INTRODUCTION TO NUMBER PORTABILITY

With this whitepaper Rabión Consultancy aims to provide a quick and broad overview of number portability. Number portability is arguably the most visible instrument a regulatory body has to its disposal for supporting liberalization in the telecommunications market. Outlined are the typical areas regulators and operators will come across while implementing and executing number portability in practice. These areas range from process to finance and from regulation to technical solution. Where lessons can be learnt from earlier choices in the past, success factors and traps are explained.

Since 1997 starting in Hong Kong, United Kingdom and The Netherlands, number portability has been implemented in numerous countries. In the early days implementing was an unknown adventure: hardly any previous experience and no off-the-shelf solutions. With today's large scale availability of number portability all over Europe, North America and in large economies such as Brazil, India and Japan, the offered solutions have become mature.

Number Portability (NP) is an instrument telecom regulators use with the intention to lower barriers for customers to switch provider. With NP, customers can more easily be persuaded to select a competing proposition –knowing that they will remain reachable under their 'own' number. Lower tariffs and better service can be reasons for switching, but also sponsored welcome gifts (for instance the latest model smart phone) can play an important role –if providers are allowed to do so. From a market perspective, NP should contribute to more competition: leading to lower prices, service diversification and improved focus on customer care. As now more and more national telecom markets open up, coming from a market with only one incumbent, new entrants should be given a fair chance to compete for customers. And not only for new customers, but also for the existing and often most valuable customers (notably business customers and mobile post-paid subscribers). Number portability will diminish or even completely wipe out switching costs for these existing customers.

TYPES OF NUMBER PORTABILITY

Generally three types of number portability are distinguished: operator, service and geographical portability.

Operator portability is the most important one from a regulatory perspective: it enables customers of an existing telephony service to change operator or service provider while retaining the same subscriber number.

Service Portability enables customers to retain their number when changing telephony service. For instance from GSM to UMTS or from pre-paid to a post-paid subscription.

Geographical portability makes it possible for a fixed network customer to retain his number when moving house. This form of portability is usually restricted within the same number area.

Mobile Number Portability (MNP) can be seen as a special form of operator portability. It provides customers the ability to change their mobile operator and/or service provider while retaining their mobile subscriber number.

Focus in this whitepaper is on operator portability in general and the additional complexity resulting from MNP.

Which technical solution to choose to implement NP is important as it will have cost implications on service providers and network operators. Deciding between different options requires considering a whole range of issues. These include roaming, operational support system modifications, call charging arrangements, routing arrangements in the national numbering plan, interconnection between national and international networks, support of NP within and across mobile technologies, the timeframes involved in the process, the cost-effectiveness of different solutions, handling of voicemail, data (including machine to machine) and fax numbers, and routing of SMS traffic in case of MNP.

NUMBER PORTABILITY PROCESS

In order for NP to work, operators will need to align the way to hand over numbers. There are two concepts for this NP process: recipient-led and donor-led. In the recipient-led process a customer will start with a request to his new operator (the number recipient) to port his number. The recipient operator, on behalf of this customer, takes care of all communication with his current operator (the number donor). In a donor-led process, the customer himself has to request his current operator if the number can be ported. Only after authorization from the donor, the new operator of choice can start the number porting. Generally the recipient-led process is preferred: the customer can enjoin one-stop shopping at his operator of choice. It is the most applied worldwide, although exceptions exist such as the United Kingdom and India. The donor-led process provides the donor with the opportunity to win-back the customer. This is obviously a disadvantage for successful application of NP.

The porting process can be split in two:

1. preparatory phase;
2. execution phase.

The preparatory phase allows for alignment between the recipient and donor operator, for instance to agree on a date/time for the porting execution. This phase deals with possible rejections of the porting request and the re-submission of requests. In the execution phase the actual transfer of the number from donor to recipient network takes place, including the connection and disconnection of the old and new mobile network services. In addition to the regular process, also policies for changing and cancellation of planned NP execution will have to be defined.
The time between concluding a new agreement and actual porting varies per country. Latest European Union (EU) directives prescribe that porting of a number must take place within one working day, in Australia it is possible within the hour and in Finland and Ghana it can even be done within minutes. To meet similar short time lines, it is crucial to keep the process as simple as possible. The process should not be hindered by unnecessary errors or rejects. This means minimizing the number of process steps and related information messages between donor and recipient.

To ensure subscribers are not unnecessarily restricted, the valid grounds for donor operators to reject a request should be agreed in advance. In case of prepaid customers the donor operator may not have many reasons to reject a porting request, under the condition that the request contained all the required information.

Issues from validating post-paid subscriptions are generally more common. Valid reject causes can vary per country, depending on the specific regulation. Examples of possibly reject causes are:

1. a customer is still bound to a contract;
2. a customer has debt, 'bad debt' or is suspended;
3. the customer could not be identified (in countries where there is no obligation to register prepaid customers).

It is most important to define the scenarios as exact as possible. For the given examples this means:

ad 1. determine if a 'future port' would be possible, that is porting at a date later than needed for the porting lead time;

ad 2. what is the accepted definition of (bad) debt;

ad 3. exactly what information has to be provided to identify a customer (for instance passport number, printed SIM card number, mobile number, home address). The information could be different for pre-paid, post-paid, business and residential customers.

In order to control the lead time to port a number, the time limit needs to be defined per process step. For example the response time of the donor after having received a porting request, which can be a rejection or approval. Also the maximum time of the actual porting should clearly be defined, including when to connect the number on the recipient network, disconnect at the donor network and when all operators need to update their local databases in order to correctly route calls.

NUMBERING MANAGEMENT

As a pre-requisite, that is before entering into process negotiations, the legal status of numbers and their 'ownership' will need to be defined clearly. Good practice in telecom legislation is to organize overall 'ownership' of numbers at a national level, and a separate telecom regulating authority with the task to allocate number capacity to operators or service providers. In turn operators and service providers can assign these numbers to their customers. An exception may be needed for toll-free numbers and other special purpose numbers: these may need to be assigned directly to the end-users and not to operators or service providers. The telecom regulating authority has to implement and maintain processes for allocation, assigning, reclaiming, and blocking of numbers.

Number management is not limited to telephone numbers. When a customer ports his/her mobile number, he needs a new SIM card. Mobile operators use SIM cards to uniquely identify their subscribers. For this purpose, SIM cards contain a so called International Mobile Subscriber Identity (IMSI): a unique code always pointing to the serving operator. This means that if the operator changes due to MNP, so should the SIM. An allocation mechanism needs to be in place for IMSI ranges as well.

There is no such thing as IMSI-portability or SIM portability: the added value is limited and the technical complexity high. The latest regulatory developments in the EU however are challenging this relation. The EU ruled that a competing operator should be allowed to provide services to customers roaming abroad within the EU. Given the proposed solution, this will for now result in enabling the use of a

different service provider abroad, without the need to change SIM or IMSI.

NETWORK SOLUTION

For a complete network solution, call related routing and non call related signalling (SMS) should be considered. Number portability has no effect on mobile data. If Voice over IP networks are involved, SIP addressing should also be taken into account.

Circuit switching based on large number blocks can easily be performed in telephony switches. The need to support NP will almost in all cases change this straight forward way of routing. Off-switch solutions transfer the knowledge of porting information into one or more private external databases that all own network switches can access for querying. The network switch may be an originating, transit or a terminating switch. As is illustrated in Figure 1, there are several ways to route calls in a NP supporting network.

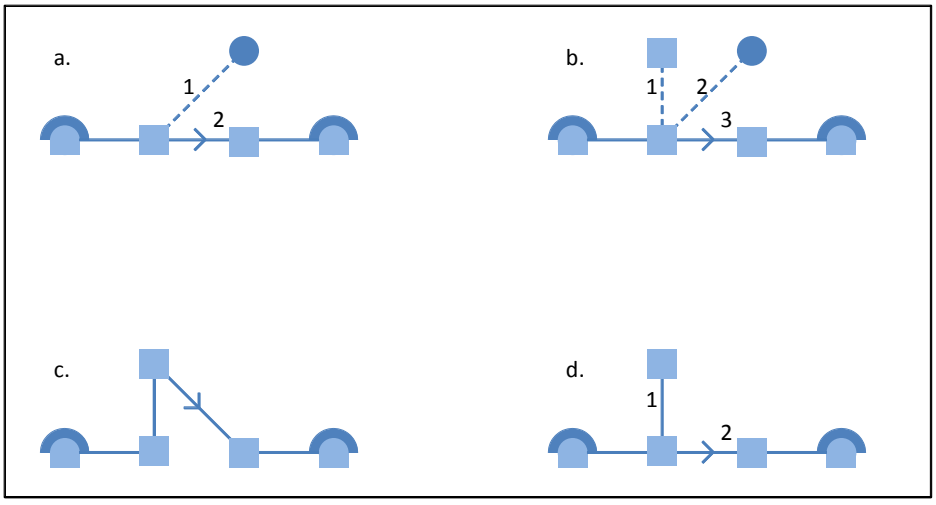

Figure 1a-d Different routing solutions: All Call Query (a), Query on Release (b), Onward routing (c), Call Drop Back (d).

All-Call-Query method: The originating network first checks the location of the dialled number in the central database and then routes the call directly to the recipient network.

Query-on-Release: The originating network first checks the status of dialled number with the potential donor network, i.e. the original operator of the number block. This network returns a message to the requesting network identifying if the number has been ported or not. The originating network then queries the central database to obtain the information regarding the recipient network and routes the call directly to the recipient network.

Onward routing: Here, the originating network connects to the potential donor network. If the dialled number has in fact been ported, the donor network itself routes the call to the recipient network.

Call Drop Back: Here the potential donor network checks if the number is ported and if it is, releases the call back to the originating network together with information identifying the correct recipient network. The originating network then routes the call to the recipient network.

From a technical perspective, the preferred solution is All-Call-Query. It is commonly used throughout the world. With ACQ for each call the switch queries a database, to see whether the number is ported or not. If the number is ported, it will receive a

so called Routing Number (RN). For efficiency reasons this can be part of the existing call messaging.

Onward routing is a method where the donor network manages the routing information (RN) for a ported number. In practice it can be applied in parallel with ACQ: especially since calls from abroad (to ported numbers) are usually not routed directly to the recipient operator.

An important aspect to take note of is the concept of 'call looping' or 'circular routing' in case mistakes occur in local NP databases. A solution is to have a clear understanding between network operators on how to include the NP information in the call signals (i.e. the routing number) and it is recommended that this shall not be altered by other parties.

When NP comes into play, routing of calls become more complex, not in the least from a technical perspective, but also from a regulatory perspective. If a number is ported from network A to network B, a call originating in network C may be routed directly to network B, the new serving network, assuming that network has the information (in an MNP register or database) that the called number is served in network B, and not in A. Network A, as the previous service provider to the customer, in this case has no role to play in routing and terminating the call. If network C does not have information about the ported number (in NP terminology this scenario is referred to as 'Onward Routing') and routes the call to network A (the original network) then network may either re-route the call to network B, or the call is lost. Also if calls are originating from foreign destinations then this situation of re-routing calls is evident. Obviously lost calls should be avoided. This may be achieved by implementing legislation requiring network operators to route incoming calls towards the destination, instead of 'dropping' calls to ported numbers. Practically this could done by making use of an interconnect service or a transit service. Many countries do not have such a rule in place and therefore telecom regulators have complex debates over network routing principles, and endless disputes between network operators.

IT SOLUTION

For the inter-operator process, the NP procedures between the service providers, a connecting solution is required. This solution is needed so that operators and/or service providers can inform each other about ongoing and completed porting of numbers in a standardized way. Because of the large amount of ported numbers, a standardized communication protocol is essential so that involved parties can automate their processing where and when desired and possible. An NP system generally consists of a clearing house function for the message handling, ported number database, interface for the operators (machine-to-machine or manual web interface) and number plan administration. Other important aspects are the reporting facilities and the system administrator function.

This solution can be implemented and owned by the regulator themselves, a federation of network operators, or an external supplier that also builds the system or any other third party.

Although the central solutions, using a clearing house, are most common, also de-central/ distributed solutions are possible and have been practiced. The centralized model involves a single reference database containing data for all mobile numbers or alternatively, all ported

numbers. This reference data is usually copied to operational databases in each participating network on a frequent basis. The distributed model involves multiple databases containing subsets of the total data.

Although the technical implementation of NP involves particular challenges, the challenges in devising the administrative arrangements facilitating porting of numbers may need equal, if not more attention. This concerns the process for the end-user to request for a number porting.

Costs related to NP

Three types of costs are of importance to consider:

System set-up costs: These costs ensure that all or most users have the capability to use number portability. These may be the costs of establishing/maintaining routing databases, conditioning existing networks, upgrading network switches, and modifying existing software. These are the costs that a provider may incur in establishing the capacity to provide number portability on its own network and in its associated operational support and administration.

Call Conveyance costs: The costs of additional conveyance of calls to ported numbers in the case that they must transit the donor network.

Administration costs: These are customer transfer costs or porting costs. They include the costs incurred by service providers in closing an existing account, setting-up a new account and coordinating the network operators in the switching over of the mobile number and routing of the calls; costs of new handsets or SIM cards; and caller costs (the additional delay in setting up a call to a ported number).

A next issue is whether these costs are recovered, either from the end-users or from either the new or the old network operator. Generally:

- The new network operator may be allowed to request the customer to pay a certain one-off porting fee, but restricted to a maximum fee;
- The old network operator is not allowed to request the customer to pay a certain one-off porting fee;
- The old network operator may be allowed to request an inter-operator fee from the new network as compensation for executing the number porting process, but on cost-base or as a component in the interconnection agreement.

Cost allocation

A question may arise whether decisions on who is paying for what should be a regulatory decision or a market decision taken by the involved operators. There are also examples where the regulatory authority carries part of the costs.

Tariffs and tariff transparency

Subscribers find it desirable to be able to predict the price of calls, and porting numbers should where possible not undermine this capability. This issue is especially important given the proliferation of tariff plans that depend on the destination of the call.

For example, some cellular service providers charge less for calls within their network (on-net calls), and more for calls to phones on other networks (off-net calls). If portability is implemented, then it may not be possible for a

caller to determine whether the call is on-net of off-net, which is a potential violation of the tariff transparency. Solutions to recover the transparency are to be considered such as notifications during the call set-up.

When looking to number portability implementations around the world then at a high level there are many similarities in these implementations in the architecture of the solution, routing solutions, porting procedures, legal issues, etc. However at a detailed level there are many differences due to the specific national regulation on NP, and due to specific differences in markets and cultures.

Success in NP

In practice, the success at which number portability is operated in various markets shows substantial differences. Some markets have high rates of ported numbers: for instance in Finland, Denmark and Hong Kong, where in others only show very low porting percentages – even after several years of operation. The success of NP may be depending of the quality of the number porting process implementation, as well as on the legal or financial conditions that are set for a number to be ported. Also cultural differences play an important role in and customer behaviour.

About us

Rabión Consultancy is an independent consultancy firm in Information and Communications Technology, based in the Netherlands. Rabión Consultancy has no ties or relations to system development or software companies.

Our clients are Telecom Operators, Service Providers, Telecom Regulators, Telecom solution/equipment suppliers. The company is founded in 1999 and privately owned.

The main areas of expertise that we work on are Number Portability and Numbering Management, Interconnection, Roaming, Mobile Virtual Network Operators and Wholesale, Mobile Communication networks (GSM, GPRS, UMTS, WLAN, and LTE), Telecom and Data Infrastructure (ADSL, IP, and VoIP), Telecom Services, Billing & Payments.

We have international experience in several countries such as Netherlands, Belgium, Aruba, Malawi, Netherlands Antilles, Hungary, Brazil, Germany, France, UK, Bahrain, Suriname, Jamaica, Moldova, Jordan, Haiti, and Luxemburg.

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