

NUMBER PORTABILITY WHITE PAPER

"WITH NUMBER PORTABILITY YOU CAN RETAIN YOUR TELEPHONE NUMBER,
EVEN WHEN YOU CHANGE YOUR ADDRESS OR TELECOM PROVIDER."



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1 Introduction

Number Portability is rapidly being introduced in the European telecommunication markets both for fixed and mobile networks. Complying with the regulations, all operators need to be able to correctly route calls to ported numbers using the nationally agreed solution. The national solution has either been decided by the telecommunications regulator or through mutually agreement between operators and service providers in the country.

1.1 Abbreviations

AcQ	All call Query
CLI	Calling Line Identity
DTMF	Dual Tone Modular Frequency
GUI	Graphical User Interface
INAP	Intelligent Network Application Part
ISDN	Integrated Services Digital Network
IVR	Interactive Voice Response
IP	Intelligent Peripheral
NP	Number Portability
O&M	Operation & Maintenance
PLMN	Public Land Mobile Network
PSTN	Public Switched Telephone Network
QoR	Query on release
SCP	Service Control Point
SMP	Service Management Point

1.2 Definitions

Service User	The Service User is the person or company that port a number or a number series from one operator to another.
Service Subscriber	The Service Subscriber is the person or company, which subscribes a telephony service with an operator that offers Number Portability and pays the bills related to the subscription.
Service Provider	The Service Provider provides the Number Portability service to which the service subscriber subscribes.
Service Operator	The Service Operator owns and operates the service platform on which the Number Portability service runs.
Network Provider	The Network Provider owns and operates the network to which the service platform is connected.

2 General

Number Portability gives service subscribers the possibility to keep their phone number or number range when changing subscription from one service provider to another, when changing from one set of services to another or when changing the geographical location. The phone numbers are now seen as being allocated to the subscribers rather than the operators and the subscribers can more easily change operator or service provider. The Number Portability service is a network service which ensures true competition in the telecommunications market.

There are different types of Number Portability:

1. Operator/Service Provider Number Portability

Local Number Portability

The subscriber retains its number when changing from one operator/service provider to another. E.g. the porting of existing directory number between fixed operators.

Mobile Number Portability

Porting of mobile telephone numbers between wireless operators.

Non-geographical Number Portability

Porting of 'service' numbers, e.g. '800'- numbers.

2. Location Number Portability

The subscriber retains its number with the same operator when moving within the service area. Both move within the local area and move outside the local area. This can be combined with Service Provider Number Portability.

3. Service Number Portability

The subscriber retains its number when changing service type. E.g. from POTS to ISDN, mobile to fixed, fixed to mobile.

2.1 Service Requirements

2.1.1 Regulatory

Before Number Portability can be implemented in a network, there either has to be a general requirement for introduction of Number Portability from the national regulator or a mutual agreement has to be made between network operators and service providers.

2.1.2 Connection to the number database

Generally for Number Portability, there is a need either for a central reference number database (CRDB) or a system of networked databases (similar to the model of HLRs and VLRs in mobile networks). Normally the national regulator or a consortium of national operators decides which of these solutions shall be used in a country. So far, directives for Number Portability are not crossing country boundaries.

In order to install and implement Number Portability, the network provider needs an agreement with the provider of the central database and/or the other national operators. This agreement gives access to database updates and the possibility for administrative information exchange with other operators.

The incumbent will most likely also offer a solution in each country that other operators and service providers may subscribe to.

2.1.3 Network requirements

The switching network needs the ability to route and bill calls to ported numbers based on information stored either directly in the switches or in online databases external to the switch itself, typically some type of IN architecture.

A number portability service based on IN makes use of the INAP signalling protocol towards the network provider's switch(es). It is a requirement that the switches have been equipped with Service Switching Functionality from the switch vendor – including the INAP protocol (preferably according to ETSI 300 374-1).

3 Benefits

The main advantages of the Number Portability service are:

For the Network Provider:

- Makes it possible to offer service subscribers a direct access to their network without need for changing the telephone number giving
 - More inbound traffic
 - Higher customer loyalty
 - Higher company value
- Makes way for true competition by making it possible to offer new services also for incoming calls to the service subscribers
- Gives the network operator a better view of all traffic related to his customers
- Gives the network operator better control over the quality of routing

For the Service Subscriber:

- Makes it possible to change network provider without changing telephone number
- Makes it possible to change geographic location without changing telephone number
- Makes it possible to change service mix without changing telephone number
- Makes it possible to choose new service providers also for incoming traffic as the same time as preserving the telephone number

4 Different components of Number Portability

4.1 Service Platform

A Number Portability service usually runs on a high capacity IN platform consisting of two functional blocks responsible for service control (SCP) and service management (SMP) respectively.

Some switching platforms are capable of handling number portability directly in the switches themselves, but this gives less flexibility than what does an IN structure normally offer.

4.2 Central Reference Database (CRDB)

The CRDB is the Central Reference Database where the ported numbers are stored and take care of the network update and administration message flow between the various operators. The CRDB can be active or passive.

Active: Store, distribute and validate messages

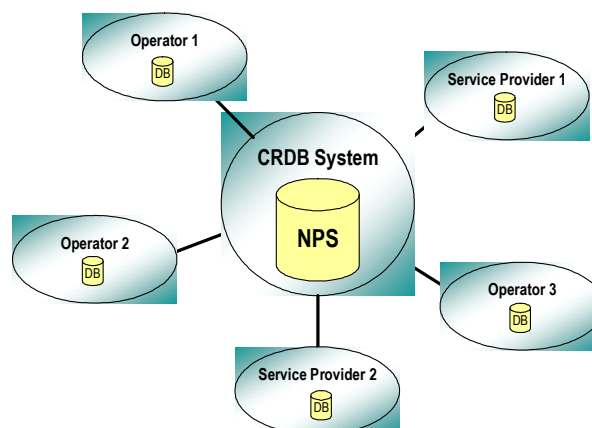
Passive: Store only

An active CRDB is the most common solution today. The CRDB can be managed by the regulatory body, a consortium of Service Providers and Network Operators or it can be outsourced to a third party company that provides all operation and maintenance of the CRDB.

4.2.1 The active Central Reference Database

An active CRDB provides a range of functions in order to facilitate the administration of number portability – most often on a national level.

There are various ways to connect operators and the CRDB together, but the most common way today is using a star topology with the CRDB as a hub between the operators as shown below:



The CRDB system delivered by Systor provides the following functionality:

Reference database for the national numbering plan

Database of number-range allocations – which number-ranges have been allocated to which network operator.

Reference database for ported numbers

Storage of present and historical information related to ported numbers (CRDB).

Message relay

Relaying of porting requests, porting confirmations and porting information messages between the recipient operator, the donor operator and all other operators connected to the central reference database.

Network updates

Based on a completion message from the recipient provider or the ordered time of porting, the CRDB broadcasts network routing information to all connected network operators and service providers.

Automatic Routing of messages

Automatic routing of messages to the correct recipient based on number information stored in the reference database.

Message validation

Message order and parameter contents are validated before relayed or broadcast.

Message flow control

System timers control compliance with the administrative procedures and the flow of administrative messages between the service providers and network operators connected to the CRDB.

Multi lingual

All system messages are placed in a translation table making it possible for the different users connected to the system to chose their preferred language.

User administration and system surveillance

The CRDB includes functionality for user administration and system surveillance.

4.3 Number Portability routing variants

In the following, a number of Number Portability routing variants are shown. If IN is used to control the switches, all solutions can in principle be based on the same IN service with necessary adaptation to national database specifications and routing principles.

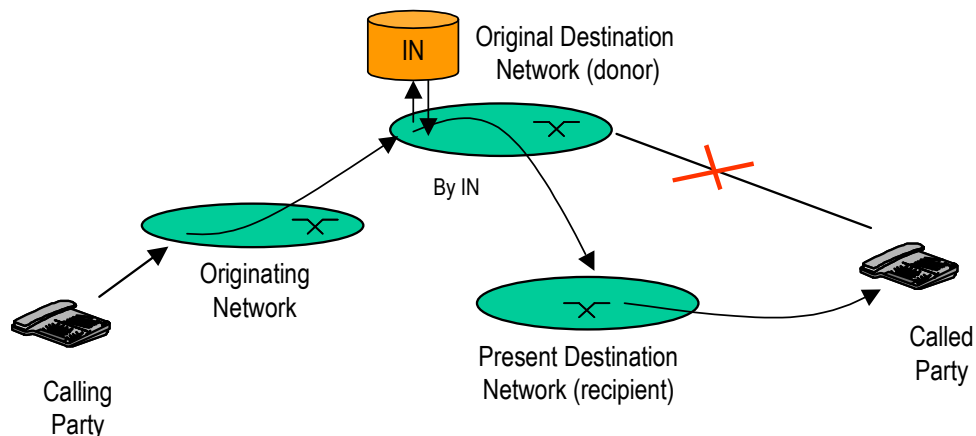
The online databases held by the SCP's are updated via the SMP through servers interfacing the national administrative network. The interface towards the administrative network is normally based on XML.

Donor is the network porting *out* a number and the **recipient** is the network porting *in* the number.

4.3.1 Fixed Network Routing

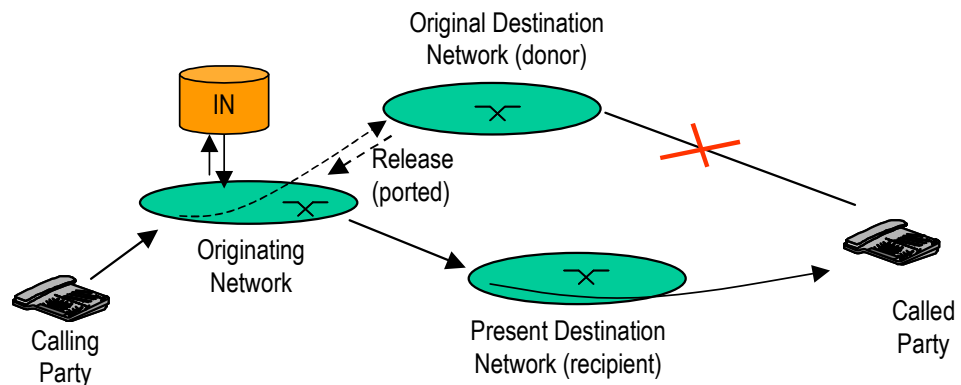
4.3.1.1 Onward Routing

Onward routing is normally used in the early faces of the introduction of number portability when there are not many numbers ported. This solution can be solved using, but does not require, IN, and there is no need for a central database. Only the donor and recipient networks need to know about the porting of a number. A call to a ported number is routed to the original destination network where the call is rerouted to the present destination network either by means of call forwarding or an IN look-up.



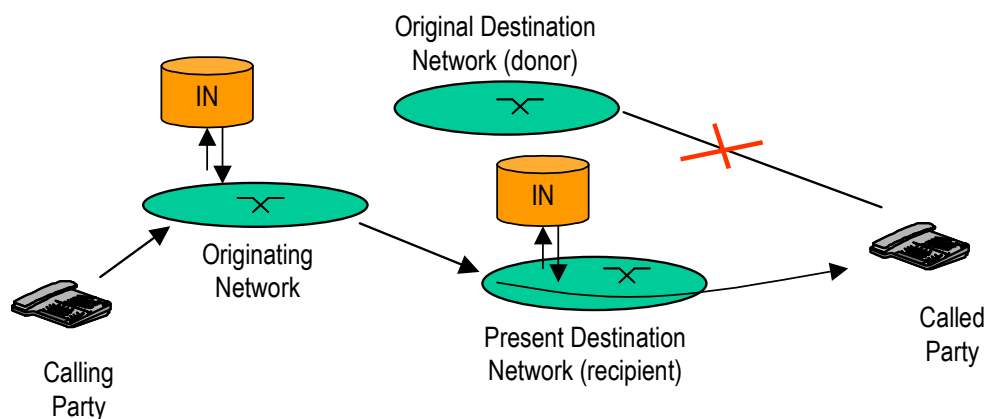
4.3.1.2 Query on Release

Query on Release is, as onward routing, also best suited for low volumes of ported numbers. This method requires, however, IN. The originating network routes all calls to the original destination network (the number range holder). If the number is ported a release message is sent to the originating network, indicating a ported number. The originating network will then make an IN look-up and route the call to the correct destination network.



4.3.1.3 All Call Query

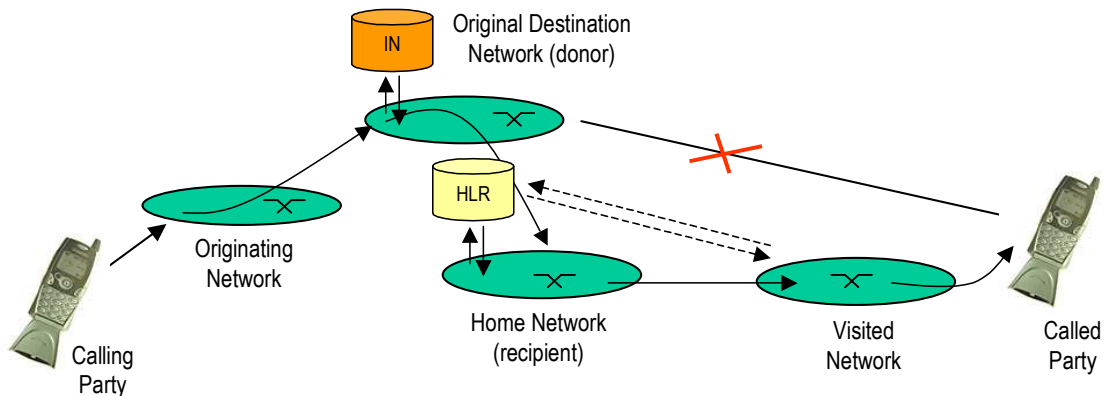
The All Call Query method is the most efficient method for large, interconnected networks and a high number of ported numbers. Using the All Call Query method, the originating network will always make an IN look-up for outgoing calls, routing the call to the correct destination network right away. Depending on the routing information conveyed in the signalling to the destination network, the destination network may or may not need to make a new IN look-up for the incoming call to terminate the call correctly within its own network.



4.3.2 Mobile Network Routing

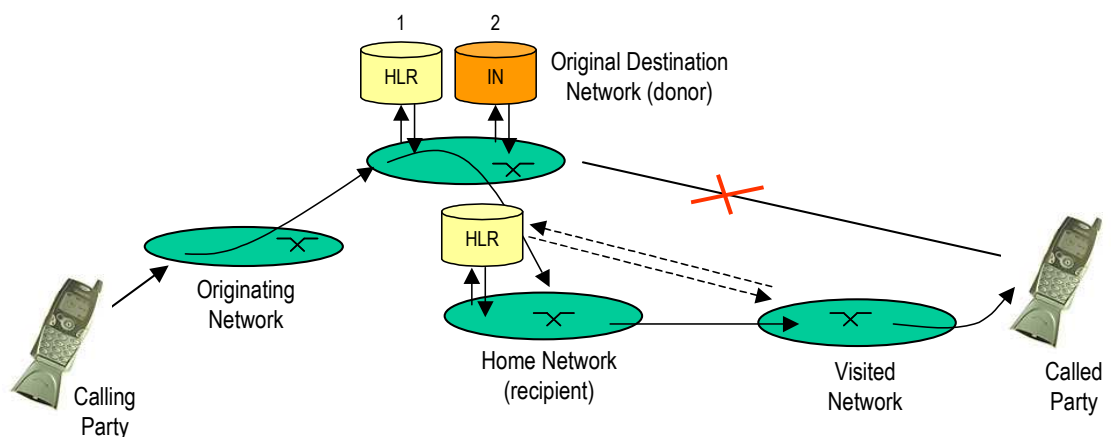
4.3.2.1 Terminating Query on Digit Analysis

Terminating Query on Digit Analysis is similar to onward routing for fixed networks, except that in the mobile case, IN look-up is performed on all terminating calls to decide whether the number is ported or not. If the destination number is ported, the call will be rerouted from the original destination network to the present destination network.



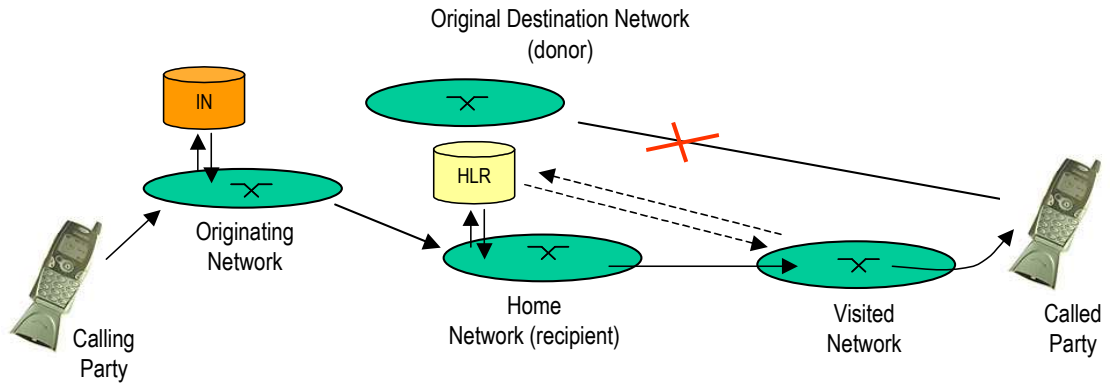
4.3.2.2 Query on HLR Release

Query on HLR Release is similar to Terminating query on Digit Analysis, but before a look-up is done towards IN, the call is attempted terminated through normal procedures. If the destination number is not present in the HLR, an IN look-up is made, and the call is routed to the present destination network.



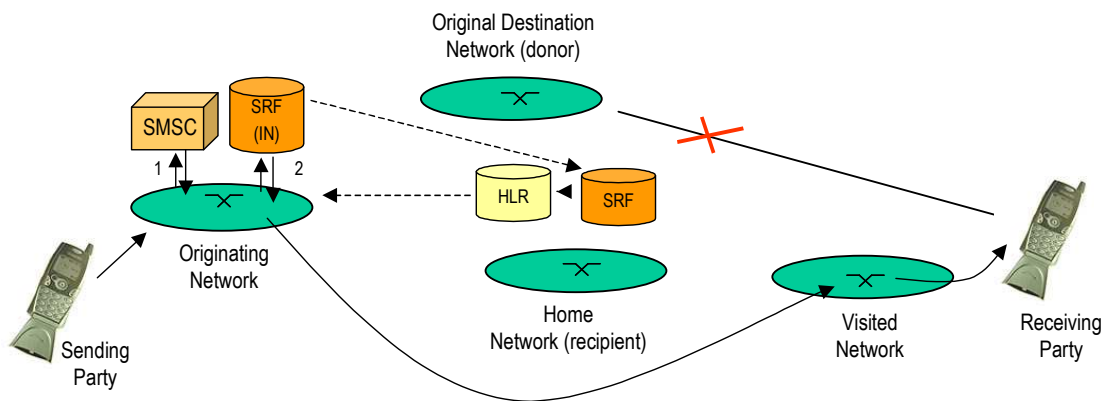
4.3.2.3 Originating Query on Digit Analysis

Originating Query on Digit Analysis is similar to the All Call Query method for fixed networks. The originating network does an IN look-up for all outgoing calls, and routes the call directly to the present destination network.



4.3.2.4 Routing of non-call related signalling (SMS)

For routing of SMS messages and other non-call related signalling to ported numbers, the Signalling Relay Function (SRF) has been introduced. The SRF is usually implemented as an integral part of an IN solution. A SMS results in the SRF making a number database inquiry, and if the result is that the destination number is ported, then the home network SRF is contacted in order to provide the new routing information from the new HLR.



4.4 How does an IN-based Number Portability solution work?

4.4.1 Service triggering

The service triggering is dependent on the type of Number Portability to be implemented in the network:

QoR All calls released by the terminating network with a certain cause value trigger an IN query.

AcQ All originating calls (also those received through carrier pre-select) except international calls and calls to specific service and emergency numbers that cannot be ported.

4.4.2 Content of the Initial Detection Point (Initial DP)

When an IN look-up is activated an Initial DP for the NP Service is sent to the IN platform containing the following parameters:

SK Service Key
CdPN Called Party Number
CaPN Calling Party Number

The Initial DP sent to the SCP on service triggering shall as a minimum contain the service key for the Number Portability Service and the called party number. If the service also is to give tariff information, the calling party number has to be present as well. The service script will use the information received firstly to check whether the called party number is a ported number or not, secondly to find the call tariff in case of a geographically ported number.

4.4.3 Service flow diagram

The Initial DP received by the SCP trigger the NP Service, which may have the following flow diagram:

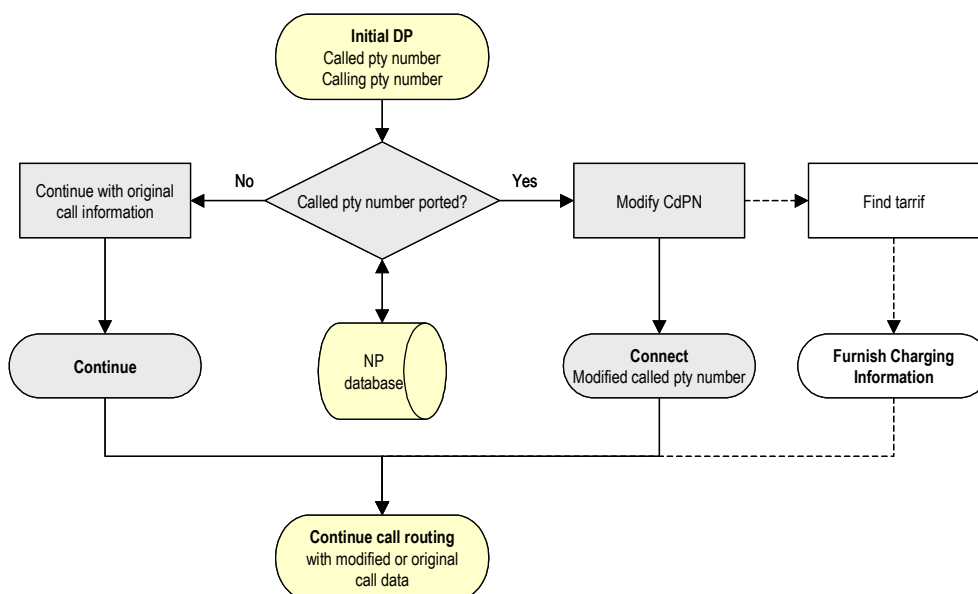


Figure 1: The functional call model. The grey boxes show the basic functionality.

Initial DP

The Service Switching Function (SSP) in the switch produces the Initial DP based on a trigger criteria as described in 4.4.1. The Initial DP provides the Service Control Point (SCP) with the information necessary to invoke the NP Service and to execute the service logic.

Check CdPN

The CdPN received in the Initial DP is checked towards the online number database residing on the SCP. If the CdPN is found in the database, the number is ported. If not, it is assumed that the number has not been ported.

Continue with original call information

If the number has not been ported, the service tells the switch to continue with the original call information. The SCP sends a Continue message to the SSP.

Modify CdPN

If the number is ported a routing prefix is added to the called party number. The form of this routing prefix is dependent on the national solution and the network specific requirements.

Find tariff

As an option, tariff information can be sent to the switch. If geographical porting is possible, and the tariff is dependent on the distance between the calling and the called party, the service will deduce the tariff information from the number database and send this information to the SSP in a Furnish Charging Operation. The specific details of the information are dependent on the national solution and the network specific requirements.

4.5 Administrative concerns

Apart from the routing, the administrative tasks needed to port a number are necessary to take into consideration.

It is normal that the authorities or a consortium of the operators in a country specify the administrative transactions between the telecommunication operator and a central number database (CRDB) as shown in the example below:

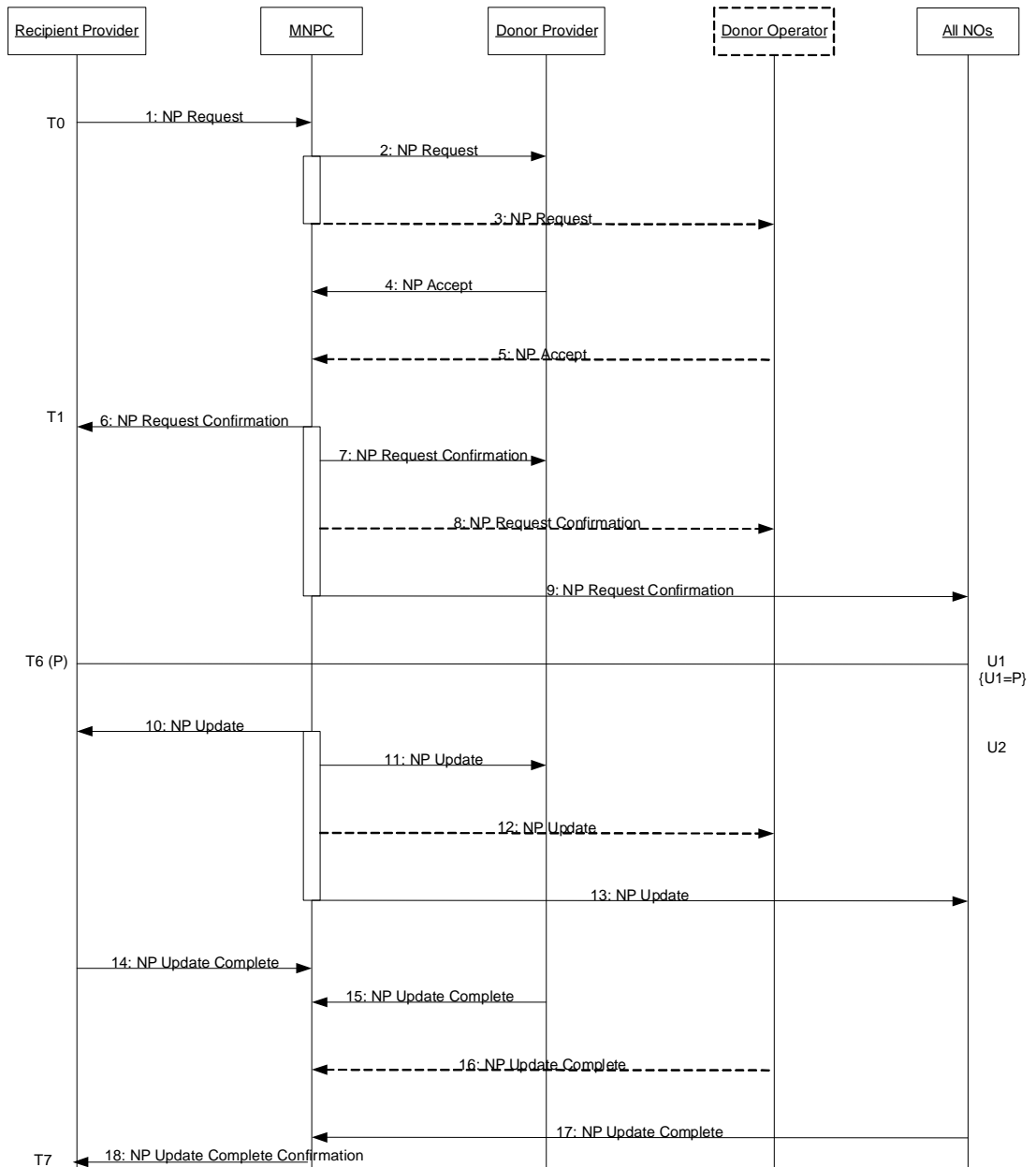


Figure 2: Example administrative transaction flow for Number Portability.

It is then up to a 3rd party vendor (like Systor) to supply the operator's user interface. It may be via a Web interface or an API directly to an operator's administration system.

4.5.1 Tasks that an administrative solution may provide

See also Figure 3 on next page.

Automatic Transfer of Transaction Files

Update transactions between the central number database and the local on-line number database, or between operators' databases in a distributed system and administrative transactions between the operator and the central database and/or between operators in a distributed system.

Automatic Handling of Database Update Transactions

Update-transactions from the central database leads to an update of the on-line database(s) with an acknowledgement returned to the central database. Similarly, update-transactions between operators in a distributed system also lead to a database update and acknowledgement.

Mail-delivery of Incoming Administrative Transaction Files to Operator

Administrative transactions from a central database or other operators are sent by mail to the operator.

WEB Interface for Accessing Administrative Transaction Files

Sending of administrative transactions from the operator to the central database or other operators is supported by a user-friendly web-interface towards the Number Portability Transaction Handler. The user interface includes automatic insertion of fixed fields and validation of user entered mandatory fields.

API for automated interface to Administrative Systems

For automatic updates and validations between customer administration systems and the transaction handler, an open standard API using Corba is offered.

Transaction Database

All transaction files received from the central database or other operators, and all transaction files sent to the central database or other operators, are stored in a database located on the Number Portability Transaction Handler. This database can be searched and reviewed from the Web-interface.

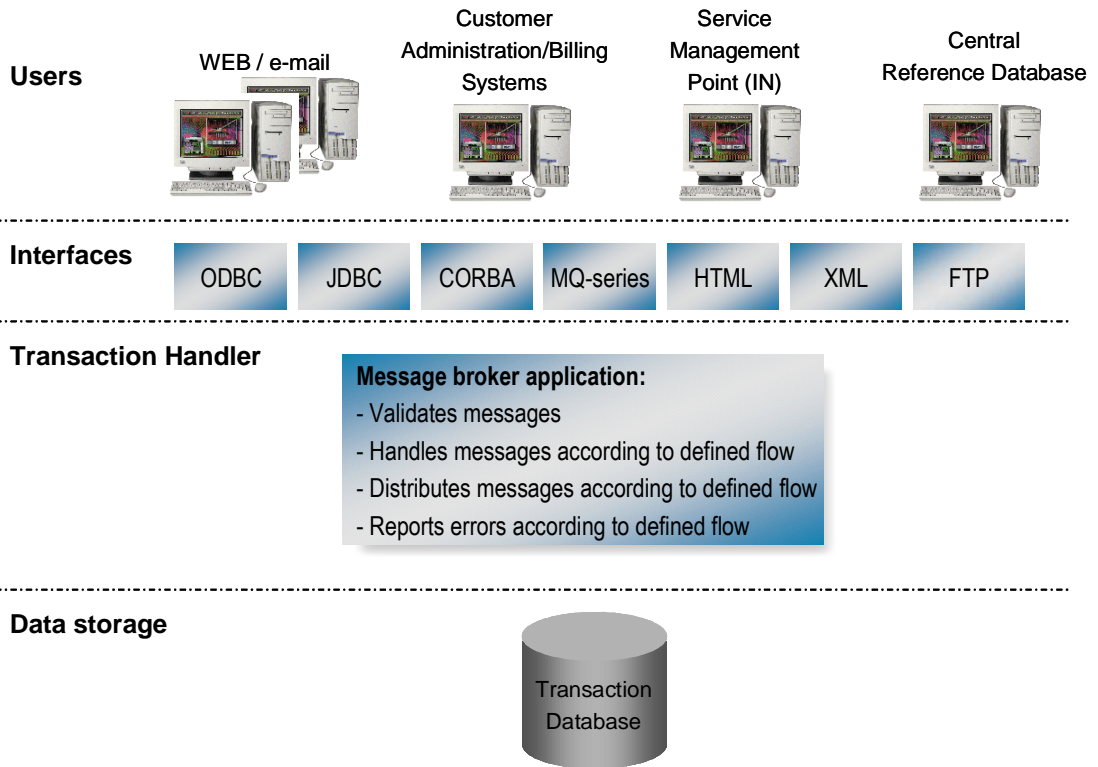


Figure 3: Possible interfaces between a Transaction Handler communicating with the CRDB and the telecommunications operator's internal systems

5 About Systor

Systor, headquartered in the technology city of Trondheim, Norway, is developing dynamic high-performance high-availability database systems and applications for several business areas.

Developing innovative high-performance high-availability database systems and applications for Information and Communication Technology usages, Systor has delivered software solutions to a number of telecommunication companies, including NRDB AS (a consortium of Norwegian service providers), Telenor Networks, Tele2 and Telenor Link. Systor has also provided in-house expertise for Telenor Research & Development, the largest ICT research institution in Norway, in the area of communications networks and services like Intelligent Networks – IN and Number Portability – NP.

Systor has recently expanded it's Number Portability business internationally, acquiring the majority share of Portabil S.A. of Portugal, the national reference database for Number Portability in Portugal, where Systor also has delivered the CRDB system, and has delivered and is presently operating the CRDB system for Mobile Number Portability in Luxembourg.