

B.2.1 General assumptions

The following list outlines the assumptions for the IN requirements:

- a) Support for overlap signalling before and after the routing number is obtained.
- b) Triggering on number blocks or individual end user numbers.
- c) Triggering can be initiated from Donor networks.
- d) IN queries from the exchanges access a real-time database system which responds with the routing information back to the exchange.

B.2.2 Number Portability data

PNCC-SPP requires additional information in order to route the call from the Originating network to the Recipient network. Signalling protocols used by IN already support the transfer of the called party's end user number, but separate transfer of routing information (i.e. Routing Number) requires signalling enhancements. This subclause outlines additional information that may need to be transferred between an exchange and a Number Portability database.

B.2.2.1 Calling party information

In order to obtain the location of the calling party, e.g. for emergency calls or for a local weather forecast, there is a need to transfer Geographic Location information together with the Calling Party Number.

B.2.2.2 Routing numbers

In addressing the Recipient network or/and Recipient Exchange, the following addressable entities, depending on the structure for the Routing Number, are identified:

- 1) *Recipient network*
Here, the routing number identifies the network where the customer is now located.
- 2) *Point of interconnection*
Here, the routing number identifies a gateway or Point of Interconnection (POI) to the next network in the routing process.
- 3) *Recipient exchange*
Here, the routing number identifies the exchange where the customer's number is now being served.
- 4) *Network termination point*
Here, the routing number identifies the subscriber/access line/service.

B.2.3 IN support for Service Provider Portability of geographic numbers

The requirement for IN support of PNCC-SPP incorporates triggering of called end user and performing an IN Number Portability database query. If the number has been ported, the response will be a routing number and an indication that the number has been ported. INAP (Intelligent Network Application Protocol) is the protocol used between the switching network and database.

Special functions are needed to support the cases where:

- a) Number ranges have variable length
This might require multiple IN NP DB queries, e.g. by request for more data, depending on number length knowledge in SSP.
- b) DDI ranges have variable length (within a number range)
This requires overlap signalling even after number translation all the way to the PBX, since the number length (per unique number) is controlled by the PBX owner.

The IN queries, to obtain a routing number are applicable both for circuit-related signalling (call set-up) and for non-circuit-related signalling (TC-based services).

NOTE – Options a) and b) are only applicable for circuit-related signalling, since the complete destination must be reached (i.e. all digits received) before the calling subscriber is able to activate, e.g. CCBS and CCNR services.

B.2.3.1 IN trigger conditions for circuit-related signalling to geographic numbers

Triggering of an IN NP DB query, during call set-up, can in principle be due to an end user's number being identified as ported-out, i.e. a "ported or vacant number"-based trigger.

The triggers are applicable to donor exchanges.

B.2.3.2 IN trigger conditions, non-circuit-related signalling to geographic numbers

Triggering of an IN DB query, during non-circuit-related signalling, can in principle be due to:

- a) an end user's number being identified as ported-out, i.e. a single number-based trigger or a number block-based trigger;
- b) a received call to "portable number", i.e. a number block-based trigger.

The triggers are applicable to originating, donor, transit and recipient exchanges in addition to the Signalling Relay Points.

NOTE – It is possible that an IN DB query could lead to violation of the transit time requirements in Table 2/Q.716.

B.2.4 Information Flows for PNCC-SSP using the IN architecture

The following descriptions give some examples of possible scenarios for Geographic Number Portability Solutions where IN architecture is used to support NP-related number translation and call control. The examples/solutions focus on actions required by IN functional/physical entities.

The special actions required for variable number length and variable DDI length are shown in some scenarios only, but are applicable to all scenarios.

The location of NP database is not the critical issue in the figures; instead, the point where query is made and what caused the IN triggering are the important issues.

The variations of interconnections are only examples since the actual interconnection is network dependent.

Transit networks are optional and included to depict interconnection topologies when routing calls/services towards ported/portable geographic numbers.

High-level network models for service provider portability of geographic numbers are described in reference [1].

B.2.4.1 Dropback from Donor, combined with the query Donor network

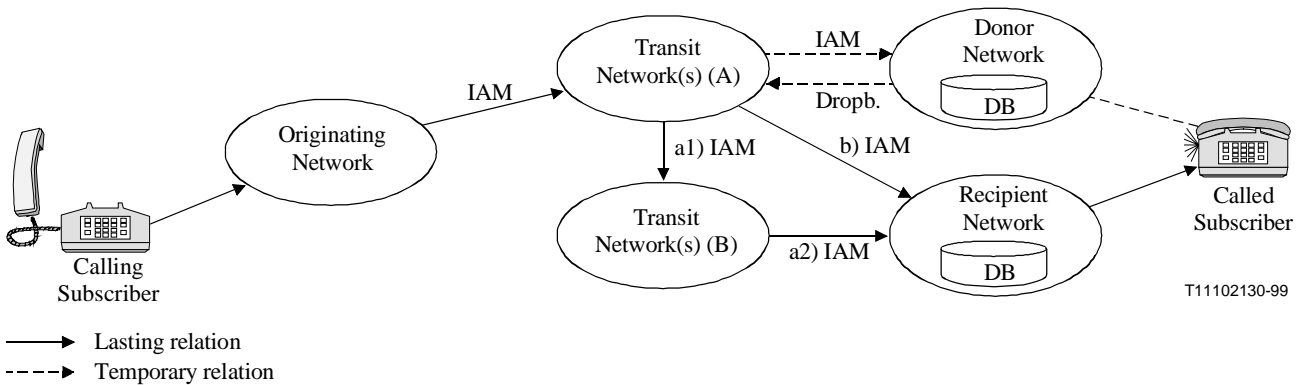


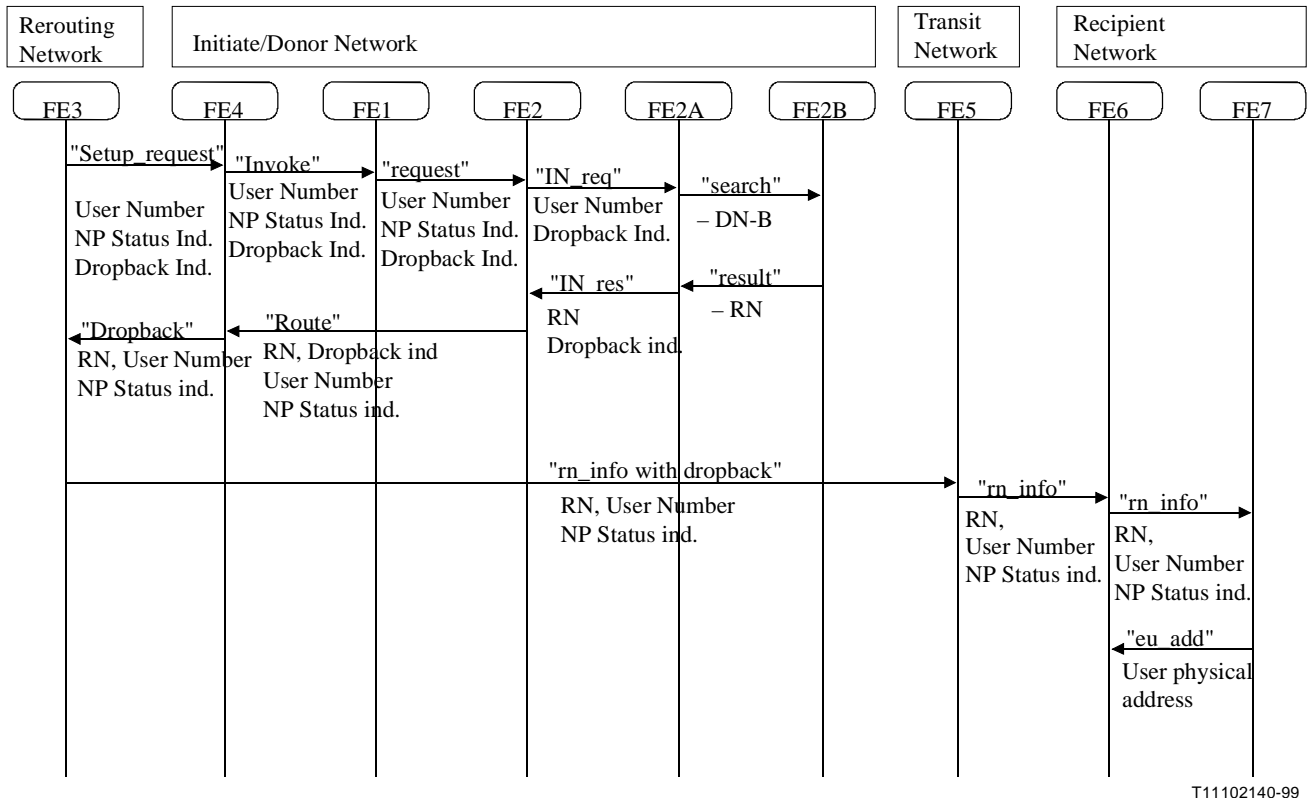
Figure B.1 – Dropback combined with query by Recipient network

Figure B.1 could be expanded since the required NP tasks could be performed within both the Donor network and Recipient network; see reference [1]. For simplicity reasons, the Originating and Transit networks are not expanded, since this does not give any additional value with the regard to IN-structured aspects in Donor and Recipient networks.

Figure B.2 provides an Information Flow diagram between functional entities (not network elements) where the functional entities from PNCC-SPP are used in conjunction with the functional entities from the IN functions to obtain the routing number. The simple case, where the donor invokes IN functions, is portrayed in Figure B.2. The elements in the figure are as follows:

- Invoke: When call is initiated incoming to the donor, FE4 determines that the PNCC-SPP capability is to be invoked for this call. FE4 provides the end user's number.
- Request: FE1 determines that the number is portable and sends a request to FE2 to obtain the routing information.
- IN-req: FE2 invokes the IN functions to obtain the routing information. FE2 makes a request to FE2A (IN function on another network node).
- Search: FE2A (IN specific FE) sends a request using IN protocols to request an operation at the NP database (FE2B) to retrieve the necessary routing information.
- Result: FE2B (IN specific FE) processes the Search request which includes the end user's number to retrieve the routing number and responds with the Result.
- IN_res: FE2A is an IN function on the exchange that interprets the Result and returns the IN_res with the RN.
- Route: FE2 has completed the function of obtaining the RN and returns the information to FE4 so the call can be routed.

- Dropback: FE4 sends Dropback information including RN to FE3.
- rn_info with Dropback: FE3 reroutes the call using the routing number through the basic call functions FE5 and FE6. FE7 interprets the NP information to determine the end user's physical location. If an additional query is needed, FE7 returns control to FE6. Note FE3, FE4, FE5 and FE6 are basic call functional entities. If an additional query is needed, FE5 or FE6 would begin the functions as FE4.



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Figure B.2 – Information Flow diagram

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