

**FINAL REPORT
ON
NUMBER PORTABILITY
FOR MOBILE NETWORKS**



4 April 2000

This study has been prepared by ETO for ECTRA

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This report has been prepared by Marco Bernardi and Jack Nuijten from ETO with the kind assistance of other experts in and outside ETO, the ECTRA Project Team on Numbering, ECMA, ETNO, ECTEL, EIIA, ETSI, INTUG Europe and GSM MoU. It is to be noted, however, that the report does not necessarily reflect the official opinions of the said organisations.

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Executive summary

The term "Mobile Number Portability (MNP)" refers to facilities enabling a customer to change his mobile network operator and/or service provider while retaining his E.164 number¹. MNP does not include Service Portability, which refers to the possibility of moving from one service to another service while retaining the same mobile number. A particular form of Service portability is Fixed-Mobile Service Portability (FMSP) enabling a customer to move between fixed and mobile services without changing his E.164 number (and without changing service provider or network operator). FMSP should be clearly distinguished from number portability between service providers or network operators.

In the case of MNP the customer changes network operator and/or service provider while keeping the same number for the provision of the same service. However in the process of changing network operator and/or service provider the customer may lose supplementary services related to the basic service.

Mobile number portability

MNP is only applicable to E.164 numbers. International Mobile Subscriber Identities (IMSI), which are used by mobile networks for the identification of mobile users and terminals, are not portable. A change of mobile network operator necessitates a change in the IMSI and in the SIM (Subscriber Interface Module) card.

The introduction of MNP includes technical, operational and economic aspects.

Technical aspects of the provision of MNP

NRAs do not have a controlling and active role in the choice and definition of the technical solution for the provision of MNP. The role of NRAs is to ensure that the technical solutions adopted meet the criteria of fairness, openness, feasibility and simplicity.

The provision of MNP implies the introduction of additional capabilities in the network to properly route the call to the final destination and provide supplementary services such as Short Message Service (SMS) and CCBS (Completion of Call to Busy Subscriber).

In discussing technical solutions for the provision of MNP it is useful to make a distinction between call-related functions and non call-related functions. The call-related functions are the functions which are used to establish a call to a mobile terminal; the non call-related functions are the functions which are invoked to provide services such as SMS which are not directly linked to a call.

¹ E.164 numbers are numbers defined in ITU-T Rec. E:164 and include numbers used for fixed and mobile telephony services.

For call-related functions two types of solution have been widely accepted as the most promising ones:

- Intelligent Network (IN) based solutions,
- Signalling Relay Function (SRF) based solutions.

For non call-related functions, solutions based on SRF have been identified as the most appropriate.

IN based solutions and SRF based solutions differ in terms of network capabilities and equipment to be deployed. SRF based solutions seem to be reasonably simple to implement, being based on the existing capabilities of mobile networks. The call handling in the switch does not need to be modified. On the other hand the use of IN based solutions requires the introduction of new functionality in the switches and some changes to the call handling.

This appears to suggest the conclusion that, at present, IN based solutions would be more costly and complex than SRF solutions. However, looking at the evolutionary scenarios with the growing convergence of fixed and mobile services, the large presence of IN based services and the availability of UMTS (Universal Mobile Telecommunication System), IN solutions are expected in the next few years to be increasingly used as a means of providing MNP.

Operational aspects of the provision of MNP

The operational aspects discussed here are mainly part of the administrative porting processes of both the relinquishing and the recipient mobile network operator and mobile service provider. In addition, the national numbering plan manager, generally in the European context the NRA itself, is involved. In principle MNP has an impact on operational processes. The processes are addressed here as far as they have relevance to the role of NRAs:

- The MNP porting process is looked at from the customers' point of view, emphasising customer interests that may deserve regulatory scrutiny. NRAs should ensure that customer interests are taken into account concerning:
 - whether customer procedures are simple to follow and how well customers are informed
 - for what reasons and for how long the porting process can be blocked
 - which and how many numbers a customer can port per changeover
 - how limited time scales are for the preparation of the porting
 - how limited disruption is during the actual changeover.
- The choice between centralised and decentralised databases to administer the porting of mobile E.164 numbers is addressed. A central master database is considered preferable.

- The effects of number portability in general, including MNP, on number administration and management are discussed, in terms of both direct effects and probable longer-term effects.

Economic aspects of the provision of MNP

First the benefits of MNP are considered. The net benefits (total benefits minus total costs) are of importance for NRAs deciding whether to introduce MNP or not. Six examples are provided of cost benefit analysis studies for MNP made for NRAs. They all show estimated net benefits, varying between 55 and 900 million Euro per country, over the first ten year period after introduction of MNP. In all these cases the total benefits significantly outweigh the total costs of MNP. It is concluded that MNP should be introduced as soon as possible.

It is important for NRAs to have insight into the costs of MNP in order to regulate the allocation of costs where required. Only the relevant costs should be taken into account; these are the incremental² costs incurred as the result of the provisioning of MNP. The commonly used categories of costs for MNP are:

- *The system set-up costs*
These are the incremental costs needed to establish MNP provisions in networks and support systems, including all non traffic sensitive one-off costs.
- *The administration costs*
These are the per number set-up costs incurred in the porting of numbers. Only the incremental costs, in addition to the normal costs of transferring customers, should be included.
- *The extra conveyance costs*
These are the additional conveyance costs of MNP for individual calls. They could include incremental capital and operating costs of additional switched processing, switching paths, transmission links and IN database capacity which are associated with MNP.

If an NRA decides to introduce MNP, the costs should be allocated according to principles that maximise net benefit for society as a whole. The following cost allocation principles are proposed for adoption:

- cost causation;
- cost minimisation;
- distribution of benefits;
- effective competition;
- reciprocity and symmetry;
- practicability.

² Incremental costs are the increase in the total costs of companies that arises from an increase in output by a discrete increment. In the context of this study, the national provision of mobile number portability is the discrete increment.

A reasonable balance in applying the six principles for cost allocation is achieved when:

- The system set-up costs are borne by each market party for its own facilities, except when neutral parties are involved, such as fixed network operators, who should recover their relevant incremental system set-up costs from participating mobile operators.
- Administration costs are recovered by the relinquishing party from the recipient party, while the recipient party may charge the customer a one-off fee for a limited amount which should not deter customers from using MNP.
- Extra conveyance costs are not recovered; an alternative is to leave recovery of extra conveyance costs to negotiations as part of general interconnection negotiations and if required a code of conduct may be developed. If market parties cannot come to an agreement the NRA should set the charge levels.

Fixed-mobile service portability

The introduction of FMSP is closely related to the emerging process of convergence between fixed and mobile services and networks. Until now the Fixed-Mobile Convergence (FMC) process has been mainly driven by market forces rather than the technology involved. The final shape of FMC is not quite clear and at the regulatory level not much has been done to guide this process. At present the mobile and the fixed sectors are still under quite different regulatory regimes.

In terms of numbering, from a customer point of view FMC means in most cases the use of a single E.164 number for both mobile and fixed services. This number may be:

- a personal number;
- a number for FMC-based services³;
- a number which can be used for both mobile and FMC-based services;
- a number which can be used for the wide range of fixed local loop services, mobile services and FMC-based services.

In these cases the national numbering plan should have number ranges designated for these purposes. Customers should be able to port these numbers between operators and service providers.

Coming back to FMSP, this type of portability is currently not available in any European country. The absence of technical solutions for the implementation FMSP is a barrier to its introduction.

From a regulatory point of view the introduction of FMSP would imply a change to a closed numbering plan, loss of geographic information and loss of tariff information carried in a number with consequences for tariff transparency.

³ FMC based services are services based upon 'full' FMC (integration between fixed and mobile)

A decision about the introduction of FMSP would be premature at present due to the uncertainty about the benefits and the costs.

1 Presentation of the study

This study has been prepared by ETO for ECTRA. The study concerns regulatory issues surrounding the provision of Mobile Number Portability (MNP) and discusses aspects related to the introduction of Fixed-Mobile Service Portability (FMSP). The scope of the study is limited to GSM networks; UMTS is not included.

The provision of MNP involves technical, operational and economic aspects. For each of these aspects the study identifies the relevant regulatory implications and discusses the action that needs to be taken by the national Regulators.

The introduction of FMSP, in terms of benefits and disadvantages, is still unclear. The report presents the most outstanding regulatory aspects that today represent a barrier to the provision of this specific form of number portability.

The work requirement addressed to ETO by ECTRA (see Annex A) sets out the following issues for study:

- the regulatory requirements for MNP regarding GSM and DCS networks and services in different countries and regions
- technical solutions for MNP and the compatibility and interoperability of these solutions
- the implications for number plan management and assignment
- cost allocation
- any implications for the Short Message Service
- requirements to support, in particular, portability between fixed and mobile networks, including changes to national number plans
- analysis of charging implications, particularly for portability between fixed and mobile networks

The study is being carried out in close co-operation with the ECTRA project team on numbering (ECTRA/PTN), ECTRA members and the parties represented in the European Numbering Forum (ENF).

The study requires the preparation of two interim reports, a draft final report and a final report. The first interim report, delivered in May 1999, focused on number portability between mobile services. The second interim report, delivered in September 1999, also addressed issues surrounding portability between fixed and mobile services. The draft final report takes into account of comments made by ENF members either in form of amended text or as annexes. The final report, which includes any comments received from individual ECTRA members, is delivered at the beginning of April 2000.

2 General Framework for MNP

This chapter introduces some general concepts related to the introduction and provision of Mobile Number Portability (MNP). In this context MNP is considered in a broad sense as the provision of facilities enabling a customer to change his mobile network operator or service provider while retaining the same E.164 number. The introduction of MNP includes technical, operational and economic aspects. These aspects are briefly introduced in this chapter and then further detailed in the following chapters.

2.1 Definitions

The definitions used in this report are derived from the definitions developed by ETSI and ITU-T in their studies on Number Portability.

Entities

Network operator:

an entity that operates a network in order to provide telecommunication services

Service provider:

an entity that offers services to users involving the use of telecommunication services provided by network operators.

Party:

the network operator and/or the service provider.

Donor network operator:

the mobile network operator from which the mobile number was initially ported.

Recipient network operator:

the mobile network operator to whom the mobile number is ported.

Relinquishing network operator:

the mobile network operator from which the number was last ported.

Donor service provider:

the service provider from whom the mobile number was initially ported.

Recipient service provider:

the service provider to whom the mobile number is ported.

Relinquishing service provider:

the service provider from which the number was last ported.

Networks

Donor network:

the initial mobile network where a mobile number was used before ever being ported.

Interrogating network:

the network responsible for the interrogation to obtain the routing number

Originating network:

the network where the calling party is connected.

Recipient network:

the mobile network where a mobile number is registered after being ported.

Relinquishing network:

the network from which the number was last ported.

Transit network:

a network that participates in a communication between two other networks.

Numbers

Directory Number:

a number in the national numbering scheme that is allocated to a customer for a telecommunication service. The Directory Number is the number that is dialled by the users to reach the customer.

Mobile number:

a Directory Number from a specific range of the national numbering scheme reserved for customers of mobile service(s).

Routing Number:

a specific number that is used by the networks to route the call. The routing number conveys information usable by the network. If the digits dialled by the user match the digits of a routing number, the dialled digits should not be interpreted as a routing number.

Ported number:

a number that has been subjected to number porting.

Number range holder:

the entity responsible for the management of numbers within a particular range.

Numbering plan manager:

the authority responsible for the management of numbers or number blocks within a national numbering plan.

Services

Supplementary services:

services that are associated with the mobile telephone service. Voice mail, SMS are examples of these supplementary services.

2.2 Mobile Number Portability

MNP is defined as the process enabling a mobile subscriber to move from a network operator to another network operator without changing his mobile number. The change of network operator may or may not imply a change of service provider.

MNP means that the customer can retain the whole mobile number. Solutions where a customer can move from a donor network operator to a recipient network operator keeping only part of the mobile number, usually the Subscriber Number (SN), and changing the National Destination Code (NDC) have to be discouraged. These solutions contradict the basic principles of Number Portability and heavily counteract the advantages and benefits of its introduction.

MNP is only applicable to E.164 numbers. International Mobile Subscriber Identities (IMSI), which are used by mobile networks for the identification of mobile users and terminals, are not portable. A change of mobile network operator necessitates a change in the IMSI and in the SIM (Subscriber Interface Module) card. The SIM card is a card inserted in the mobile phone storing information relating to the customer's subscription and the home network.

MNP must be interpreted in a broad sense including the capability for a mobile subscriber to move from one service provider to another retaining the same mobile number. As regards the changing of service providers two cases to have be distinguished:

1. both the donor and the recipient service provider are connected to the same network operator;
2. the donor and the recipient service provider are connected to two different network operators.

In the first case MNP has no impact in the set-up phase of a call to a ported number. In the second case MNP has impact in the routing process to establish the call. For both cases MNP requires that some operational actions are undertaken by the service providers and the network operators. Such actions take place off-line at the beginning of the porting process.

It should be noted that MNP does not include Service Portability. By Service Portability is meant the capability to move from one service to another service retaining the same number. Service Portability concerns number portability between an analogue mobile network and GSM networks. FMSP is a particular form of Service Portability involving the customer porting a number between fixed and mobile services.

MNP only allows a customer to change network operator or service provider while keeping the same mobile number for the provision of the same basic service (e.g. GSM teleservice). When the network operator or service provider is changed the customer may lose or gain some supplementary services related to the basic service (e.g. voice mail).

2.3 Introduction of Mobile Number Portability

The introduction of MNP involves issues of three kinds:

1. technical;
2. operational;
3. economic.

From a technical point of view, supporting MNP requires the introduction of additional mechanisms to route the call to the final destination. In the absence of number portability the call to a mobile terminal is routed on the basis of the called party number to a gateway switch which is responsible for the interrogation of the Home Location Registry (HLR). The result of the HLR interrogation is a roaming number used to route the call to the current location of the called party.

When a number is ported from one network operator to another one, the simple analysis of the called party number only allows the identification of the donor network, which usually no longer has the routing information required to terminate the call. This information resides at this stage in the recipient network and needs to be retrieved. Chapter 3 describes architectures and mechanisms to properly route a call to a ported number considering both call-related functions and non call-related functions.

The introduction of MNP implies the establishment of an operational process between the parties involved. In the porting process the following roles are identified:

1. donor service provider and/or donor network operator;
2. recipient service provider and/or recipient network operator;
3. relinquishing service provider and/or relinquishing network operator;
4. customer.

The relinquishing service provider and the relinquishing network operators are the service provider and the network operator from which the number is being ported out. In the case of a first porting the relinquishing party is the donor, and in the case of a second or subsequent porting the relinquishing party is the former recipient. In some case the roles listed above can be combined and fulfilled by the same legal entity.

The porting process is always initiated by the customer with his request to change service provider or network operator. Chapter 4 addresses some of the operational processes related to MNP, putting particular emphasis on regulatory aspects.

In terms of regulatory aspects it should be noted that the introduction of MNP also heavily affects the administration and management of the national numbering plan. As an example the presence of number portability may impact on the concept of number range holder. The question of which operator will have legal responsibility for a ported number has to be answered.

Finally the introduction of MNP raises some important economic questions. The provision of MNP brings a number of direct and indirect benefits to the customers and also in general to the whole industry, but it implies some additional costs as well.

The crucial step, subsequent to the identification of cost categories, is the examination of the principle for distribution of the cost between the parties involved, which basically are the calling and called customers, the donor service provider/network operator and the recipient service provider/network operator.

Chapter 5 will address these issues in further detail, describing principles for cost allocation and mechanisms for cost recovery.

2.4 Current development of MNP

MNP is taking its first steps in Europe. Today there are only two ECTRA countries, the Netherlands and the United Kingdom, where MNP is available. Certain other countries, such as Switzerland, Italy, Denmark and Ireland, have planned to introduce MNP in the next two years.

Annex B provides an overview of the current and future development of MNP in the ECTRA countries.

The process of introduction of MNP could be speeded up by an EU decision in this direction. At the moment the EU policy on number portability for mobile services has not yet been established. In the communication from the Commission on the 1999 Communications Review, the Commission proposes to extend the availability of service provider portability to mobile users.

Outside Europe MNP has been introduced in a few countries. In Singapore in order to promote competition in the mobile sector, MNP was made mandatory by TAS (Telecommunication Authority of Singapore) in April 1997. To implement MNP a phased approach has been adopted. The initial solution has been based on call forwarding capabilities and a migration to IN based solution has been planned. In the initial phase of the provision of MNP customers suffered some limitations on the services provided. For example Calling Line Identity service and SMS for GSM users were not available. In terms of allocation of costs TAS has played a role in facilitating the commercial negotiations among the mobile operators to agree on how to share the costs incurred in the provision of MNP.

During this negotiation it was agreed that the recovery of costs, at least for the interim solution, would involve a charge to porting subscribers decided by the industry. The TAS agreed that a charge of 4-5 Euro per month was fair. According to some observers the amount of this monthly charge has been the explanation for the initially slow take off of MNP in Singapore.

In the United States the FCC (Federal Communications Commission) has requested that by the end of December 1998 all wireless carriers must have the capability to query the appropriate Number Portability database to deliver calls to ported numbers. In addition the wireless carriers must introduce MNP, including nation-wide roaming capabilities, in the 100 largest Metropolitan Statistical Areas (MSA) by the end of June 1999.

In Hong Kong, according to OFTA (Office of Telecommunications Authority), MNP was implemented in March 1999. MNP will be implemented by a distributed database solution with fixed telecommunication operators providing the database interrogation in the initial phase of the service. Mobile operators should cover the system set-up and the additional conveyance costs faced by fixed operators. In the future mobile network operators could decide to run and maintain their own NP databases if they think that is more convenient than using the database interrogation services offered by fixed operators.

3 Technical solutions for implementation of MNP

This chapter describes technical solutions for implementation of MNP in the network. The aim of this chapter is to present the different architectures and functionality needed to support MNP; it does not attempt to provide a detailed description of these solutions in terms of protocols and signalling aspects.

In the following a distinction is made between the "call-related functions", which are used to establish a call to a mobile terminal, and the "non call-related functions", which are invoked to provide supplementary services such as SMS and CCBS.

3.1 Call-related functions

In a case where a number has been ported between two network operators the establishment of a call cannot be based on the simple digit analysis of the called party number. Such analysis only allows the identification of the donor network that, in principle, is no longer responsible for the ported-out number. The information about the ported-out number and how to route the call resides now in the recipient network. The problem then is to identify the recipient network and to route the call to this network so that the call can be handled in the appropriate way and completed.

At present there are two types of solution which have been widely accepted as the most promising ones for the call-related functions:

1. IN (Intelligent Network) based solution;
2. SRF (Signalling Relay Function) based solution.

The two solutions differ with regard to the network functionality and the network equipment used to obtain the routing information required to route the call to the ported customer. Both solutions are standardised and described in the ETSI Technical Specification GSM 03.66.

3.1.1 Solutions based on Intelligent Network

The idea that lies behind this solution is the use of Intelligent Network capabilities to retrieve the routing information required to forward the call to the recipient network. The interrogation may be performed in the originating network, a transit network or the donor network. Triggering in the originating network optimises the call routing.

As an example figure 1 depicts one of the possible solutions: the call is routed to the donor network that performs the NP interrogation. No detail is given on protocols and interfaces used.

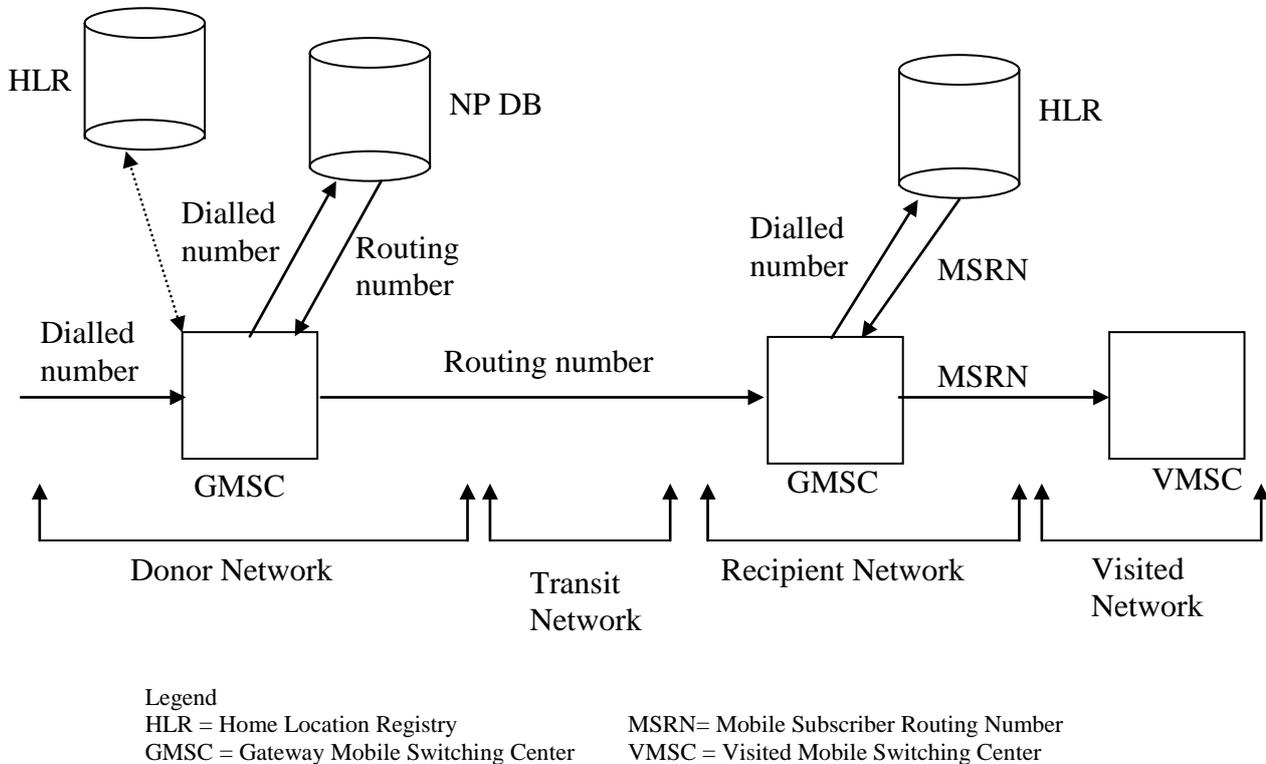


Figure 1: IN solution for call related functions

In this example, when the signalling message used to set up the call and containing the called party number⁴ reaches the GMSC of the donor network a query to the IN Number Portability database is triggered. If the number has been ported the result of this database dip is the routing number used to route the call to the recipient network.

The query to the IN Number Portability database can be triggered by different criteria:

1. systematically for every call (method called AcQ, All call Query);
2. on the basis of a digit analysis of the called party (QoD, Query on Digit analysis);

⁴ for sake of simplicity in the following this message will be generally referred as "set-up message" without any reference to a specific signalling system

3. as a result of a preceding interrogation of the HLR (QoHR, Query on HLR Release. This option is possible only if the interrogation is performed in the donor network. The HLR is first interrogated and if the number proves to be unknown, or to have been ported out, a second query is made to the Number Portability database to obtain the routing number.

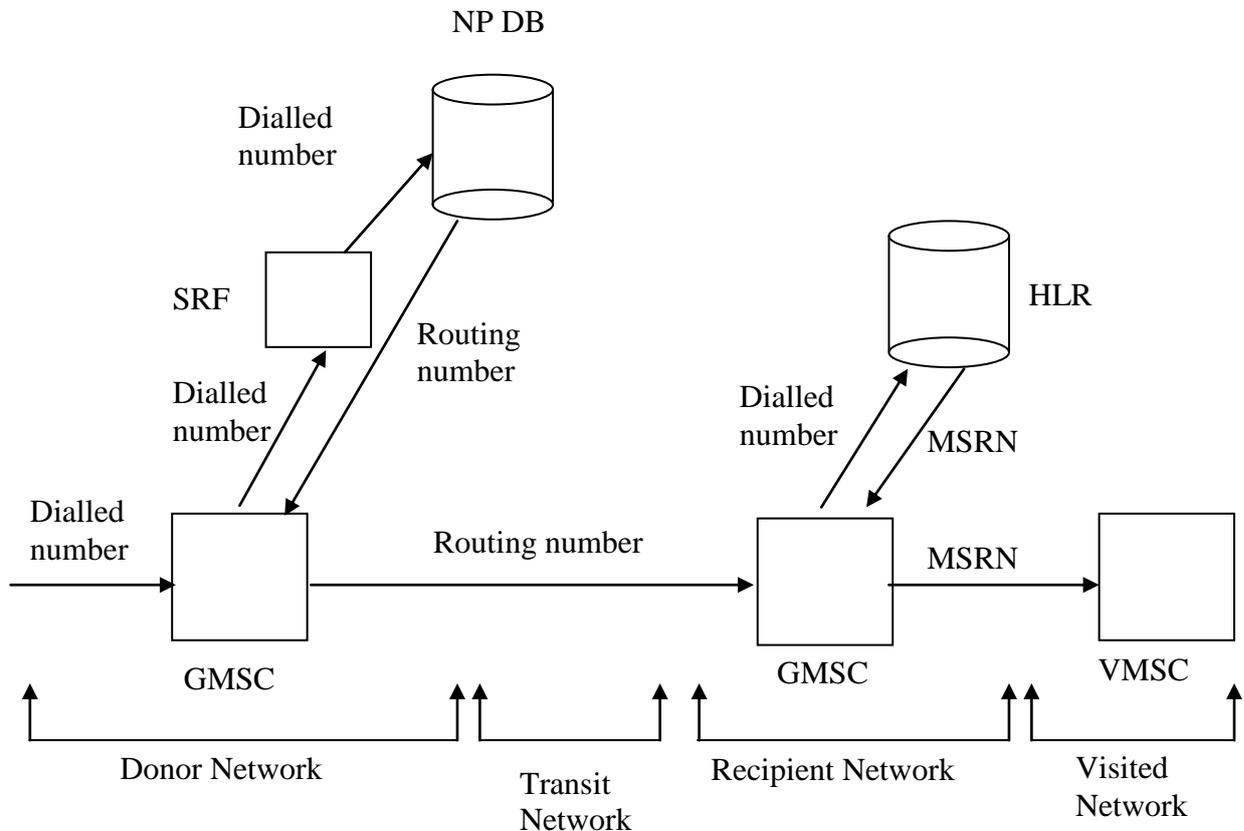
The advantage of the first two options is that the HLR is not involved in calls to ported-out numbers. This is especially interesting in case of a large amount of ported-out numbers. In addition there is no need to introduce the HLR release as a new triggering criterion. The third option has the advantage that it is only for ported out numbers or misdialled numbers that the IN database is interrogated.

Irrespective of the mechanism used to trigger the IN query after the routing number is retrieved, the RN is inserted in the "set up message" and the call is routed to the recipient network.

When the "set-up message" reaches the recipient network the GMSC interrogates the HLR to obtain the Mobile Subscriber Roaming Number used to identify the physical location of the called party.

3.1.2 Solutions based on Signalling Relay Function

SRF includes re-routing capabilities provided by the signalling system at the SCCP (Signalling Connection Control Part) level. The SRF intercepts the "set up messages" used to route the call, performs the portability check and returns routing information to the GMSC or relays the message to the HLR. This can be done by either the originating or the donor network. Figure 2 describes the case where the portability is processed by the donor network. The solution is depicted without any detail in terms of protocols and interfaces used.



Legend

HLR = Home Location Registry

GMSC = Gateway Mobile Switching Center

SRF = Signalling Relay Function

MSRN= Mobile Subscriber Routing Number

VMSC = Visited Mobile Switching Center

Figure 2: SRF solution for call-related functions

In this example when the "set-up message" reaches the GMSC a routing enquiry is sent to the SRF. The SRF, analysing the called party number, determines whether the number has been ported to another network. If the number has been ported there are two possibilities: either the SRF can determine and return to the GMSC a routing number enabling the routing of the call to the recipient network (Figure 2); or it relays the message to the SRF function of the recipient network which returns a routing number to the GMSC. As is the case in the IN based solution when the "set-up message" reaches the recipient network, the GMSC interrogates the HLR to obtain the Mobile Subscriber Roaming Number used to identify the current physical location of the called party.

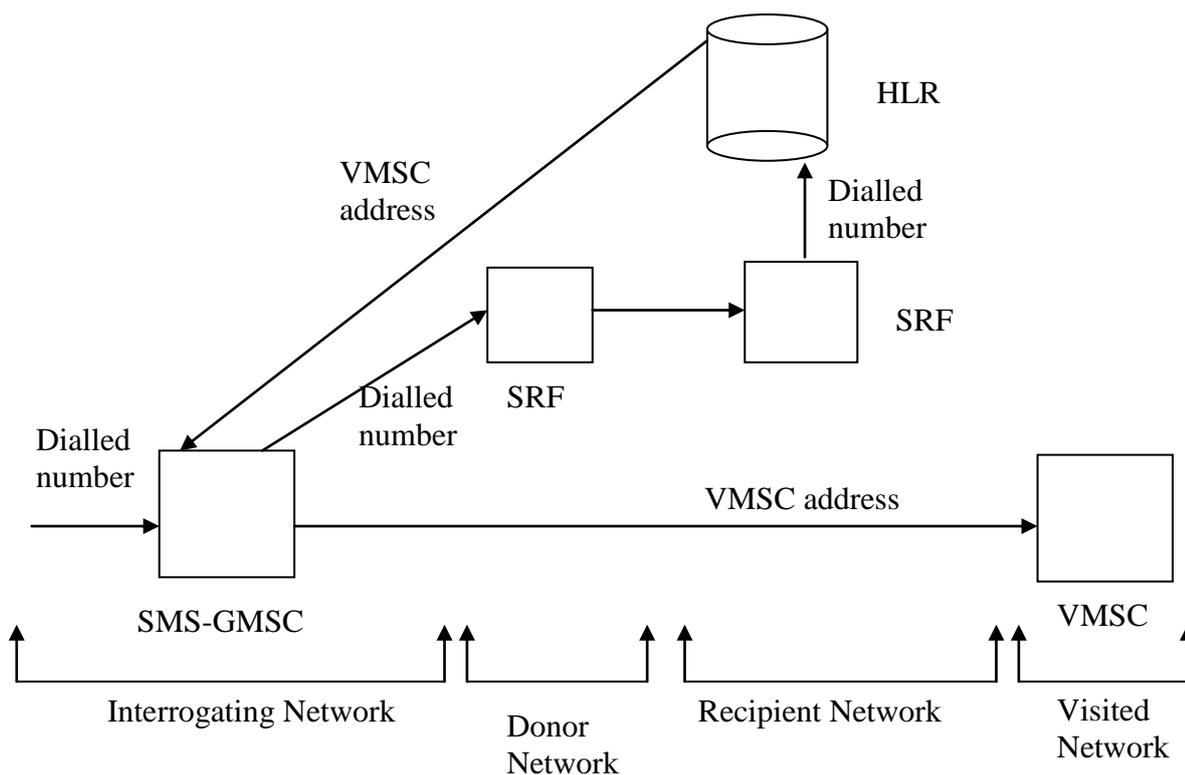
What is presented in figure 2 is just one of the possible solutions based on SRF. One variation is about the location of the interrogation. It may occur either in the originating network or in the donor network. The first option allows the originating network to route the call directly to the recipient network without involving the donor network in the retrieval of the routing number.

3.2 Non call-related functions

MNP must not preclude the provision of supplementary services, including services offered not in conjunction with a call. SMS, Optimal Routing and CCBS are examples of these types of service whose provision requires the use of non call-related functions.

For non call-related functions, solutions based on SRF have been identified as the appropriate ones.

Figure 3 shows the solution for the provision of an SMS to a ported customer. The figure is a logical diagram only and it does not show protocols or interface aspects.



Legend

HLR = Home Location Registry

GMSC = Gateway Mobile Switching Center

SRF = Signalling Relay Function

VMSC = Visited Mobile Switching Center

Figure 3: SRF solution for non call-related functions

The SMS-GMSC in the interrogating network generates the routing enquiry for the Short Message delivery to the SRF function of the donor network which relays the routing enquiry to the SRF function of the recipient network. In the recipient network the appropriate HLR is interrogated and the result of the database dip (VMSC address) is returned to the SMS-GMSC, which can be either in the donor network or in the originating network. The GMSC then routes the Short Message to the VMSC.

Apart from the indirect routing method (Figure 3) which involves the donor network, there exists the direct routing method where the interrogating network interrogates an NP-database and relays the message to the recipient network without involving the donor network. Considering the fast growing SMS traffic and the coming CCBS function, it should be noted that direct routing will be the most cost effective method when the volume of ported numbers grows.

3.3 Evaluation of the technical solutions

The evaluation of the merits and drawbacks of the various solutions for the implementation of MNP is a difficult exercise that has to take many aspects into account.

There are purely technical aspects pertinent to network architecture, routing, protocols, signalling, etc. There are aspects related to management, maintenance and updating of the information, such as routing numbers, required to implement MNP. And finally there are aspects pertinent to the cost of rolling out and running network capabilities for the provision of MNP.

Another important aspect which has to be taken into account is the opportunity to use some of the capabilities that are deployed to support MNP to provide new services to customers and to improve the efficiency of the networks. In other words the new network capabilities will not only be used for MNP but also to provide innovative services or existing services in a more efficient way.

For call-related functions two preferable types of solutions have been identified: SRF based and IN based. It should be noted that, irrespective of the technical solution used, the provision of MNP requires some enhancements to the routing mechanism and consequently to the signalling system.

SRF based solutions seem to be reasonably simple to implement, being largely based on the existing capabilities of mobile networks. The capability of providing MNP is offered at the SCCP level; this implies that any future enhancements or changes taking place at the Application level should not interfere with the solutions for MNP.

For the provision of MNP the SRF capacity required for non call-related traffic may need to be extended to support the additional traffic arising from calls to ported numbers. This suggests the conclusion that SRF based solutions can be implemented with reasonable costs to cover the deployment of the NP database and the enhancement of the capacity of the signalling links and systems to cope with the additional signalling traffic due to calls to ported numbers.

In addition to supporting MNP, the introduction of SRF allows mobile operators to increase the flexibility of their networks, breaking the close relationship between MSCs, HLRs and the numbering plan. Subscriber information can be moved to different HLRs and advanced services can be provided by using specialised HLRs. These specialised HLRs can be run by independent number-translation database service providers.

The provision of MNP by using IN based solutions requires the introduction of new functionality in the GMSC. In particular, for GMSCs that are not yet equipped with IN capabilities, substantial investments have to be planned to introduce these IN mechanisms. For GMSCs that are already equipped with IN capabilities to support advanced service control functionalities, more limited investments are required.

If IN solutions are used the call handling in the MSC has to be changed; an additional load is introduced due to the need for invocation of IN functions.

It is also worth noting that the deployment of IN based solutions for call-related traffic requires in addition the use of SRF capabilities for non call-related traffic. SRF based solutions, on the other hand, can be used for both call-related and non call-related functions. The combined use of two different solutions, IN and SRF, may represent a disadvantage in terms of cost, network efficiency and network maintenance. As an example the use of two solutions may imply the need to keep and run two databases, one for call-related traffic and one for non call-related traffic, with clear problems in terms of alignment and coexistence of the information stored in the two databases.

To summarise, at present IN based solutions seem to be more costly and complex than SRF solutions as a means of providing NP in mobile networks. However, looking at the evolutionary scenarios with the growing convergence of fixed and mobile services and the availability of UMTS, some extra considerations can be taken into account. In the next few years the boundaries between mobile and fixed services are going to blur and in the long run to disappear completely. The idea of UMTS, which is an important example of this convergence, is to provide customers with advanced telecommunication services in a user friendly way. The same services will be available from mobile, satellite and fixed networks, giving the customer a perception of a convergence between the fixed and the mobile environments. IN capabilities are likely to be largely used to provide subscribers with these services.

IN based solutions have been identified as promising solutions for providing number portability in fixed networks. Bearing in mind what has been said about fixed and mobile convergence, the spread of IN solutions in the fixed environment may pave the way for a rapid adoption of these solutions for MNP. This would facilitate interoperability between fixed and mobile networks to complete calls to ported numbers. In addition the investment in rolling out the IN capabilities will mainly be covered by the provision of these new advanced services, based on the idea of being able to communicate with anybody, anywhere, at any time, in an easy and quick way.

3.4 Role of NRAs

The whole industry, including network operators, service providers and manufacturers should be involved in the identification and development of the technical solutions for implementation of MNP. In this area a key role is expected to be played by the standardisation bodies, in particular ITU-T at the global level and ETSI at the European level.

The availability of standardised solutions developed by ETSI and ITU-T will make the introduction of MNP easier. At the national level the interested parties can choose among the standardised solutions available those solutions which they think can best meet their requirements.

The role of NRAs is not to choose and impose a specific national technical solution for the provision of MNP but to ensure that the solutions taken into account meet criteria of fairness, openness, feasibility and simplicity. As an example NRAs should promote technical environments which do not unduly penalise any of the parties involved, are not based on specific technology, are as far as possible internationally standardised and finally are flexible enough to coexist with other solutions and, if required, to evolve.

The choice of the technical solution to implement MNP should be left to the network operators and service providers. NRA action should be envisaged if the technical solutions adopted violate the above mentioned principles of fairness, openness, feasibility and simplicity.

This limited involvement of NRAs in technical aspects is in line with the principle that regulation should be neutral with respect to technology as long as the technical solutions do not distort the market.

ETO concludes that:

NRAs should not have a direct role in the choice and definition of the technical solutions to implement MNP but ensure that these technical solutions meet reasonable requirements in terms of fairness, openness, feasibility and simplicity.

4 Operational aspects of the provision of MNP

The operational aspects discussed here are mainly part of the administrative porting processes of both the relinquishing and the recipient parties. In addition, the national numbering plan manager is involved. Depending on the technical solution chosen for the network, other mobile and fixed network operators or independent number-translation database service providers may be involved. This may occur if, for example, an IN solution is chosen with a national translation database for all mobile and fixed networks. The national database may be managed by a service provider which is independent from the operators.

In principle MNP has an impact on operational processes. A brief overview of the impact is provided below:

- *Operational procedures*

Extra information flow is required for transferring customers who port their numbers. Here some customer interests are at stake which are addressed in the next section.

- *Charging procedures*

The impact of MNP is probably heaviest on network systems for charging operators of other networks. The impact depends on the cost recovery mechanisms. Roaming partners may also have to be informed about ported numbers for charging purposes.

- *Administration databases*

Administration databases, whether centralised or decentralised, are addressed in section 4.2.

- *Automation of the porting process*

The automation of procedures within operators' networks needs to be reflected by similar automation between networks. A system for the automatic porting and synchronisation of operators' switching and operational support systems should be developed. Here also there are some customer interests at stake which are addressed in the next section.

The operational impact of MNP is considered in this chapter to the extent that it may have relevance to the role of NRAs. Generally in the European context, the NRA itself is one of the parties involved as the national Numbering Plan Manager (NPM) with responsibility for keeping track of ported numbers. More importantly, the NRA should ensure that coordination between parties involved is carried out in time. The operational aspects can be compared with the main bulk under water of an iceberg where the technical solutions for the networks are merely the visible tip of the iceberg. These operational aspects require thorough preparation and national wide co-ordination and should not be underestimated. NRAs should have an active role in the preparatory process by ensuring that certain customer interests are taken into account.

The impact of the use of pre-paid cards on MNP deserves special attention as it poses some additional problems. The use of pre-paid cards is increasing rapidly at present and their attractiveness for customers cannot be ignored. A general problem with pre-paid SIM cards is that the customer is anonymous, and this provides more opportunity for fraud. In cases where subscribers have to be identified by the network for special rates, there is another problem regarding real-time rating of calls from pre-paid mobiles.

The sections below address the following issues:

- the porting process from the customers' point of view with emphasis on customer interests that may deserve regulatory scrutiny;
- the choice between centralised and decentralised administration databases;
- effects of MNP on number administration and management, both direct effects and probable longer-term effects;
- recommendations to NRAs regarding their role in operational aspects.

4.1 Customer interests

Customer interests in the MNP porting process include the following aspects:

- customer procedures;
- blocking of the porting process;
- which and how many numbers per changeover;
- time scales for the preparation of the porting;
- disruption during the actual changeover.

Each of these aspects is subsequently addressed in the subsections below and illustrated with examples of solutions chosen in some countries, in particular the United Kingdom, The Netherlands and Hong Kong.

4.1.1 Customer procedures

Customer procedures should be straightforward and explained in simple terms. Customers should be well informed about porting procedures and associated costs.

A one-stop shopping process is preferred by customers. A market study by Libertel, the Dutch second GSM operator, reveals that 90% of the customers prefer one-stop shopping. In The Netherlands, the United Kingdom, Denmark and Hong Kong, customers go to the recipient party to request the switch of party with porting of their numbers. The recipient party contacts the relinquishing party to check whether the customer can switch.

Of course, the relinquishing party should be allowed to contact the customer. This may help to avoid a mobile number being ported without the customer's knowledge or consent ('slamming').

4.1.2 Blocking of the porting process

A number should not be released for porting before the customer using the number has fulfilled all his obligations towards the relinquishing party. There may, for example, be blocking issues such as outstanding payments due from the customer or an unfinished minimum subscription period. Blocking issues deserve careful attention in the preparation process and should not be underestimated. Important blocking issues include subsidised handsets, pre-paid SIM cards and SIM locks. These issues should be subject to regulatory scrutiny. Subsidised handsets would justify a minimum contract period before the customer can port his numbers. Pre-paid SIM cards are often combined with subsidised handsets.

MNP for pre-paid cases is possible in the United Kingdom and in The Netherlands. In The Netherlands there is no transfer of call balances between the relinquishing and the recipient operators. To solve the pre-paid handset problems, a SIM lock is often built into the software on the pre-paid SIM card. The SIM lock links the SIM card to the handset. The SIM card therefore cannot be exchanged to enable the porting of the handset in the number porting process. A hardware change in the handset is needed to adapt to a new SIM card.

In 1996 the European Commission stated that SIM locks are allowed for subsidised handsets if three conditions are fulfilled:

- the subscriber should be informed about the SIM lock;
- the SIM lock should not stay on the handset longer than needed;
- removal of the SIM lock should be simple.

In the United Kingdom SIM locking is allowed. The porting customer can even be charged for the hardware change if the change is kept simple. In The Netherlands, there are over one million pre-paid customers and SIM locking is generally applied. The Dutch independent NRA has investigated whether the application of SIM locking is in conformity with the conditions set by the European Commission. The NRA is developing policy rules on the issue. One of the most important conditions is that the customer himself can unlock the SIM-lock in a simple way without the need to go to a telecom shop. The SIM lock is forbidden in Finland and virtually unknown in Denmark.

4.1.3 Which and how many numbers per changeover

The customer expects to be able to port the E.164 mobile numbers which are associated with the mobile service concerned. The SIM card contains the IMSI which is not in fact used by the customer. As IMSIs are unique to a network operator, an IMSI should not be ported. The porting customer should have a new SIM card with a new IMSI.

There should be no limit to the quantity of numbers that a specific customer can port at one time. The quantity for which the normal procedures can be followed may be limited. Above that quantity, the porting of numbers requires special treatment. In the United Kingdom the threshold is 25 numbers for MNP. In The Netherlands it is 1,000 numbers for both fixed NP and MNP.

4.1.4 Time scales for the preparation of the porting

The time scales for the preparation period following a porting request should be such that customers are not deterred from porting their numbers. It may be advisable to allow sufficient time for the relinquishing operator to check whether a mobile number has been ported without the customer's knowledge or consent ('slamming').

In the United Kingdom, the customer is entitled to choose the date for the porting, from a minimum of 15 up to a maximum of 25 working days in advance. In The Netherlands, the date for porting is settled between the customer and the recipient party. The regulator considers two weeks to be a reasonable period. The service providers have agreed on at least 5 working days before the actual porting can take place. During this time, the recipient party checks with the relinquishing party whether the customer can be released. In Denmark, a single number takes 3 to 5 working days if the customer's identity is known and otherwise 8 to 10 working days. A set of interdependent numbers takes 8 to 10 working days if the customer's identity is known and otherwise 15 to 20 working days. In Hong Kong, a switch can take place in one or two days. In Australia, the numbering advisory committee believes the porting should take place within five working days of the customer making an application; it is considered that it would be extremely difficult to implement any immediate process.

4.1.5 Disruption during the actual changeover

There should be minimal disruption and interruption to customers during the number porting process. The exact moment of the actual changeover is not known in advance. If the old SIM card is de-activated too early or the new SIM card is activated too late, the customer will lose incoming calls. If network actions are not co-ordinated closely in time between networks and also with the SIM card provider, calls may be sent to the wrong network and therefore lost to the porting customer.

In the United Kingdom, the period of uncertainty for the customer is limited to a time window from 11.00 until 15.00 on the day of porting. In The Netherlands, the service providers have agreed on a changeover during 5 to 10 minutes. This period is not common practice yet. During the period of changeover progressively fewer calls can be received on the old SIM card. When the customer cannot make a call on the old SIM card anymore, he should replace the old SIM card by the new one. Then, the porting has been completed.

4.2 Administration databases

Each participating mobile network operator and service provider, and the NPM as well, has to keep track of the ported numbers where these numbers are under his responsibility.

Generally, numbers are assigned in blocks by the NPM to mobile network operators. The mobile network operators assign numbers from their blocks to individual customers or they assign parts of their blocks to mobile service providers who in turn make the assignment to individual customers. When a number is ported, the number blocks of network operators or service providers are affected. This requires updating of the administration databases of involved parties.

Updating of administration databases should be an automated process in order to cause minimum disruption for the customer during changeover. Automation of updating requires that the databases are linked by a network. At the national level two approaches can be chosen for linking the databases:

- a centralised approach, i.e. all information is collected in one central database;
- a decentralised approach, i.e. the information is distributed over several databases.

Using the decentralised approach implies that the databases are directly linked with each other. Using the centralised approach requires that all databases are linked with the central database, also called master database or reference database. A choice has to be made between the centralised approach and the decentralised approach. The advantages of each solution in comparison with the other are listed below:

- *Advantages of decentralised databases (disadvantages of centralised databases)*
 - quicker implementation;
 - easier assignment of costs to the parties involved;
 - clearer separation between the responsibilities of each party.
- *Advantages of centralised databases (disadvantages of decentralised databases)*
 - higher efficiency when there are more than a few databases (a new database only requires one interface with the central database instead of an interface with each other database);
 - lower barrier for new operators and service providers;
 - higher reliability (one central database makes testing and auditing easier and it provides a reference to resolve disputes);
 - simpler recovery of data for all parties involved;
 - simultaneous availability of data to all parties involved, including the NPM.

Choosing a centralised approach also implies consideration in depth of:

- ownership and management of the central database (options for database manager: regulator, incumbent, consortium, third party);
- financing and cost recovery;
- functionality (storage and distribution of information about ported numbers, hub for exchange of messages required in the porting process, provision of number information, number assignment, numbering plan management, support of emergency services, law enforcement).

It may be appropriate for customers' details to be contained on a central database, but the security associated with the access to this database would need to be carefully considered.

Finally, the choice between the centralised approach and the decentralised approach to MNP depends on the approach chosen for fixed NP and on the degree of future need (for instance in terms of fixed-mobile convergence) to combine the databases for both types of NP.

The centralised approach is chosen in The Netherlands and in Switzerland with an independent company chosen by the operators as the central database manager. The central database is used for both MNP and fixed NP. In Switzerland, the same system maintains a centralised directory of all ported numbers which can be accessed by operators for direct routing of calls to ported numbers. In Sweden the technical standards recommend a central database for fixed NP. However, Sweden will start with a decentralised approach, mainly because of problems in agreeing on cost recovery for the central database.

4.3 National number administration and management

In this section the consequences of MNP for national number administration and management are discussed. First, the direct effects are addressed, then the potential long-term effects.

4.3.1 Direct effects of MNP

Generally, numbers for mobile services are assigned by the NPM (National Numbering Plan Manager) to operators in blocks. The legal responsibility for the numbers of the block remains with the operator holding the block as long as no numbers have been ported out from the block. But the legal responsibility for ported numbers requires extra rules.

In The Netherlands, for both MNP and fixed NP, legal responsibility is transferred with the porting of a number to the recipient operator. A number which becomes free after porting returns to the donor operator. In the United Kingdom, for both MNP and fixed NP, legal responsibility remains linked to the full number block originally assigned. The donor operator maintains a list of ported numbers. When a donor operator loses 60% or more of one of his blocks of 10,000 numbers to any recipient operator and at least 40% of this block is handled by one recipient operator, the donor operator or the recipient operator may apply to Oftel for reallocation of that block to the recipient operator. If reallocation is made, the donor operator may apply for a new number block. A number which becomes free after porting returns to the donor operator. This last point also applies to MNP in Hong Kong, where a ported number is regarded as being free when the customer's service has been terminated with the recipient operator for more than three months.

MNP requires assignment of additional numbers for the routing of ported numbers. The routing numbers may be E.164 numbers but may also come from other resources. In Hong Kong, blocks of routing numbers which identify gateways are allocated to each mobile network operator.

4.3.2 Long-term effects of MNP

In the longer term it is expected that MNP (together with all other types of NP) will affect national number administration and management in more fundamental ways. The following assessment of effects relates to a long-term perspective but includes factors which may be applicable to the present day situation. The view is of a tentative nature where developments have been taken into account beyond the scope of MNP. For a more extensive discussion of the long-term effects of NP in general reference should be made to the ETO study on 'The Effect of Number Portability on National Number Administration & Management'.

- *Numbering plan*

In general, all types of NP together ultimately require elimination of information from the number, e.g. regarding service, tariff, location, operator, service provider. This trend is fortified by the synergy of NP with other driving forces such as separation of name and address, fixed-mobile convergence (see chapter 6), reduction of distance dependence of tariffs and alternative means of informing users about tariffs. NP for mobile telephony will contribute to this trend, in particular because of the loss of information regarding tariff and operator.

- *Numbering assignment*

MNP implies that mobile numbers ultimately cannot contain any operator or service provider identity. With MNP it therefore is no longer necessary to assign blocks of numbers to mobile network operators or to service providers. Individual assignment of mobile numbers by the NPM directly to users is not foreseen. Number pooling may be an attractive alternative in particular when capacity constraints for mobile numbers are expected. Number pooling is a numbering management process by which numbering resources are assigned to a shared reservoir associated with specific designated numbering resources. It provides an easy way of exchanging unused parts of originally assigned number blocks or numbers between operators.

4.4 Role of NRAs

ETO concludes that:

NRAs should ensure that:

- the impact of MNP on operational processes is not underestimated and sufficient time is allowed for coordination between parties involved;

- certain customer interests are taken into account, in particular:
 - by ensuring that customer procedures are straightforward and explained in simple terms and that customers are well informed about the porting procedures including the associated costs; by stimulating a one-stop shopping process where the recipient party is responsible for managing the whole process;
 - by defining for what reasons, for what period and by what means it is permissible for customers to be blocked from porting their numbers, in particular with respect to SIM locking;
 - by requiring that a particular porting request can be applied to E.164 mobile numbers associated with the mobile service concerned without a limit to the quantity of numbers;
 - by requiring that the time scales for the preparation period following a porting request are such that customers are not deterred from porting their numbers;
 - by requiring that the actual changeover causes minimal disruption to the porting customers;
- a decision is taken about linking administration databases of operators and service providers, preferably using a central national database; if a central database is used, appropriate security measures for customer details need to be established and a decision has to be taken on the functions of the database, on its financing, on cost recovery and on the choice of the central database manager;
- common rules are developed regarding number block responsibility, if applicable, before the introduction of MNP.

NRAs should consider the following for the long term:

- in general, all types of NP together ultimately require elimination of information from the number, e.g. regarding service, tariff, location, operator, service provider;
- with MNP number pooling may be an attractive way of assigning mobile numbers, in particular when capacity constraints for mobile numbers are expected.

5 Economic aspects of the provision of MNP

This chapter focuses on the economic aspects of provision of MNP both between network operators and service providers. This implies that MNP should not only be applicable when customers switch both service provider and network operator but also when customers change service provider but stay with the same network operator. This is logical from the customer's point of view. In addition, this type of MNP potentially promotes competition both between network operators and between service providers.

First the benefits of MNP are considered and then the costs. The net benefits (total benefits minus total costs) are an important consideration to enable NRAs to decide whether to introduce MNP or not. If an NRA decides to introduce MNP, the allocation of costs among the parties involved is relevant in order to maximise the net benefits. Attention is subsequently devoted to the categories of costs, the cost allocation principles and the actual cost allocation. Finally, recommendations are made concerning the role of NRAs in relation to these economic considerations.

5.1 Benefits of MNP

In Annex C examples are provided of cost benefit analysis studies for MNP made for NRAs in the United Kingdom, The Netherlands, Sweden, Denmark, Australia and Hong Kong. They all show estimated net benefits, varying between 55 and 900 million Euro for a country over the first ten year period after introduction of MNP. In all these cases the total benefits significantly outweigh the total costs of MNP and all these studies conclude that MNP should be introduced as soon as possible. A recent study for the German NRA by WIK (Wissenschaftliches Institut für Kommunikationsdienste; see the bibliography in Annex D) confirmed the conclusions that the total benefits significantly outweigh the total costs of MNP.

These total benefits include not only the benefits which directly concern users, both porting users and calling users, but also the indirect benefits which concern society as a whole. These indirect benefits are probably the most important benefits. They are the consequences of the expected increase in competition because of MNP and the related improvement in the quality/price ratio of telecommunications services. The increase in competition is expected because MNP makes it easier for customers to switch service provider or network operator, provided that the charge to customers for porting their numbers does not act as a barrier.

These figures show consistency in the outcome of different studies regarding the net benefits of MNP. It should be noted that these figures are only valid on the assumption that MNP is introduced speedily. Delays in the introduction would result in loss of benefits. It should also be noted that the figures from different countries are hard to compare as the situations in the countries differ, e.g. one country has a higher degree of penetration of mobile telephony than another.

Not all specific cases of number portability will necessarily yield a positive outcome of a cost benefit analysis. For example, service portability between analogue and digital mobile networks will have less effect on competition in cases where a change of handset is required and lack of NP is only one component of a customer's switching costs. In particular where analogue networks are being phased out, NP may not be beneficial.

It should be noted that mobile operators in general oppose the idea that MNP would be beneficial. Their arguments are that the mobile market should not be compared with the fixed market: competition in the mobile market already exists and development of this market should not be jeopardised by burdening the operators with extra costs while they have to make large investments in building mobile networks. These arguments, however, do not invalidate the result of the studies mentioned above.

Without it being necessary to go into detail it can be concluded that, generally speaking, MNP is beneficial for society as a whole, and that this justifies its speedy introduction. When introducing MNP, it is important to regulate cost allocation in such a way that net benefits are maximised.

5.2 Categories of costs of MNP

It is important for NRAs to have insight into the costs of MNP in order to regulate the allocation of costs where required. Only the relevant costs should be taken into account, and these are the incremental⁵ costs incurred as the result of providing MNP. The commonly used categories of costs for MNP are:

- *The system set-up costs*

These are the incremental costs needed to establish MNP provisions in networks and support systems, including all non traffic-sensitive one-off costs.

- *The administration costs*

These are the per number set-up costs incurred in the porting of numbers. Only the incremental costs, in addition to the normal costs of transferring customers, should be included.

- *The extra conveyance costs*

These are the additional conveyance costs of MNP for individual calls. They could include incremental costs of additional switching capabilities, transmission links and IN database capacity which are associated with MNP.

⁵ Incremental costs are the increase in the total costs of companies that arises from an increase in output by a discrete increment. In the context of this study, the national provision of mobile number portability is the discrete increment.

The parties incurring the heaviest burden of costs are the mobile operators participating in the introduction of MNP. Depending on the technical solution chosen, other parties such as fixed network operators may also incur some of the system set-up costs and extra conveyance costs. Apart from fixed network operators, other entities could for example be independent number-translation service providers. The mobile service providers have some system set-up costs and administration costs which can be considered relatively modest, primarily involving modifications to the billing and administrative systems of the service providers.

In Annex C examples are provided of estimated costs resulting from cost benefit analysis studies for MNP made for NRAs in The Netherlands, Sweden and Hong Kong.

These estimates can be summarised as follows:

- system set-up costs: 11 and 26 million Euro in NL⁶ and Sweden respectively;
- administrative costs per porting customer: 8 and 11 Euro in NL and Sweden resp.;
- extra conveyance costs per call to a ported number: .02 Euro in NL and Sweden;
- total costs over a 10 year period are 74 million Euro in NL and between 56 and 112 million in Hong Kong.

For The Netherlands and Sweden the assumption was made that onward routing is used. For Hong Kong two possibilities were considered: an off-switch solution either immediately or by migration via onward routing. The migration option would cause less delay but would be the more costly. It should be noted that these figures are only valid based on the assumption that MNP is introduced speedily. Delays in the introduction would, according to these studies, result in lower costs, but the reduction would not outweigh the loss of benefits because of the delay.

Allocation of costs, especially the additional traffic costs, may vary from one technical solution to another. It is important to produce a set of cost allocation principles which is consistent for all MNP services and implementations.

5.3 Cost allocation principles

Cost allocation may vary from one technical solution to another. The costs should be allocated according to principles that maximise net benefit for society as a whole. The proposals for cost allocation principles do not differ substantially between studies known to ETO. Below, the six principles which are also supported by Oftel in the United Kingdom are described and explained:

⁶ NL = The Netherlands

- *Cost causation*

In general, cost allocation should have strong regard to whose actions cause additional costs to be incurred. When parties cause costs then they should also bear at least some of the costs in order to encourage economically efficient behaviour from them. In the absence of externalities this principle suggests allocating the incremental costs of MNP to the porting customers or, as a substitute, to the recipient operators. However, assuming that the costs are caused by a national policy decision, all parties may have to bear their own costs. According to that view, the provision of MNP is an essential feature of a competitive market and should be regarded as a normal part of a telecommunications service.

- *Cost minimisation*

Those who are in a position to affect the level of the costs should face strong incentives to minimise costs. This might involve limiting the proportion of an operator's costs which can be passed to others or regulating charges and only allowing an operator to pass on the costs which an efficient operator, using the most effective technical solution, would incur.

- *Distribution of benefits*

Cost allocation should recognise that ported customers are not the only beneficiaries of MNP. Benefits from MNP also accrue to callers and to users in general.

- *Effective competition*

Cost allocation should promote competition and not weaken the benefits which MNP would bring to the mobile market. Maximising the benefits which are external to the porting customers could be done by limiting the costs which the donor operator can pass to the recipient operator or by limiting the price which can be charged to the porting customer to a proportion of the costs.

- *Reciprocity and symmetry*

Cost allocation should as far as possible be symmetrical and reciprocal, given that MNP is required to be offered in both directions. The main difference in most countries between fixed NP and MNP is in terms of symmetry. For fixed NP the costs are markedly higher for the incumbent operator than for the other operators. In contrast, there is a considerable degree of symmetry in the mobile market.

- *Practicability*

Cost allocation should be easy to implement. This includes minimising opportunities for cheating. This might involve each operator bearing its own costs or treating MNP costs in exactly the same way as other interconnect charges, perhaps just negotiating a lower interconnect charge for calls delivered to ported numbers (assuming that the NP costs are likely to form a small proportion of total interconnect charges and precise allocation of NP costs is of relatively minor importance).

The next section will examine the practical consequences of adopting the six principles for cost allocation.

5.4 The regulation of cost allocation

The consequences of the six principles of cost allocation described in the previous section are not always straightforward. The principles are partly in conflict with each other. Depending on which principle is given priority, the consequences will differ to some extent. Generally speaking, the choices proposed are largely consistent throughout the studies and throughout the policy decisions so far taken in the countries mentioned before, in particular the United Kingdom, The Netherlands, Sweden, Switzerland, Denmark and Hong Kong. A compilation of some relevant decisions taken by NRAs regarding cost allocation for MNP is presented and discussed in the next subsections.

One party which is not specifically included in the next subsections is the caller to a ported number. Allocating costs to the caller would not be consistent with the cost allocation principles, except for the principle of distribution of benefits. Costs should, therefore, not be allocated to the caller. Generally speaking, a caller should not notice a substantial difference in costs between a call to a non-ported number and a call to a ported number. MNP could, however, raise one complication which does not arise so clearly with fixed NP. The caller may find that there is a noticeable difference in costs to the same number before and after the porting. This may happen in particular when the call is made from a fixed network and the tariffs of fixed-to-mobile calls differ substantially between the relinquishing network and the recipient network. However, if tariffs are not in conflict with the national numbering plan or national tariff regulations, MNP should not be a reason for additional tariff limitations. On the other hand, it may be worthwhile for NRAs to ensure that some effort is put into educating users regarding MNP and its effects on tariffs, depending on the national situation.

5.4.1 The system set-up costs

In general, the preferred option in studies and policies is for each market party to bear the system set-up costs for its own facilities. This is consistent with all six cost allocation principles. When neutral parties are involved who are not offering MNP, such as fixed network operators, each neutral party should have its system set-up costs recovered in full from participating mobile operators in proportion to the relevant size of each participating operator's network. Neutral parties may incur costs because of a requirement for a more cost-effective solution. Full cost recovery is then required to obtain co-operation from neutral parties and to avoid cross subsidisation between customer groups of participating parties and of neutral parties.

In practice the system set-up costs of neutral parties are likely to be small. In this respect it is important to look at the programme for implementing other services which require provisions also needed for MNP. Examples of these other services are in particular IN based services and NP as a whole across the mobile services, fixed local loop services and non-geographic services. Taking the other services into account, neutral parties for a particular MNP service may in any case incur costs in providing those other services. The incremental costs for MNP may then be small. The neutral parties may then need to recover little in the way of costs for MNP.

5.4.2 The administration costs

The allocation of administration costs differs from country to country:

- The United Kingdom and Hong Kong have allocated these costs to the recipient party. The study report for Sweden proposes to do the same. In the United Kingdom and Hong Kong, it is then up to the recipient parties to charge the porting customer. Such charges would include costs incurred by the relinquishing operator as well as by the relinquishing operator's service provider, where appropriate. The United Kingdom, however, has explicitly stated that ongoing per-number set-up costs should not result in ongoing charges being made by relinquishing parties; annual fees for 'residual subscriptions', for instance, will not be allowed.
- The Netherlands, Switzerland and Denmark have left the allocation of these costs to negotiations between the relinquishing and the recipient party. In The Netherlands, it is then up to the recipient parties to charge the porting customer, with a maximum one-off amount of 9 Euro. In Denmark a possible dispute can be settled by the regulator.
- Singapore provides an early example of the effect of charging the porting customer. There, cost allocation, at least for the interim solution, involves a charge to porting customers agreed by the industry: 4 - 5 Euro per month. As a result of the monthly charge, the number of customers who have ported is low.

Following the principle of cost causation, the relinquishing party should charge the porting customer the incremental administrative costs of porting the number of the customer. This gives a clear price signal to those customers considering MNP to prevent uneconomic behaviour.

This is consistent with all other principles except the ones on effective competition and on cost minimisation. To meet these last principles, at the expense of relaxing the 'right price signal', it would be preferable for the relinquishing party to charge the recipient party rather than the customer, leaving it to the recipient party to charge the customer. The charge to the recipient party could be subject to regulatory scrutiny and only the costs of an efficient party allowed. The charge to the customer should be a one-off charge and should be kept limited in order not to deter customers from using MNP. A market study of Libertel, the second mobile operator in The Netherlands, revealed that 45% of the porting customers were willing to pay a fee of 10 to more than 25 Euro.

5.4.3 The extra conveyance costs

The technical solutions used for MNP in most cases involve the donor network for calls to a ported number. The relinquishing network is only involved if it is at the same time the donor network, which is the case for numbers that have been ported only once. In addition, originating networks may be involved. The originating networks may be mobile networks or fixed networks.

The allocation of extra conveyance costs differs from country to country:

- The Netherlands, Switzerland and Denmark have left the allocation of these costs to negotiations between the donor and the recipient operator. A possible dispute can be settled by the regulator. In Switzerland, conveyance costs need to be included in the interconnection agreements.
- In the United Kingdom the donor operator is not permitted to charge the recipient operator a specific MNP charge for additional conveyance. As the United Kingdom uses SRF, originating networks have no extra costs.
- The study report for Sweden proposes to allocate these costs to the recipient operator. But the Swedish regulator acknowledges that allowing recovery of extra conveyance costs from the recipient operator may be inhibiting MNP.
- In Hong Kong, the mobile operators are expected to bear their own extra conveyance costs. The fixed network operators, mobile operators or the independent agent providing the mobile number translation services should recover the extra conveyance costs:
 - from the terminating mobile operators in the case of fixed-to-mobile calls
 - from the originating mobile operators in the case of mobile-to-mobile calls.
- The cost causation principle is followed in the study report for Sweden. It supports the recovery of extra conveyance costs incurred by fixed and mobile operators and other involved parties from the recipient mobile operator. The study report does not, however, follow the principles of cost minimisation and of effective competition which are strongly emphasized by the Swedish regulator. This principle of cost minimisation is also stressed in the United Kingdom in order to encourage donor operators to minimise additional conveyance costs and thus adopt the most efficient routing method for providing MNP. Consistency with the cost causation principle is then created by stating that the provision of MNP is an essential feature of a competitive market and the routing of calls to ported numbers should be regarded as a normal part of a telecommunication service. The Study on the Cost Allocation for Number Portability, Carrier Selection and Carrier Pre-selection for the European Commission, finalised in October 1999, also confirms that recovery of additional conveyance costs may have negative effects on the take-up of NP. Finland provides an example of these negative effects.

An alternative to no cost recovery at all would be to leave cost recovery to negotiations as part of general interconnection negotiations and under regulatory scrutiny. Extra guidance could be developed, for example by industry through setting bench marks or developing a code of conduct or by regulators if the industry is not able to develop guidance principles by themselves. Regulatory limits to cost recovery are required to maintain consistency with the principle of cost minimisation. If the market parties cannot come to an agreement, the NRA should set the charge levels. Assuming that the extra conveyance costs are very modest compared with total interconnect charges, negotiations also serve the principle of practicability.

The incremental costs for investments and operations made for IN solutions to handle extra conveyance could be treated as additional traffic costs rather than system set-up costs. This provides incentives for operators to move to full IN solutions. The term 'incremental' implies that, in the situation where a full IN solution may be used for many purposes, including several NP and non-NP services, only costs that arise from the incremental 'MNP' are taken into account. The remaining costs for the IN solution will then need to be apportioned between the other services.

Porting customers should not be charged for extra conveyance costs if the principle of effective competition is to be respected.

5.5 Role of NRAs

ETO concludes that:

In order to maximise benefits for society as a whole, NRAs should ensure that:

- MNP both between mobile operators and between mobile service providers is introduced as soon as possible
- cost allocation for MNP is based on a reasonably balanced application of the six principles of cost causation, cost minimisation, distribution of benefits, effective competition, reciprocity and symmetry and, finally, practicability.

A reasonable balance in applying the six principles for cost allocation is achieved when:

- system set-up costs are born by each market party for its own facilities, except when neutral parties are involved, such as fixed network operators, who should recover their relevant incremental system set-up costs from participating mobile operators in proportion to the relevant size of each participating operator's network;
- administration costs are recovered by the relinquishing party from the recipient party, while the recipient party may charge the customer a one-off fee for a limited amount which should not deter customers from using MNP;

- extra conveyance costs are not recovered; an alternative is to leave recovery of extra conveyance costs to negotiations as part of general interconnection negotiations, unless market parties cannot come to an agreement, in which case the NRA should set the charge levels; a code of conduct may be developed if required.

6 Number portability between fixed and mobile services

In the previous chapters of this report a number of issues related to the provision of MNP have been discussed. In addition to MNP there is another form of number portability that deserves to be carefully studied. This form of portability, in the following referred as Fixed-Mobile Service Portability (FMSP), concerns enabling a subscriber to move between fixed and mobile services without changing his E.164 number (and without changing service provider or network operator). FMSP should be clearly distinguished from number portability between service providers or network operators. Porting a number between a fixed network operator and a mobile network operator implies both FMSP and number portability between network operators.

The introduction of FMSP is closely related to the emerging process of convergence between fixed and mobile services and networks, the initial results of which are now starting to affect the whole telecommunication industry.

This chapter provides an introduction to Fixed-Mobile Convergence (FMC) followed by consideration of FMSP issues with particular attention to regulatory implications.

6.1 Fixed-Mobile Convergence (FMC)

Until recently mobile telephony and fixed telephony were two clearly separated worlds. Today things are changing and a process of convergence between fixed and mobile telephony is under way. The final shape of the FMC process is not quite clear but already now some initial effects can be seen in terms of services offered to customers, market structures and network infrastructures.

So far FMC has not been driven by the technology involved but mainly by the need for network operators and service providers to retain existing customers and attract new ones in an increasingly competitive market. For network operators and service providers the ability to provide integrated fixed and mobile services may be a winning card to obtain a new market share and to be able to distinguish themselves from competitors.

From a customer's point of view FMC means an integrated service package, whereby the customer is offered both fixed and mobile services, using one terminal and possibly one number, and receives one bill. It also implies one customer care service for both fixed and mobile services. FMC meets the customer's expectations in terms of independence from a terminal and a technology.

In terms of terminals, already today there are terminals available that can be used both as a mobile phone away from home and as a cordless fixed phone at home. The success of some commercial offers based on this kind of terminal (the Duet service offered by Tele Danmark or the Onephone service launched by BT Cellnet) seems a promising starting point for development of FMC.

From the point of view of an operator or a service provider FMC potentially has a twofold advantage.

The first advantage is commercial. As mentioned before, the ability to provide integrated fixed and mobile services offers opportunities both for the provision of promising services and for a recognisable differentiation from competitors. In other words FMC can be regarded as a mechanism to increase revenues per subscriber and to gain new subscribers. In particular fixed and mobile operators can erode each other's market shares. For fixed operators the convergence may slow down the growth of the mobile market and give vitality back to the fixed market. For mobile operators FMC is a way to compete in the new sectors that are dominated by fixed operators such as data and value-added services.

The second advantage is operational. FMC may allow network operators to save money in terms of infrastructure and operational costs. The idea is to run one single network instead of two separate networks, one for fixed services and one for mobile services. However, it should be noted that the technological integration between fixed and mobile networks still has to take place. The initial step is likely to be a convergence in terms of IN platforms and services and only after that a convergence at the switching level when integrated switches have become available.

6.1.1 General regulatory aspects

FMC is taking shape, promising to be initially a good commercial opportunity and in due course a sound technical solution. At the regulatory level not much has been done so far and regulatory convergence is still far from being achieved.

Currently in most European countries mobile operators and service providers are under a regulatory regime which is much more open and free than the regime for fixed operators. The obligation to provide number portability is a clear example of this. Number portability in fixed networks, in line with the EU directives, is available in most EU countries. In the mobile environment number portability is a relatively new concept and its availability on a large European scale is years away.

Another example of the imbalance in regulation between fixed and mobile is the different approach, in some European countries, in terms of obligation to provide universal services, indirect access and interconnection rates based on cost orientation.

This difference between the fixed and mobile regulatory regimes can be attributed to two historical factors:

1. the initial need to facilitate the take off of mobile services, creating the right conditions to attract investments to roll out mobile networks;
2. the fact that within the mobile sector there is not a situation of dominant operators able to exploit their position to distort competition.

Today the situation is quite different. The mobile market is well developed and is directly competing with the fixed market in terms of services offered, revenues and customers. According to some forecasts, before the year 2010 in Europe the number of mobile customers will exceed the number of fixed customers and this, indeed, has already happened in Finland with a 60% penetration of mobile phones.

In addition, falling prices for mobile calls are creating a situation of call substitution where instead of making a call using available fixed telephones customers tend to use their mobile phones.

In order to prevent forms of distortion of competition between the mobile and fixed sector it is crucial to promote a common regulatory framework. This common regulatory framework cannot be just a transposition of the "fixed" regulatory regime into the mobile sector. It is expected that the common framework will be based on light regulation able to guarantee safeguarding of customers' rights and fair competition between the parties concerned without abuse of dominant positions. Regulatory intervention must be envisaged when the market conditions do not meet criteria for fair competition.

6.1.2 Regulatory aspects concerning E.164 numbering

To identify regulatory E.164 numbering aspects, different elements of combined fixed-mobile service offers should be distinguished:

1. Integrated customer care and integrated billing

Customers have a single contact point for customer care and receive a single bill for both their mobile and fixed terminal usage.

2. Single handsets

Customers have a single handset for fixed and mobile services. As long as the fixed and mobile networks have not been integrated, the handset actually is a dual handset incorporating two terminals, in particular a GSM and a DECT terminal. The dual handset uses the fixed network when in the range of the DECT base station and the GSM network when outside the range. With this type of FMC on the service level, customers still have separate directory numbers for mobile and for fixed services.

3. Single directory numbers

Customers have only one directory number. This may be a personal number which diverts either to their mobile phone or to the fixed phone where they are at the time. This requires that they call in and let the network know the number where they are located. In this situation, the customer still has both a mobile and a fixed terminal.

Let us now look at the regulatory numbering consequences following from service offers based on one of these elements or a combination of these elements. The first two elements have no consequences for national numbering administration and management. It is the third element that has such consequences. Five cases containing the third element, combined or not with the second element, can be distinguished:

a) *Personal numbering with separate fixed and mobile terminals*

If a service offered only concerns personal numbering then the obvious consequence is that a range for personal numbers should be available in the numbering plan. A personal number range implies that the calling party should be aware of the tariff for a call to a personal number, which in general is higher than the national rate. It is obvious that customers should be able to port their personal numbers both between operators and between service providers.

b) *Personal numbering with single dual handsets*

Single directory numbers can be combined with another element in a particular service offer. Of relevance in the numbering context is the combination with single handsets. This combination yields a service offer for which customers have both a single terminal and a single directory number. This can most easily be realised by using a dual handset and a personal number. The regulatory numbering consequences are then identical to the ones described under a).

c) *Special numbers for converged fixed-mobile services with single handsets*

In the long term, if the fixed and mobile networks have been integrated ('full' FMC), customers will be able to have a single handset which incorporates only one terminal and they will have a single directory number. The directory number might initially be a number from a range which has been designated for services based upon 'full' FMC. The regulatory numbering consequences are similar to those mentioned under a): a number range for services based upon 'full' FMC should be available, the calling parties should be aware of the tariff for a call to such numbers and the numbers should be portable both between operators and between service providers.

d) *Numbers for mobile and converged fixed-mobile services with single handsets*

In the long term, with 'full' FMC, it could be that the numbering plan no longer distinguishes between mobile services and services based upon 'full' FMC. This seems in general easy to realise as both types of service use non-geographic numbers without local dialling (which in general is not the case with numbers for fixed local loop services). The directory number could then be chosen from a wide range of numbers that can be used for both types of service. The regulatory numbering consequences are similar to those mentioned under a): a number range for both mobile services and services based upon 'full' FMC should be available, the calling parties should be aware of the tariff for a call to such numbers and NP between all operators and between all service providers offering mobile services or services based upon 'full' FMC should be available.

e) *Number for fixed, mobile and converged fixed-mobile services with single handset*

In the long term, with ‘full’ FMC, it could even be that the numbering plan no longer distinguishes between fixed local loop services, mobile services and services based upon ‘full’ FMC. The directory number could then be chosen from a very wide range of numbers that can be used for any of these services. This case clearly has the most extensive consequences for national numbering administration and management. It is obvious that NP between all operators and between all service providers offering fixed local loop services, mobile services or services based upon ‘full’ FMC should be available.

The consequences for FMSP are discussed in section 6.2.3.

ETO concludes that:

For personal numbers NRAs should ensure that NP between operators and between service providers should be available.

Once ‘full’ FMC has been introduced NRAs should ensure:

- when a separate number range has been designated for services based upon ‘full’ FMC, NP between all operators and between all service providers offering these services is available.
- in cases where the same number ranges are designated for both mobile services and services based upon ‘full’ FMC, NP between all operators and between all service providers offering these services is available.
- when the same number ranges have been designated for fixed local loop services, for mobile services and for services based upon ‘full’ FMC, NP between all operators and between all service providers offering these services is available.

6.2 Fixed-Mobile Service Portability

6.2.1 Current implementation of Fixed-Mobile Service Portability

FMSP is today not available in any European country. The only country that has planned the introduction of FMSP, in conjunction with number portability between network operators, is Denmark.

According to the Danish Executive Order on Free Carrier Selection and Number Portability, customers must have the possibility, no later than 1 January 2001, of retaining their subscriber numbers when changing between network operators or service providers within the fields of telephony, ISDN and public mobile communications.

At present no solutions have been developed on how to introduce and implement this form of Number portability. Network operators and service providers are expected to agree on the practical means of introducing FMSP and if they cannot FMSP will be regulated by the Danish Ministry of Research and Information Technology at a later point in time.

The Danish case and the situation in Europe more generally seems to indicate that the provision of FMSP presents a number of problems which still need to be investigated.

The following sections discuss some of the most important barriers to the introduction of FMSP.

6.2.2 Technical barriers

In order to enable a number to be ported from a fixed service to a mobile service and vice versa, study of technical solutions for the proper routing of the call to the final destination first has to be made.

ETSI has defined a number of solutions to implement number portability in fixed and in mobile networks. These solutions are based on the use of on-switch and off-switch capabilities and, in some cases, on the extensive use of IN architecture.

In all cases the ETSI solutions are based on the assumption that the Donor and the Recipient are homogeneous (both are either fixed or mobile networks). In the case of FMSP the Donor and the Recipient networks are heterogeneous and interworking capabilities need to be developed. These interworking capabilities must ensure that two basic functions can be fulfilled:

1. the routing information associated with the ported number has to be properly stored and updated;
2. the routing information has to be accessible by the interrogating network.

Whether the current solutions for provision of NP in fixed and mobile networks can easily interoperate is still an open issue that should be addressed as soon as possible by standardisation bodies. The current lack of standardised technical solutions is one of the outstanding barriers to the introduction of FMSP especially in cases where this type of portability will be provided in conjunction with number portability between network operators.

6.2.3 Regulatory barriers

FMSP implies consequences for national numbering administration and management which are similar to those of 'full' FMC with the same number ranges designated for fixed local loop services, mobile services and services based upon 'full' FMC (case e) in section 6.1.2). There should at least no longer be a distinction between fixed local loop services and mobile services in the numbering and dialling plan.

Introduction of FMSP would require a closed numbering plan and absence of geographic information in the national numbers. Elimination of geographic information may happen gradually rather than instantaneously. The process contributing to this elimination is the subsequent porting of numbers from a fixed terminal in a certain location to a mobile terminal and then back to a fixed terminal in another location. Elimination of geographic information would be accelerated if the NPM assigns numbers for fixed local loop services independently of geographic location.

At the same time much tariff information would be eliminated from the numbers:

- Any tariff distinction between calls to mobile services and calls to fixed local loop services is lost. Although this tariff difference is, generally speaking, gradually being reduced, a significant difference may remain.
- (Gradual) elimination of geographic information implies that any tariff distinction between local and national calls disappears from the numbers.

A significant difference in tariffs for calls to fixed local loop numbers and mobile numbers may provide a barrier to the introduction of FMSP. The mixed use of numbers, combined with a significant tariff difference, would undermine tariff transparency as long as no feasible alternatives for informing users about tariffs are available. Denmark has started examining technical solutions to maintain tariff transparency.

There may be a barrier to (gradual) elimination of geographic information if the difference in tariffs between local and national calls is significant. But it is expected that this difference will gradually become insignificant.

Another barrier may be the need for local dialling. But where this barrier exists, it would probably gradually disappear as more terminals offer simplified dialling procedures.

6.2.4 Role of NRAs

The introduction of FMSP seems premature at present. As mentioned in the above sections a number of technical and regulatory issues still need to be solved.

In addition at present it is not yet quite clear what kind of benefits the introduction of FMSP can bring to the telecommunication industry or more generally to the whole of society. This uncertainty about benefits, and in part about costs, makes it difficult for NRAs to take policy decisions on the introduction of FMSP.

In the coming years, with the growing spread of MNP and the widespread availability of NP in fixed networks, more information and data will be available to enable better assessment of the pros and cons of FMSP. Another aspect which may add clarity in the near future is the emergence of the eventual form of Fixed-Mobile Convergence, with the consequent blurring of the difference between mobile and fixed services.

In taking decisions on the introduction of FMSP and the resulting action required it is important that NRAs regard FMSP as an integrated part of the FMC process.

ETO concludes that:

A decision about the introduction of FMSP would be premature at present due to the existence of technical and regulatory barriers.

Before taking policy decisions NRAs will have to investigate carefully the advantages and disadvantages of the introduction of FMSP, keeping in mind that this type of portability is inherently involved in the FMC process.

Standardisation bodies such as ETSI should start studying how solutions for the implementation of NP in fixed and mobile networks can interoperate in the future. Availability of standardised solutions would certainly facilitate the introduction of FMSP.

The current difference between the price of mobile calls and fixed calls combined with the need for tariff transparency represent, in the short term, important barriers to the introduction of FMSP.

7 Proposals and conclusions

This chapter summarises the proposals put forward in the previous chapters of this report.

The proposals dealing with the role of NRAs in ensuring the creation of the right regulatory environment for the provision of MNP should lead to further action within ECTRA.

General aspects of MNP

1. NRAs should ensure that MNP both between mobile operators and between mobile service providers is introduced as soon as possible.

Technical aspects of MNP

2. NRAs should not have a direct role in the choice and definition of the technical solutions to implement MNP but should ensure that these technical solutions meet reasonable requirements in terms of fairness, openness, feasibility and simplicity.

Operational aspects of MNP

3. NRAs should ensure that the impact of MNP on operational processes is not underestimated and sufficient time is allowed for coordination between parties involved.
4. NRAs should ensure that certain customer interests are taken into account, in particular:
 - by ensuring that customer procedures straightforward and explained in simple terms, and that customers are well informed about the porting procedures including the associated costs; by stimulating a one-stop shopping process where the recipient party is responsible for managing the whole process;
 - by defining for what reasons, for what period and by what means it is permissible for customers to be blocked from porting their numbers, in particular with respect to SIM locking;
 - by requiring that a particular porting request can be applied to E.164 mobile numbers associated with the mobile service concerned without a limit to the quantity of numbers;
 - by requiring that the time scales for the preparation period following a porting request are such that customers are not deterred from porting their numbers;

- by requiring that the actual changeover causes minimal disruption to the porting customers.
5. NRAs should ensure that a decision is taken about linking administration databases of operators and service providers, preferably using a central master database. If a central database is used, appropriate security measures of customer details need to be established and a decision has to be taken on the functions of the database, on its financing, on cost recovery and on the choice of the central database manager.
 6. NRAs should ensure that common rules are developed regarding number block responsibility, if applicable, before the introduction of MNP.
 7. For the long term NRAs should consider that, in general, all types of NP together ultimately require elimination of information from the number, e.g. regarding service, tariff, location, operator, service provider.
 8. For the long term NRAs should consider that, with MNP, number pooling may be an attractive way of assigning mobile numbers, in particular when capacity constraints for mobile numbers are expected.

Economic aspects for MNP

9. NRAs should ensure that cost allocation for MNP has a reasonable balance in applying the six principles of cost causation, cost minimisation, distribution of benefits, effective competition, reciprocity and symmetry and, finally, practicability.
10. A reasonable balance in applying the six principles for cost allocation is achieved when:
 - system set-up costs are born by each market party for its own facilities, except when neutral parties are involved, such as fixed network operators, who should recover their relevant incremental system set-up costs from participating mobile operators in proportion to the relevant size of each participating operator's network;
 - administration costs are recovered by the relinquishing party from the recipient party while the recipient party may charge the customer a one-off fee for a limited amount which should not deter customers from using MNP;
 - extra conveyance costs are not recovered; an alternative is to leave recovery of extra conveyance costs to negotiations as part of general interconnection negotiations, unless market parties cannot come to an agreement, in which case the NRA should set the charge levels.

FMC related service provider portability

12. For personal numbers NRAs should ensure that NP between operators and between service providers should be available.

13. Once 'full' FMC has been introduced NRAs should ensure that:

- when a separate number range has been designated for services based upon 'full' FMC, NP between all operators and between all service providers offering these services is available;
- in cases where the same number ranges are designated for both mobile services and services based upon 'full' FMC, NP between all operators and between all service providers offering these services is available;
- when the same number ranges have been designated for fixed local loop services, for mobile services and for services based upon 'full' FMC, NP between all operators and between all service providers offering these services is available.

FMSP

14. A decision about the introduction of FMSP would be premature at present due to the existence of technical and regulatory barriers.
15. Before taking policy decisions NRAs will have to investigate carefully the advantages and disadvantages of the introduction of FMSP, keeping in mind that this type of portability is inherently involved in the FMC process.
16. Standardisation bodies such as ETSI should start studying how solutions for the implementation of NP in fixed and mobile networks can interoperate in the future. Availability of standardised solutions would certainly facilitate the introduction of FMSP.
17. The current difference between the price of mobile calls and fixed calls combined with the need for tariff transparency represent, in the short term, important barriers to the introduction of FMSP.

ANNEXES

Annex A Work requirement

1. Subject: Mobile Number Portability

2. Purpose

The main objective of this study is to present and discuss regulatory and technical issues surrounding the provision of Mobile Number Portability (MNP) in Europe. In addition to portability of a number between mobile network operators or service providers the study will also investigate issues concerning portability between fixed and mobile networks.

3. Justification

As a result of ETO's study on non-discriminatory access to number resources ECTRA has adopted a Recommendation that Administrations should ensure that operators provide operator number portability in the fixed local loop. This should be implemented as soon as the launching of competition in the local loop, or where the implementation is not feasible at that date, no later than three years after the liberalisation of voice telephony.

The European Union has adopted a Directive that instructs member states to introduce number portability in the fixed local loop by 1 January 2000 or within two years after liberalisation of voice telephony.

The European Commission has asked a private consulting firm to study MNP issues as well, taking into account the importance of the matter.

ETO expects that the Commission will provide policy guidance on the implementation of MNP later this year. This may cover the issues of number portability between mobile and fixed networks, and between GSM and DCS networks as well as portability between similar mobile networks. There might also be a requirement to permit portability from analogue to digital networks.

ECTRA wishes ETO, in parallel with the EC actions, as a matter of priority, to conduct a separate study in co-operation with national experts to prepare its own position.

ETO proposes this study with the main objective of facilitating the extension of the policy of the European Union across the member countries of CEPT in an appropriate manner.

4. Work Requirements

A number of issues require study to ensure that Administrations will be able to provide for MNP in their own countries. These include:

- the regulatory requirements for MNP regarding GSM and DCS networks and services in different countries and regions
- technical solutions for MNP and the compatibility and interoperability of these solutions
- the implications for number plan management and assignment
- cost allocation
- any implications for the Short Message Service (SMS)
- requirements to support, in particular, portability between fixed and mobile networks, including changes to national number plans
- analysis of charging implications, particularly for portability between fixed and mobile networks

5. Methodology

The work will be carried out in close co-operation with ECTRA/PT N, ECTRA members individually and ENF.

6. Deliverables

ETO will deliver two interim reports and a final report.

The first interim report, focusing on portability between mobile networks, will contain a general framework for MNP, including:

- an overview of the situation in the ECTRA countries
- a description of the technical solutions under development and their cost implications
- a presentation and an assessment of the principles for cost allocation and the mechanisms for cost recovery
- a discussion of the operational issues, including numbering plan administration and management, related to the introduction of MNP
- and finally some initial proposals on the role of NRAs

ETO will deliver the first interim report by 30 May 1999.

ETO will deliver the final report of the study by 28 February 2000.

7. Man-power

ETO expects that it can accomplish this task with six man-months of expert effort.

Annex B Extract from the ETO progress report on number portability in public telephony networks in ECTRA countries

This annex contains an extract from the ETO progress report on number portability in ECTRA countries.

The ETO progress report reflects the state-of-the-art of regulation in ECTRA countries on number portability for fixed telephony service, mobile telephony services and non geographic services such as free phone, personal number services. In this annex only the relevant to MNP are presented.

1. Background

Introduction

Of the 43 ECTRA countries, 25 countries have responded to an ETO questionnaire on number portability: Austria, Belgium, Croatia, Cyprus, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Latvia, Luxembourg, Norway, The Netherlands, Poland, Portugal, the Russian Federation, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland and the United Kingdom. Four of the countries which have responded have not yet made decisions on the issues concerned. Those countries are Croatia, Ireland, Latvia and Poland. Some information from other sources has been added for Ireland and inserted for Italy. The progress report is a living document that will be updated when new information is received.

Types of number portability

Two types of number portability are distinguished:

1. Service provider portability: the customer can retain his number when changing network operator or service provider (while not changing service).
2. Service portability: the customer can retain his number when changing service (while not network operator or service provider).

Only portability of the full number has been taken into consideration. Partial portability, in which case only part of the number is ported (usually all digits except the initial digits), has not been included. Service provider portability is the most important factor when considering the development of competition and consumer protection and is therefore subject to regulation. Service portability may or may not be regulated. Service portability should in any case be within the limitations set by the national numbering plan and the charging requirements.

Categories of cost and methods of cost allocation

There are three main types of costs for implementing service provider portability:

- The system set-up costs are the costs needed for having number portability provisions in networks and support systems.
- The extra conveyance costs are the additional conveyance costs of number portability for individual calls. For advanced IN solutions there may be no extra conveyance costs.
- The administration costs are the costs incurred in the porting of an individual number.

For all types of costs only the incremental costs should be taken into account.

Used methods of allocating the costs of service provider portability distinguish between conveyance costs and administration costs (each party bears its own system set-up costs in all cases):

- The donor service provider pays all costs.
- The recipient service provider pays all costs.
- The cost allocation is negotiated between the old and the new service provider, possibly between certain limits derived from national or EU regulation on interconnection agreements.
- All parties bear their own costs.

2. Implementation of service provider portability for mobile telephony services

The table below contains the following data regarding service provider portability for mobile telephony services:

- the introduction date (month and year)
- who offers mobile number portability (all SPs = all service providers)
- the solution used (SR = signalling relay) irrespective of whether it is regulated or not
- who pays the costs for extra conveyance and administration (donor = donor service provider/network operator; recipient = recipient service provider/network operator, negotiated; bear own = all parties bear their own costs).

Country	Service provider portability for mobile telephony services				
	Intro date	Who offers NP	Solution	Cost allocation	
				Conveyance	Administration
Belgium	?2000	all SPs			
Czech Republic	01.2001				
Denmark	01.2001	all SPs		negotiated	negotiated
Germany		all SPs		bear own	
Hungary	01.2002	all SPs			
Ireland	01.2000				
Italy	07.1999?				
Luxembourg	2001	all SPs			
Netherlands	04.1999	all SPs	SR	negotiated	negotiated ⁷
Slovenia	12.2000				
Sweden	01.2001 ⁸	all SPs			recipient
Switzerland	03.2000	all SPs		negotiated	negotiated
United Kingdom	01.1999	all SPs	SR	donor	recipient

⁷ The maximum amount that the customer in can be charged by the recipient is about 9 Euro.

⁸ The date has been proposed by the NRA and is subject to public consultation at present.

3. Implementation of service portability for mobile services

The table below contains the following data regarding service portability for cellular mobile services irrespective of whether it is regulated or not:

- the introduction date (month and year)
- who offers number portability (all SPs = all service providers).

An example of service portability for mobile services is portability from analogue services such as NMT to digital services such as GSM. Portability between GSM 900 and GSM 1800 is not considered to be an example of service portability.

Country	Service portability for mobile telephony services	
	Intro date	Who offers NP
Czech Republic	01.2001	
Denmark⁹	01.2001	all SPs
United Kingdom	06.1997	all SPs

⁹ In addition FMSP will be available

Annex C Estimated benefits and costs of MNP

In this annex examples are provided of estimated net benefits (= total benefits minus total costs) and of estimated costs resulting from cost benefit analysis studies of MNP made for NRAs in a number of relevant countries.

Estimates of net benefits of MNP

- *United Kingdom*
A study by consultant Ovum for Oftel concluded in 1997 that the net benefit to the United Kingdom economy would be at least 98 million pounds (146 million Euro) over the first ten year period after introduction of MNP.
- *The Netherlands*
A study by consultant Ovum for the Dutch ministry concluded in 1996 that the net benefit to the Dutch economy would be 947 million DFL (430 million Euro) over the first ten year period after introduction of MNP.
- *Sweden*
A study by consultant Ovum for the Swedish independent regulator concluded in 1997 that the net benefit to the Swedish economy would be 4,538 million SEK (570 million Euro) over the first ten year period after introduction of MNP.
- *Denmark*
A study by consultant Fischer & Lorenz for the Danish independent regulator concluded in 1996 that there was a strong case for implementing MNP immediately. No complete cost benefit analysis was done, however.
- *Australia*
According to an independent study in 1995, the annual benefit of digital MNP to the Australian economy would be 160 million ADs (90 million Euro). This figure indicates the total of benefits without costs subtracted. The costs have not been yet estimated.
- *Hong Kong*
A study by consultants NERA/Smith for the independent regulator in Hong Kong concluded in 1998 that the net benefit to the Hong Kong economy would be 461 million HKDs (55 million Euro) over the first ten year period after introduction of MNP.

It should be noted that these figures are only valid on the assumption that MNP is introduced speedily. Delays in its introduction would result in loss of benefits.

Estimates of costs for MNP

- *The Netherlands*

The study by consultant Ovum for the Dutch ministry concluded in 1996 that the costs of MNP, assuming an onward routing solution (which was considered simpler but more expensive than an IN solution) together with the costs for service portability from the analogue NMT network to the GSM networks, would be:

- system set-up costs: 24 million DFL (11 million Euro) in total (8 million DFL per network);
- administrative costs per porting customer: 18 DFL (8 Euro);
- extra conveyance costs per call to a ported number: .05 DFL (.02 Euro);
- extra post-dialling delay costs per call to a ported number: .005 DFL (.002 Euro);
- total costs over a 10 year period are 164 million DFL (74 million Euro).

The system set-up costs are lower than for fixed NP because of the lower level of complexity and more up to date software used by mobile networks for their customer support systems. The extra conveyance costs are higher than for fixed NP with call drop back reflecting the less efficient routing of the onward routing solution.

- *Sweden*

The study by consultant Ovum for the Swedish independent regulator concluded in 1997 that the costs of MNP, assuming an onward routing solution and only porting between digital networks, would be:

- system set-up costs: 230 million SEK (26 million Euro);
- administrative costs per porting customer: 100 SEK (11 Euro);
- extra conveyance costs per call to ported number: 20 øre (.02 Euro);
- extra post-dialling delay costs per call to ported number: 0.2 øre (.0002 Euro).

- *Hong Kong*

The study by consultants NERA/Smith for the independent regulator in Hong Kong concluded in 1998 that the costs of MNP over a ten year period would be:

- assuming immediate roll-out of an off-switch solution: between 500 and 700 million HK dollars (between 56 and 78 million Euro);
- assuming migration via onward routing to an off-switch solution: between 600 and 1000 million HK dollars (between 67 and 112 million Euro).

It should be noted that these figures are only valid based on the assumption that MNP is introduced speedily. Delays in its introduction would, generally speaking, result in lower costs, but the reduction would not outweigh the loss of benefits because of the delay.

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Annex E List of abbreviations

AcQ	All call Query
CCBS	Completion of Call to Busy Subscriber
DB	Database
DN	Directory Number
ECTRA	European Committee on Telecommunications Regulatory Affairs
ECTRA/PTN	ECTRA Project Team on Numbering
ETNO	European Public Telecommunications network operators' Association
ETO	European Telecommunications Office
ETSI	European Telecommunication Standardisation Institute
EU	European Union
FMC	Fixed-Mobile Convergence
FMSP	Fixed-Mobile Service Portability
GMSC	Gateway Mobile Switching Center
GSM	Global System for Mobiles
HLR	Home Location Registry
IMSI	International Mobile Subscriber Identity
IN	Intelligent Network
ITU	International Telecommunication Union
ITU-T	ITU Telecommunication Standardisation Sector
MNP	Mobile Number Portability
MSRN	Mobile Subscriber Routing Number
NP	Number Portability
NPM	National Numbering Plan Manager
NRA	National Regulatory Authority
RN	Routing Number
QoHR	Query on HLR Release
QoD	Query on Digit analysis
SIM	Subscriber Interface Module
SMS	Short Message Service
SN	Subscriber Number
SRF	Signalling Relay Function
SCCP	Signalling Connection Control Part
UMTS	Universal Mobile Telecommunication System
VMSC	Visited Mobile Switching Center

Annex F Comments of ENF Members

This annex contains the comments of ENF Members on the second interim report. Comments were received by ECTEL, ETNO and ETSI. Most of the comments have taken into account in the draft final report.

ECTEL Comments on the "Second interim report on number portability for mobile networks"

1. Page 11, clause 2.2, option 1

Note: This case (both the donor and the recipient service provider are connected to the same network operator) is currently not considered by GSM ("outside of scope"). We understand the relevant document is SMG 02/66.

2. Pages 20-21, Clause 3.3.

Having established the principle that 'regulators should not have a controlling role in the choice and definition of the technical solutions for the implementation of MNP', the evaluation of merits of options and technical solution chosen and should be left to the interconnecting parties.

We strongly recommend that the whole clause 3.3 be deleted.

3. Page 22, ETO conclusion at the end of section 3.4

In the conclusion (in the box) add the words "for the end user" after the word "...simplicity" to read "...and simplicity for the end user."

4. Page 31 clause 4.4, ETO conclusions related to long term considerations by NRA.

Neither of these recommendations are strictly related to MNP only and as such require further study in the context of long term numbering requirements and the 1999 regulatory review.

ECTEL believes that there is a need to ensure a manageable and quality interworking between the two domains (E164 and IPv4/6) to guarantee an uninterrupted "universality" between addressing schemes that were not designed to communicate with each other.

ETNO Reflection Document “Comments on the ETO 2nd interim report on number portability for mobile networks”

Preliminary Remark

ETNO has noted an apparent change to the procedures for commenting, on the occasion of a previous ETO report. In that, only ECTRA comments were considered at the draft final stage. If this is the case again for this report on mobile portability, ETNO requests that his contribution should be annexed, without any modification, to the draft final version, at least up to the detailed comments.

Introduction

ETNO would like to thank ETO for having taken into account some of its comments on the previous version. However, ETNO has also noted and strongly regrets the ETO decision not to consider this second interim report as a new 1st interim report, as regards the possibility to comment. This particularly applies to section 6 of this report related to number portability between fixed and mobile networks, which only appears in this version and would have deserved more consideration. Given that ETO has concluded that decisions on fixed-mobile portability are premature at this time, ETNO would expect that fixed-mobile portability would be subject to further study and a report at the appropriate moment. ETNO will be ready to bring its expertise in this debate and recalls in the annex to this document some initial views expressed on the occasion of the first interim report.

As for the first interim report, ETNO expresses its comments hereafter as general and detailed comments.

General comments

Organisation and scope of the study

ETNO noted ETO’s decision not to consider UMTS in the report, therefore limiting its scope to GSM and DCS. For sake of clarity, ETNO believes that a statement on this should be introduced in the report, e.g. in the presentation of the study and in the executive summary.

Number administration.

The report often refers to issues concerning numbering administration, number plan structures and number allocation procedures that are wider in scope than mobile portability. In some countries, there are also some questions regarding number branding that need to be considered. It is the ETNO view that recommendations on these issues are inappropriate for this report, and in any case are handled too superficially in the report. Therefore, ETNO requests that ETO deletes from the report any reference to these issues, e.g. Section 4.3.2 second bullet item, the two last conclusions of section 4.4, items 7 and 8 of section 7...

The report also considers the need for the allocation of new IMSIs when E164 numbers are ported. The potential exhaustion of IMSI’s needs to be recognised and careful consideration included in section 2.2 and elsewhere in the report.

Market for portability

In several European countries, where portability systems are already implemented, it is perceived that the demand for number portability remains very low. For example, the British MNP solution, introduced on January 1st, 1999, shows extremely modest results. Only 1 per thousand per month of the mobile network operators' total customer base asks for number portability when changing operator. This is less than 1.5% per year, compared to churn rates of the operators which are far above 20% per year.

Furthermore customers already complain about the decrease of tariff transparency concerning calls from and with ported subscribers and about loss of quality (more call interruptions or no call set-up). This shows the imperfectness of some of the now implemented technical solutions, which are often if not always proprietary solutions that do not correspond to the ETSI-developed standards.

On the other hand, tariff transparency is difficult to reach in MNP because in competitive markets there will be a natural price difference between mobile calls to a mobile number before and after porting (intra-vs. inter-network calls). Also, service transparency between competing operators' value added services is impossible to reach as distinctive service offering is one of the main sources of competitive advantage in mobile business.

ETNO agrees that either the variety of tariff models that came into existence for mobile services through intensive competition, or the diversity of costs for calls from the mobile to the fixed network, resulted in a great demand for tariff transparency for customers. Tariff transparency should be ensured.

Economic aspects

ETNO recognises that MNP may be a customer demand under personal economic conditions. However, it would appear that the cost benefit model and assumptions used for MNP are the same as those used for fixed-network portability. ETNO has some doubt about the relevance of this model to MNP. In many countries, MNP will have less significance for enabling competition and therefore, a general overall benefit may not be demonstrated. In the light of this, ETNO questions the validity of the cost allocation.

One should also consider MNP's negative effects on network competition, pricing and advanced value added services. Although the negative effects are difficult to present in exact monetary terms, they should be included in the analysis as major sources of MNP related costs. Currently the cost analysis focuses only on implementation costs. Conclusions based on inadequate cost-benefit analysis are both inaccurate and misleading.

Overall ETNO believes system set-up costs must be allocated where the benefits fall. If there is true general benefit to the mobile user then that will be as recommended but if there isn't, it may not. The cost allocation principles should also align with those for CPS and fixed NP, so that new entrants and existing players should be able to plan effectively.

Detailed comments

This section mostly offers comments on the recommendations in the ETO report, and assesses the relevance of those recommendations with the text that precedes them. ETO makes a number of recommendations at the end of each section. Numbering these recommendations would have made somewhat easier to provide comments. However, since they also appear numbered in chapter 7, ETNO will use the numbering of chapter 7 as necessary to refer to them.

Executive Summary

There are specific examples in the Executive Summary that reinforce the need for the presentation of the text to illustrate clearly what is the role of the NRA's and what is only informative text. For example, the text under the heading technical aspects in the provision of MNP should have as its first paragraph "NRA's do not have a controlling and active role in the choice and definition of the technical solution. The role of the NRA's.....".

The remaining text on technical aspects in the provision of MNP, and the 2nd bullet in the section titled operational aspects of the provision of MNP, that deals with databases, presents information as a given where clearly the impact is wider than MNP. These sections should deal with how the NRA's ensure the introduction of MNP is achieved in line with the criteria that have been outlined.

The executive summary on FMSP appears contradictory. The last paragraph should in fact be the first paragraph. The remaining text should be positioned as preliminary considerations.

Chapter 2.2

Page 11, last paragraph: Consideration of Fixed-Mobile Service Portability as a particular form of Service Portability can be controversial, depending on the definition of Service Portability (SP). As ETNO understands, SP can be interpreted as number portability when the subscriber migrates to a switch or network with a different technology that allows new services not supported under the former one, but without changing operator. Typical examples are the migration from a switch that only provides POTS to one providing ISDN, when the subscriber wishes this service, or mobile number portability from an analogue network to a GSM one of the same Operator. If the migration is from a fixed network operator to a mobile network from other operator, it is a case of both Operator Number Portability and Service Portability, and not a case of SP. This paragraph needs more clarification to take account of the above issues, or even suppressing the last sentence. This should also apply to the statement contained in the Executive Summary, page 4, first paragraph.

Chapter 3.2

Only one out of two routing methods for non-call related functions is described. Apart from the described indirect routing method which involves the donor network, there exists the direct routing method where the originating network interrogates a NP-database and relays the message to the recipient network. Considering the fast growing SMS traffic and the coming CCBS function, it should be noted that direct routing is the most cost effective method when the volume of ported numbers grows. Page 19, legend of figure 3: Acronym MSRN is not necessary.

Section 4.4 : conclusions

ETNO finds recommendation 5 at odds with recommendation 2. The impact of the recommendation is at odds with the Report, going beyond MNP as it does, into the area of Number Administration. There are a number of other issues surrounding the use of these databases such that ETNO believes that this recommendation should be removed. The ETO report, for example, does not indicate the benefits, if any, and the costs that such administration as described might incur. However there is a need to recognise the impact that MNP will have in the longer term on the way in which numbers are managed. Such impact will depend upon the manner in which the national environment evolves in the future, and as such it is premature to consider as ETO does in this report.

ETNO finds the 5th and 6th bullet present a particular view of MNP, and its long-term effects that have not been debated. It would appear that the text to support these recommendations (see section 4.3.2) has a particular view of number administration. The limited debate that is presented in the text does not give the whole picture, nor does the text recognise the manner in which national variations to the introduction of MNP specifically, and NP generally, occur as national environments react differently. ETNO also recalls its second general comment, which applies on these bullets.

Section 6.1 : conclusions

Recommendation 13 is based on specific assumptions concerning numbering associated with fixed mobile convergence. These assumptions offer a limited view on the issues associated with fixed mobile convergence. While the report appears to acknowledge the immature status of FMC, these recommendations and conclusions are premature.

Annex C

Studies of different consultants about cost/benefits of MNP triggered probably an accelerated introduction of portability in some countries before the availability of an ETSI reference standard. Some technical problems which appeared in the MNP implementation process were originated by this lack of common reference. This situation could be avoided if the national technical specification is prepared on the basis of a common ETSI standard.

Finally, costs of MNP are frequently underestimated and the calculation of benefits are quite optimistic. In fact, forecasts of consultants about penetration of MNP in countries where it has been implemented has not been confirmed by the experience, being much lower, while extra conveyance costs per call to a ported subscriber is shown to be significantly higher than initially. ETNO is still of opinion that the figures concerning benefits and costs can not be used for any firm conclusions since the figures in the studies referred to, e.g. in Sweden, have been criticised.

ANNEX

Issues for consideration of number portability between services and between fixed and mobile networks

In the Executive Summary it is mentioned that Mobile Number Portability (MNP) does not include Service Portability. But anticipating a future Interim Report about Number Portability between fixed and mobile networks, there might be Service Portability. One network operator could offer Number Portability between 450 MHz Mobile and 900 MHz (GSM) and GSM 1800 as a service, this would be a kind of Service Portability.

Using Number Portability between fixed and mobile networks would dissolve the geographic numbering plan as geographic numbers will be used for phone calls to mobile phones and mobile numbers for phone calls to fixed lines. Geographic information in a phone number will be lost, as well as the ability of a differentiated tariff between fixed and mobile, due to the need for harmonised tariffs for these calls. Different tariffs to fixed and mobile lines may confuse users. Considering those problems, users' interest for fixed-mobile portability has to be proved before considering its possible introduction.

If a call is originated in the fixed network and the called party is in the mobile network but ported to the fixed network, would a release lead to a database query in the fixed network or in the mobile network? If the called party is in the mobile network and ported to another mobile network, does the release lead to database query in the mobile network? Or would it be better to get a routing information from the fixed network? All possible scenarios must be investigated concerning their regulatory implications.

A variable number length in a numbering plan leads to the use of a specific technical solution for Number Portability in fixed networks. Using Number Portability so that geographic and mobile numbers are mixed up, needs investigation if the same technical system could be used for MNP (Synergetic effects?) or if it would be cheaper to use a separate system in the mobile network. This seems to be considered by ETO and the result is ETO's recommendation for NRA's which should have no controlling role in the choice of the technical solution. The role of NRAs is to ensure that the technical solutions adopted meet reasonable requirements in terms of fairness, openness and promotion of the competition.

Correct on line billing (e.g. calls from a public phone) is not solved yet and will have to be seriously considered.

ETSI Comments on the "Second interim report on number portability for mobile networks"

In the paragraph operational aspects of the provision of MNP the term non-call related is ambiguous. Change the sentence to: "The operational aspects discussed here only concern the operational processes of an operator or a service provider which have to be executed before running MNP".

Disagree with the sentence "The call handling in the GSMN does not need to be modified". This is not the case. A new routing mechanism is required in the MSCs for MNP and signalling system have to be modified to support the required enhancements for the new routing mechanism. We emphasise that these enhancements are required irrespective of which MNP solution is used.

Type error GSMC --> GMSC

Advantages of centralised/decentralised databases. It was felt that the disadvantages of either solutions should be highlighted.

General comment to all section 6: The definition for Fixed mobile number portability, fixed mobile service portability and Fixed mobile convergence shall be clearly defined and once defined, used appropriately

Annex G Comments of the UK

OFTEL Comments on behalf of the United Kingdom

OFTEL believes that the recommendations in the draft report are generally consistent with the UK's position in respect of mobile number portability.

Factual accuracy

The report contains certain factual inaccuracies concerning UK implementation of mobile number portability. These are listed in the attached annex together with new developments in UK porting processes.

Fixed/mobile service portability

OFTEL agrees that the introduction of fixed/mobile service portability (FMSP) would be premature at this stage. The UK has, over the past few years, been in the process of introducing a family-number scheme to improve the transparency of call charges to types of numbers—for example, 090 premium-rate service numbers are flagged as being likely to be expensive. The changes to the existing number scheme to deliver this family-number recognition scheme were not easy to introduce.

The lack of tariff convergence or an efficient means of informing callers of tariffs is likely to prove to be a significant barrier to FMSP. The UK has not considered the compatibility of the technical processes involved in fixed and mobile portability.

ANNEX

Operational aspects

The issue of prepay portability was discussed in depth during the formulation of the new process manual. It was generally accepted that, technically and operationally, porting prepay was simpler than porting postpay. It was also felt that the impact of fraud concerns had been overestimated during the formulation of the previous process. For this reason, prepay porting is included within the new porting manual, incorporating the same timeframe as postpay porting.

Customer procedures

Following introduction of the new processes, customers will no longer approach the RSP to initiate the port request. The customer shall instead request a Porting Authorisation Code (PAC) from their DSP.

Blocking of the porting process

Any reasons allowing a company to block a customer-port request should be well documented and understood. Any reasons for rejection should be made clear to the customer at the point of request, along with what actions the customer may take in order to allow the port to commence—for example, fulfil any contractual terms. These conditions are specifically written into the new UK process manual.

Which and how many numbers per changeover

Timescales for the preparation of the porting

The quoted timescales (15-25 days) will change significantly when the new process manual is implemented. It is envisaged that a single port will be guaranteed within seven working days of a customer submitting his PAC to the RSP. The customer will not normally have the opportunity to select a port date (except in the bulk procedure).

Administration-cost allocation

Administration costs (currently around £25 plus VAT) incurred by the DSP may be recovered direct from the exporting customer. This occurs because there is no mechanism by which the DSP can easily recover costs from the RSP.

Annex H Comment of Denmark

Comments on ETO's Final Report on "Number portability for mobile networks" – the situation in Denmark.

Concerning item 6.2 on Fixed-Mobile Service Portability the report concludes:

"From a regulators point of view the introduction of FMSP would imply a change to a closed numbering plan, loss of geographic information and loss of tariff information carried in a number with consequences for tariff transparency. A decision about the introduction of FMSP would be premature at present due to the uncertainty about the benefits and costs."

Denmark thinks that this statement is too general for that reason alone, that Denmark already has a closed numbering plan with no geographic information carried in the numbers. Furthermore, possible regulatory issues are being resolved and a method for maintaining tariff transparency has been developed and is being discussed in Denmark.

The introduction of Fixed-Mobile Service Portability in Denmark is scheduled for 1 January 2001.