Final Version NPG1V1F.doc - 6 May 1998

Number Portability Task Force - PT1 :

Service Description Number Portability for Geographic Numbers

BIPT

Contents

1.Scope

The scope of this document is to describe Geographic Number Portability in terms of high-level service definitions and terminology.

The following topics will be discussed in this document:

- Regulatory Requirements;
- Explanation of the definitions and abbreviations used in Geographic Number Portability;
- High level service description of Geographic Number Portability;
- Expectations of both the customers and the network operators;
- A high level description of the responsibilities of the different entities involved in providing Number Portability;
- Interworking aspects with other services;
- Implementation requirements;
- Quality of Service.

The scope of the requirements is limited to :

- the portability of individual customer numbers;
- the portability of complete DDI ranges.

For the sake of clarity, the following number portability types are outside the scope of this document:

- Number Portability for Mobile Numbers;
- Number Portability for Non-Geographic Numbers.

2. Regulatory Requirements

This document serves as a basis to introduce Geographic Number Portability in Belgium, as described in the Law of 21 March 1991 Article 105bis § 6.

The Geographic Number Portability as described in the Law corresponds to Network Operator Portability[1]. As and when applicable, this encompasses Location Portability and/or Service Portability.

3. References

[1] Telecom Law of 21 March 1991
[2] Royal Decree on the Management of the Numbering Plan of 10 December 1997
[3] ETR NA-010063 High Level Description of Number Portability
[4] ITU-T Rec. E.164 The International Public Telecommunication Plan

4. Definitions and Abbreviations

4.1 Definitions

The following definitions and terms will be used by the different project teams involved in the implementation of Number Portability in Belgium.

- **Block Portability (BP)**

  Re-assignment by the BIPT of an assigned block of numbers from one operator (the initial Number Allocated Network Operator) to another network operator (the New Number Allocated Network Operator).

[1] Limited to Geographic Numbers

- **Call Trap Function (CTF)**

  The function whereby a mechanism is employed to determine whether or not a number is ported.

- **Database Query Function (DQF)**

  The function whereby a database is accessed in order to ascertain whether a number is ported, and if it is, Routing Information is obtained that may be used to route the call to the appropriate destination.

- **Directory Number (DN)**

  A number in the National Numbering Scheme that is allocated to a customer for a telephony service.

- **Donor Network /Exchange (DON/DOE)**

  The network/exchange from which the number was ported.

- **Geographic Number (GN)**

  An E.164 number as defined in the Royal Decree on the Management of the Numbering Plan of 10 December 1997.

- **Geographic Number Portability (GNP)**

  Geographic Number Portability as described in the law corresponds to Network Operator Portability[1]. As and when applicable, this encompasses Location Portability and/or Service Portability.

- **Location Portability (LP) (also called Number Mobility (NM))**

  The ability of an end user to retain the same E.164 number when moving from one location to another within the same numbering area, without changing either network operator or the nature of the service offered.

- **Network Operator (NO)**

  The entity which has been reserved or assigned geographic E.164 numbers by the BIPT.

- **Network Operator Portability[1] (OP)**

  The ability of an end user to retain the same geographic E.164 number when changing from one network operator to another without changing either location or the nature of the service offered. Network Operator Portability[1] can be concatenated with Location Portability (LP) and/or Service Portability (SP).

- **Number Allocated Network Operator (NANO)**

  The network operator to which the number block, containing the ported number, is assigned by the BIPT.

- **Originating Network/Exchange (ORN/ORE)**

  The network/exchange to which the calling party is connected. For the purposes of this document it should be noted that, where carrier selection is employed, the Originating Network is the selected carrier network. Similarly, for incoming international calls, the Originating Network is the network containing the gateway connected to the international network, and for incoming mobiles calls, the Originating Network is the network containing the gateway connected to the mobile network.
  In the above three cases, the network to which the caller is directly connected shall not perform any Number Portability functions.

- **Point of Interconnection (POI)**

  The physical point located on the interconnect link where two networks are interconnected (and through which the calls are handed over from one network to another). The POI is the boundary between the operators' domains of responsibility.

- **Ported Number (PN)**

  An end user's E.164 number that has been subject to number portability.

- **Ported-In Number (PIN)**

  An end user's E.164 number that has been subject to number portability and that has been ported to a recipient network/exchange.

- **Ported-Out Number (PON)**

  An end user's E.164 number that has been subject to number portability and that has been ported out to the donor network/exchange.

- **Range Analysis Function (RAF)**

  The function whereby a number of significant digits of a number are examined in order to determine the appropriate Routing to a destination entity.

- **Real-Time Database (RTDB)**

  Database that contains the number portability service Routing Information that is used in real-time by the Database Query Function of the Serving Network.

- **Recipient Network /Exchange (REN/REE)**

  The network/exchange to which the number is ported.

- **Reference Database (RFDB)**

  Database that contains the number portability service Routing Information and that is used as reference for the consistency of the Real-Time Databases.

- **Routing Information (RI)**

  Information that allows the call to be routed. The Routing Information consists of one of the following:
  - A Second Number;
  - A Routing Number;
  - A Routing Prefix.

- **Routing Information Addition Function (RIAF)**

  The function which determines and adds the information necessary to enable the call to be routed to the appropriate destination.

- **Routing Number (RN)**

  An E.164 number that allows the call to be routed. In this case, the number addresses a network or a network entity and does not contain an identification of the individual ported number.

- **Routing Prefix (RP)**

A sequence of digits in front of the Ported Number containing the Routing Information that allows the call to be routed. The Routing Prefix may comprise hexadecimal digits.

- **Second Number (SN)**

  An E.164 number that allows the call to be routed. In this case, there is a one to one correspondence between this number and the ported number.

- **Service Portability (SP)**

  The ability of an end user to retain the same E.164 number when changing from one type of service to another within the same service domain (in this scope the service domain corresponds to the services using geographic numbers), without changing network operator nor location.

- **Serving Network (SEN)**

  A network that performs all or part of theServing Network Functionality. The Serving Network Functionality may be split across multiple networks, and may reside in the Originating, Transit, Donor or Recipient Network/Exchange.

- **Serving Network Functionality (SNF)**

  The serving network functionality consists of the following functions:
  - the Call Trap Function;
  - the Database Query Function;
  - the Routing Information Addition Function;
  - the Range Analysis Function.

- **Transit Network/Exchange (TRN/TRE)**

  A network/exchange between two networks/exchanges, e.g. between the originating and the donor network/exchange, between the Donor Network/Exchange and the Recipient Network/Exchange.

4.2 Abbreviations.

BP	Block Portability
CCBS	Call Completion to Busy Subscriber
CLI	Calling Line Identity
CTF	Call Trap Function
DDI	Direct Dialling In
DN	Directory Number
DOE	Donor Exchange
DON	Donor Network
DQF	Database Query Function
GN	Geographic Number
GNP	Geographic Number Portability
ISDN	Integrated Services Digital Network
LP	Location Portability
MWI	Message Waiting Indicator
NANO	Number Allocated Network Operator
NDC	National Destination Code
NM	Number Mobility
NO	Network Operator
NOC	Network Office Code
NP-DB	Number Portability Database
NSN	National Significant Number
OP	Network Operator Portability
ORE	Originating Exchange
ORN	Originating Network

PIN	Ported-In Number
PN	Ported Number
POI	Point of Interconnection
PON	Ported-Out Number
PSTN	Public Switched Telephone Network
RAF	Range Analysis Function
REE	Recipient Exchange
REN	Recipient Network
RFDB	Reference Database
RI	Routing Information
RIAF	Routing Information Addition Function
RN	Routing Number
RP	Routing Prefix
RTDB	Real-Time Database
SEN	Serving Network
SN	Second Number
SNF	Serving Network Functionality
SP	Service Portability
TC	Transaction Capability
TRE	Transit Exchange
TRN	Transit Network

5. Service Definition

Number Portability refers to the case where a customer retains its originally assigned directory number while having a major change to the subscription of that customer. Depending on the kind of subscription change the following types of number portability can be identified:

- Network Operator Portability;
- Service Portability;
- Location Portability.

Network Operator Portability refers to the ability of an end user to retain the same directory number when changing from one network operator to another without changing location nor the nature of the service offered. Network Operator Portability is therefore a facility provided by one operator to another which enables customers to keep their existing telephone numbers when switching between those operators. Network Operator Portability may both be provided for geographic numbers and for non-geographic numbers.

Location Portability refers to the ability of an end user to retain the same directory number when moving from one location to another within the same numbering area, without changing network operator nor the nature of the service offered. Location Portability is only applicable to geographic numbers, as by their nature, non-geographic numbers do not incorporate location information. Unless combined with other types of portability, location portability is an internal network operator matter.

Service Portability refers to the ability of an end user to retain the same directory number when changing from one type of service to another within the same service domain (e.g. PSTN to ISDN), without changing network operator nor location. Service portability is a network operator option to provide additional features of a network operator's service portfolio within the same service domain. In the scope of this document, the service domain corresponds to the services using geographic numbers.

From the customer's point of view, all three types of number portability are desirable because a change of directory number is usually linked with considerable inconvenience and expense.

The different types of Number Portability may be combined or concatenated at the same time (e.g. a customer may change location and operator at the same time). Cancatenating of different types of Number Portability can have implications if the customer wishes to revert to the original set-up. E.g. Network Operator Portability followed by Location Portability may make it impossible for the customer to revert to the original Donor Network Operator, as the Donor Network Operator may not offer Location Portability to the extent of the geographic area of that offered by the Recipient Network Operator). In case Location Portability is provided at the same time, or after Network Operator Portability (i.e. a customer changes operator and address but retains his number), the ability to provide Location Portability remains entirely with the recipient operator and is not dependent on the donor operator.

This document concentrates on the Network Operator Portability for Geographic Numbers only. Network Operator Portability for Non-Geographic or Mobile Numbers, Location Portability and Service Portability are not within the scope of this document.

6. Service Description

In today's environment, in the absence of Network Operator Portability, geographic telephone numbers are assigned to network operator's local exchange on an NDC-NOC basis. An NDC-NOC is defined as the national destination code (NDC) and network office code (NOC) of an end user's telephone number (e.g. (0)2/2268759 has its NDC=2 and NOC=226). Each NDC-NOC contains a total of 10,000 different telephone numbers. Because an NDC-NOC is only served by a single local exchange in today's network, the telephone number identifies the network termination point, as well as the actual local exchange, or telephone switching system, that serves that network termination point. In effect, the dialed NDC-NOC is a terminating switch's routing address to the rest of the network.

With the implementation of Network Operator Portability, which allows network operators to serve numbers within the same NDC-NOC, this routing scheme can no longer be used. If normal call routing would be used, the call would be delivered to the old exchange where the subscriber was initially served (the donor exchange).

Therefore, to allow users on a switching system to switch from one network operator to another which implies changing of switching system while retaining their public-directory numbers, routing of calls to ported numbers can no longer be based on the NDC-NOC. Routing Information has to be added or inserted to allow the routing of the call to the new network operator's network (the recipient network) or the new operator's exchange serving the ported subscriber (the recipient exchange). The Routing Information can consist of one of the following elements:

- A Second Number (excluded by the BIPT);
- A Routing Number;
- A Routing Prefix.

The Routing Information for subscribers, who have moved or ported to another network operator, is usually stored in a Number Portability Database (NP-DB). This database contains the directory numbers of all ported subscribers and the Routing Information to allow a call to the ported number to be routed. Two types of NP-Databases can be used: Reference Database(s) and Real-Time Databases (e.g. one for each operator). The NP-Database can be integrated in the switches or can be accessed by the switches using e.g. an intelligent network application protocol (INAP).

The determination of the Routing Information for a ported call may occur in the originating network, a transit network or the donor network. The network that performs the query is called a Serving Network.

The whole process associated with the termination of a call to a ported number is depicted in Figure 1.

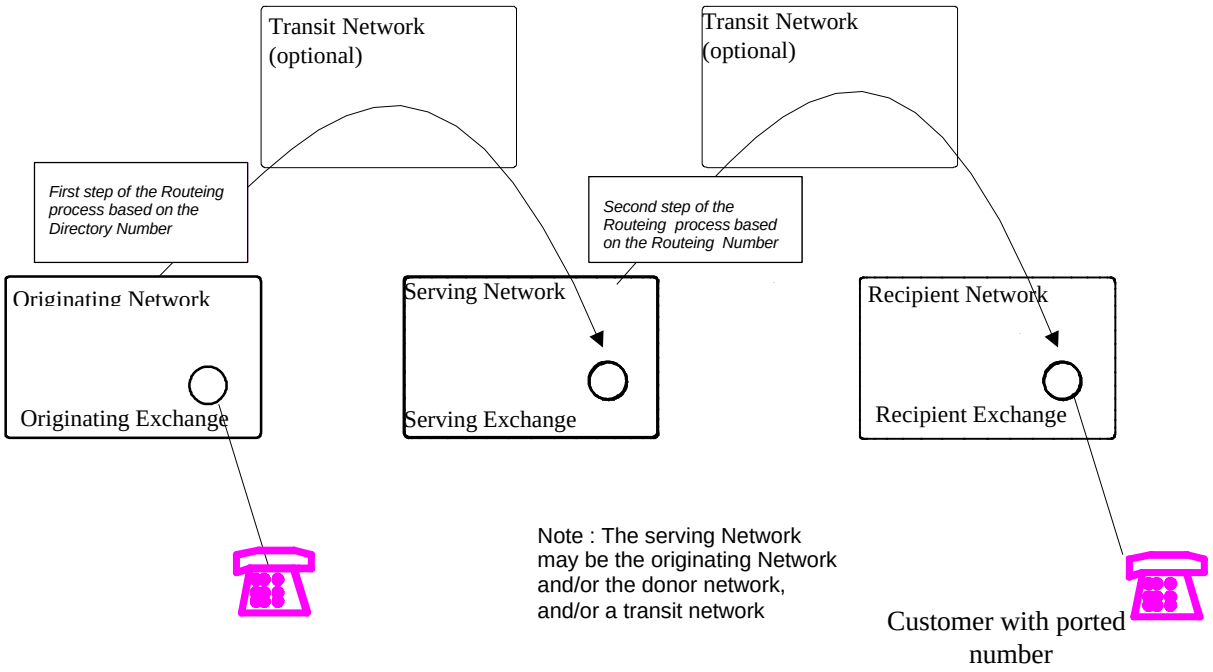

Figure 1: Conceptual Framework for Terminating Calls to Ported Numbers

7. Network Operator Responsibilities

7.1 Routing of Calls to Ported Numbers

In this section the responsibilities of the operators involved in routing a call to a ported number are described.

Originating Network
The Originating Network is the network where the call is originated. It should be noted, however, that for the purposes of this document, where carrier selection is employed, the selected carriers network becomes the Originating Network. Hence the network to which the caller is directly connected shall not perform any Number Portability Function.

If the originating network is at the same time the Recipient Network or a Serving Network, the routing functions as described in the relevant sections below should be carried out. Otherwise, the Range Analysis Function should be carried out to route the call towards the Donor Network, possibly via a Transit Network.

Transit Network
The Transit Network should carry the call between two other networks.

If the Transit Network is acting as a Serving Network, it should carry out functions as described in the Serving Network section. If it is not, the Transit Network should

- *if no Routing Information has been previously added or inserted*, carry out the Range Analysis Function on the called party number to route the call towards the donor network (possibly via another Transit Network);

- *if there is Routing Information previously added or inserted by another network*, carry out the Range Analysis Function on the Routing Information and/or called party number to route the call towards the recipient network (possibly via another Transit Network)

Donor Network
There are no specific requirements of the Donor Network, unless it is acting as a Serving Network.

It is a Donor Operator's responsibility to ensure that all calls destined to its Ported-Out Numbers are passed to the Recipient Operator. Calls to its Ported-Out Numbers, whether originating on the Donor Operator's network or received from other networks, are to be passed to the Recipient Operator.

Recipient Network
The Recipient Network should use the Routing Information and/or the called party number to route the call to the network termination point of the ported number. Another Database Query function may be required to do so.

It is the Recipient Operator's responsibility to ensure that all calls made to Ported Numbers, are correctly delivered once they are correctly received from the Donor or Transit Operator.

Serving Network

The Serving Network Functionality may be split across multiple networks, and may reside in the Originating, Transit or Donor network. The following functionality should be carried out :
- The Call Trap Functionality should be carried out to determine that a number may be ported;
- The Database Query Function should be carried out to determine the Routing Information;
- The Routing Information Addition Function;
- The Range Analysis Function should be carried out on the Routing number and/or the called party number to direct the call towards the Recipient Network (possibly via a Transit Network)

7.2 Number Management

In this section, the responsibilities related to the service provision and number management are described.

Donor Network Operator
The Donor Network Operator must not reallocate ported numbers to another customer.

Recipient Network Operator
The Recipient Network Operator must inform the Donor Network Operator and Serving Network of any change in the circumstances associated with any ported number that may affect calls being delivered to a ported number.
The Recipient Operator will inform the Donor Operator, Serving Network and Number Allocated Network Operator when a customer has given up a Ported Number.

8. Subsequent Portability

Once a number has been ported to one operator, the customer may wish to switch again to another operator, still retaining the original number. Provided the customer is not returning to the operator from whom he first obtained the number, these subsequent changes of operator are known as 'Subsequent Portability'. So far as the Number Allocated Network Operator is concerned, it makes no difference, whether the portability it is providing is an initial or a subsequent porting. Subsequent Portability increases the normal operational complexity since a third party – a 'new' recipient operator is involved.

When a customer seeks to port their number a second time, creating a chain of Donor Networks should be excluded.

9. Block Portability

In case the number of ported numbers within a certain NDC-NOC block of 10.000 numbers is sufficiently high (e.g. the Donor Operator loses X % or more of its customer numbers to Recipient Operators, and at least Y % of those Customer Numbers are handled by one Recipient Operator, X and Y to be defined by BIPT) , the BIPT might allow the Recipient Operator to apply to the BIPT for the re-assignment of that block to that operator called Recipient Block Operator.

If an entire block of 10.000 Customer Numbers is transferred from a Number Allocated Network Operator to a Recipient Block Operator, all operators will have to make amendments to the Routing tables of their switches, exactly in the same way as if a new 10.000 number block would been opened up by the Recipient Block Operator. Therefore all calls to numbers in that block will be automatically routed to their correct location. This implies that for each ported block, the following additional modifications will have to be undertaken by the Number Allocated Network Operator and the Recipient Block Operator:

- Most of the previously ported numbers in the number block, those that were ported to the Recipient Block Operator, will become not-ported;
- The remaining ported numbers in the number block, those that were ported to other Recipient Network Operators than the Recipient Block Operator, will become ported from the Recipient Block Operator, being the new Number Allocated Network Operator, to ohter Recipient Network Operators;
- Numbers that were not ported before, become ported from the new Number Allocated Network Operator (the Recipient Block Operator), to the old Number Allocated Network Operator, after the block transfer.

The following operational requirements should be taken into account when doing block portability:

- there should be no adverse effect upon network services or facilities available to remaining customers of the Donor Operator once the re-assignment takes place;
- there shall be proper arrangements in place in order to co-ordinate consequent changes of primary Routing of the re-allocated range of numbers and alteration of transfer arrangements in relation to those numbers.

10. Network Impact

Below are but a few of the impacts that geographic number portability will bring to the telecommunications network.

Switching Network
Substantial changes to call-processing logic and administration software will be required in all switching systems in use in today's telecommunications network to implement geographic number portability.

Signalling Network
Unlike today's network, in which calls to local subscribers between local exchanges are translated in the originating local exchange, geographic number portability will require an NP-Database query for every call to a ported subscriber that is not served by the originating switch. This will require capacity increases in the number of SS7 links to the Signaling Transfer Points, and in the event deployment of new Service Control Points to run the NP-database application.

Billing, Administration, and Maintenance Systems
Because local number portability removes the direct association of a subscriber's directory number to a central office, which many operations support systems were based upon, substantial changes will be required in most of the systems in use today in local telephone company networks.

11. Customer expectations

Solutions to provide number portability should assure the following generic assumptions :

- Only E.164 number (NSN) should be considered eligible to be ported.
- In some cases not a single E.164 number but a collection of E.164 numbers may be requested to be ported. Porting of single numbers within a DDI range is not allowed.
- The privacy of the user which has ported his number should be granted. That means that the calling party should not be informed that the called party has ported his number.
- Number portability should not affect the call dialling procedures.
- When Calling Line Identity Presentation is required it shall be the directory number.
- The mechanisms by which portability is provided should subject the call to minimal (if any) performance degradation relative to that offered to non ported numbers. This includes both post dial delay and transmission.

- In case of individual numbers out of a particular MSN are ported, it means that the ported numbers do not belong anymore to the MSN and are treated out of the context of the corresponding MSN.
- Customers will get access to services determined by the Network Operator to whom they are connected, minimizing the difference in service offer to ported and non-ported numbers.
- Customers expect to have a continuous service.

12. Implementation Requirements

1) Architectural Flexibility: The set of architectures selected for support of number portability should allow network operators reasonable flexibility in the manner in which the architecture is implemented, the use of equipment from a multi-vendor environment. Each operator should be able to decide about its own network architecture, network functions and design of internal interfaces, as long as external requirements are fulfilled.
2) Transparency: The mechanism by which portability is provided should be transparent to ported and non-ported customers.
3) Performance: The mechanism by which portability is provided should subject the call to minimal (if any) performance degradation relative to that offered to non ported numbers. This includes both post dial delay and transmission.
4) Interconnection: All network operators offering portability within the same numbering area should interconnect, either directly, or via a transit, and complete calls. Direct or transit interconnection is a commercial decision.
5) Efficient use of numbering resources: Because of the scarceness of the numbering resources in Belgium, numbering resources should be used efficiently.
6) Migration and evolution: Solutions to support number portability should allow rapid deployment of number portability in such a manner that Network Operators can migrate between technical solutions. Solutions should be developed such that technology should not be presented as a barrier to implementing number portability. Each operator should be able to decide about its own network architecture, network functions and design of internal interfaces, as long as external requirements are fulfilled.
7) Subsequent Porting: When a customer seeks to port their number a second time, creating a chain of Donor Networks should be excluded.
8) Only the E.164 number (not including prefixes, suffixes, etc.) should be considered eligible to be ported.
9) The entire E.164 number and not only part of it should be ported.
10) In some cases the customer may request the porting of a collection of E.164 numbers.
11) The privacy of the user which has ported his/her number should be granted. That means that the calling party should not be informed that the called party has ported his number.
12) Number portability should not affect the call dialling procedures.
13) When line identity presentation is required it shall be the directory number.
14) Introducing number portability must not adversely affect conformance with national or international propagation and echo standards.
15) Ensure that the preferred solutions are compatible with one another and provides a migration path between introductory solutions and long term solutions.

13. Operational expectations

Many administrative steps will be required to move or "port" an end user from one Network Operator to another. Specifically, database changes will be required in the donor exchange, the recipient exchange and the NP-Databases. In addition, the end-user must be disconnected from the donor network and connected to the recipient network.

- The customer has the possibility to address the donor or the recipient operator to request network operator portability for geographic numbers.
- When changing network operator, the customer has the possibility to change number or to ask for number portability within the numbering areas.
- The customer will be informed about the exact time of porting.

- An acceptable synchronization delay is required to hand-over the number between the network operators.
- The number of the customer will be ported between the network operators in a reasonable time period respecting the contractual termination period, the implementation period and any other time constraint required for porting a number between operators.
- In case of Block Portability, the following operational requirements should be fulfilled:
    - there should be no adverse effect upon network services or facilities available to remaining customers of the Donor Operator once the re-allocation takes place;
    - there shall be proper arrangements in place between all affected operators in order to co-ordinate changes of primary routing of the re-allocated range of numbers and alteration of transfer arrangements in relation to those numbers.

14. Impact on Other Services

Number Portability shall not inhibit support of PSTN and ISDN services for as these are supported in the commercial offer of the concerned operator. This ideally includes the TC based services e.g. CCBS and MWI. The originating caller's CLI settings shall be maintained by any operator handling a call to a Ported Number.

15. Quality of Service

When a number is ported, additional times are incurred that may degrade performance. Two elements combine to create the additional time:

- the look up time (time requested by the Database Query Function);
- subsequent connect time (time requested to subsequently route the call to the correct destination).

The extra set-up delay for a ported number should ideally be less than 1s compared to the post dial delay for a non-ported number.

Terminating calls to a ported number should not suffer undue loss of quality of service. There should be no extra transmission loss.