Consultation Paper No. 7/2005

Telecom Regulatory Authority of India

Consultation Paper

on

Mobile Number Portability

New Delhi: July 22, 2005

Preface

Number Portability will allow subscribers to change their service provider while retaining their old telephone number. Portability benefits subscribers and increases the level of competition between service providers, rewarding service providers with the best customer service, network coverage, and service quality. Given the growth of telecom services in India, and enhanced competition in the mobile sector, it is pertinent to deliberate about the issue of mobile number portability at this time.

Operator portability both for fixed and mobile services, and service portability have been implemented in different parts of the world. It might be thought that number portability would have the greatest impact in maturing markets when service demand growth has eased and the market structure has become more rationalized. However, the decision to introduce number portability could be taken well before that. The Netherlands decided to provide mobile number portability (MNP) when mobile penetration was 10%, and Pakistan, with 6.9% cellular penetration, is planning to introduce MNP shortly. This suggests that it is not too early for India to discuss number portability, so that it could be implemented by the time that the market has further expanded in the next few years.

This paper introduces the concept of number portability, explains its different types and benefits, and the technical, operational, and economic issues that might arise out of its implementation in India. The specific issues such as ensuring tariff transparency, the National Numbering Plan, and regulating porting charges, etc. have been raised and will need careful consideration.

We invite all stakeholders to participate in a collective thinking process about number portability, and seek the comments of all interested parties in response to the questions raised in this Consultation Paper. The paper has already been placed on TRAI's website (www.trai.gov.in). Written comments on the issues may please be furnished to Secretary, TRAI by August 30, 2005. For any further clarification on the matter please contact the Secretary, TRAI or Advisor (MN) at jsengg@bol.net.in or (011)-26106118.

(Pradip Baijal)
Chairman, TRAI

Table of Contents

Note: This document has a total of 44 pages from title page till the end.

List of Abbreviations Used

	Abbreviation	Expansion
1.	2G	Second Generation Mobile Telephone Technologies
2.	3G	Third Generation Mobile Telephone Technologies
3.	ACA	Australian Communications Authority
4.	ACCC	Australian Competition and Consumer Commission
5.	ACIF	Australian Communications Industry Forum
6.	BSNL	Bharat Sanchar Nigam Limited
7.	CCS7	Common Channel Signaling System 7
8.	CEPT	European Conference on Postal and Telecommunications Administrations
9.	CLI	Caller Line Identification
10.	CPP	Calling Party Pays
11.	ECC	European Communications Commission
12.	FCC	Federal Communications Commission, USA
13.	FNP	Fixed number Portability
14.	GSM	Global System for Mobile
15.	HDTP	Netherlands Posts and Telecommunications Department
16.	ILDO	International Long Distance Operator
17.	IN	Intelligent Network
18.	MNP	Mobile Number Portability
19.	MSC	Mobile Switching Center
20.	MTNL	Mahanagar Telephone Nigam Limited
21.	NLDO	National Long Distance Operators
22.	NNP	National Numbering Plan
23.	OFTA	Office of the Telecommunications Authority, Hong Kong
24.	OPTA	Post and Telecommunications Authority, Netherlands
25.	SIM	Subscriber Identity Module
26.	SMS	Short Message Service
27.	WLL(F)	Wireless in Local Loop, Fixed

Chapter 1. Introduction

1.1. Background

As per the TRAI Act, TRAI shall make recommendations, either *suo moto* or on a request from the licensor, on

- measures to facilitate competition and promote efficiency in the operation of telecommunication services so as to facilitate growth in such services;
- technological improvements in the services provided by the service providers;
- measures for the development of telecommunication technology and any other matter relatable to telecommunication industry in general.

Additionally, as per the Act, TRAI has to lay-down the standards of quality of service to be provided by the service providers and ensure the quality of service and conduct the periodical survey of such service provided by the service providers so as to protect interest of the consumers of telecommunication service.

Considering the growth of telecom services in India, it is appropriate at this stage to discuss the issue of number portability in order to ensure fuller competition in the telecom industry based on all issues of concern to subscribers including QoS, customer service, coverage, tariffs, variety of services offered, and so on, thereby maximizing subscriber benefits. To this end, TRAI has initiated this consultation process on number portability.

1.2. Growth of Telecom Services in India

Several positive steps taken by the Government, the Telecom Regulatory Authority of India (TRAI), and the aggressive efforts and co-operation of service providers, have led to fundamental reforms and explosive growth in India's telecom sector over the past decade. Increased competition has been a major reason for this growth.

The growth of wireless services – mobile and fixed – has led the overall growth in telecom services evident from the graphs below (Figure 1.1, 1.2 and 1.3).

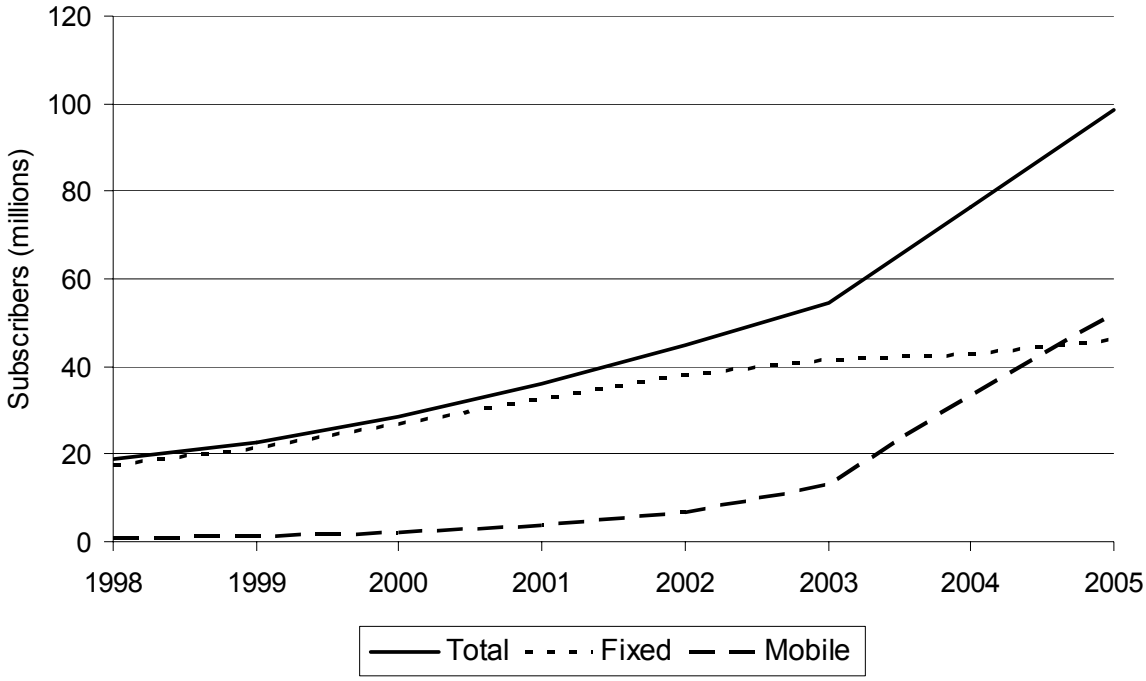

Figure 1.1: Growth Telecom Services in India

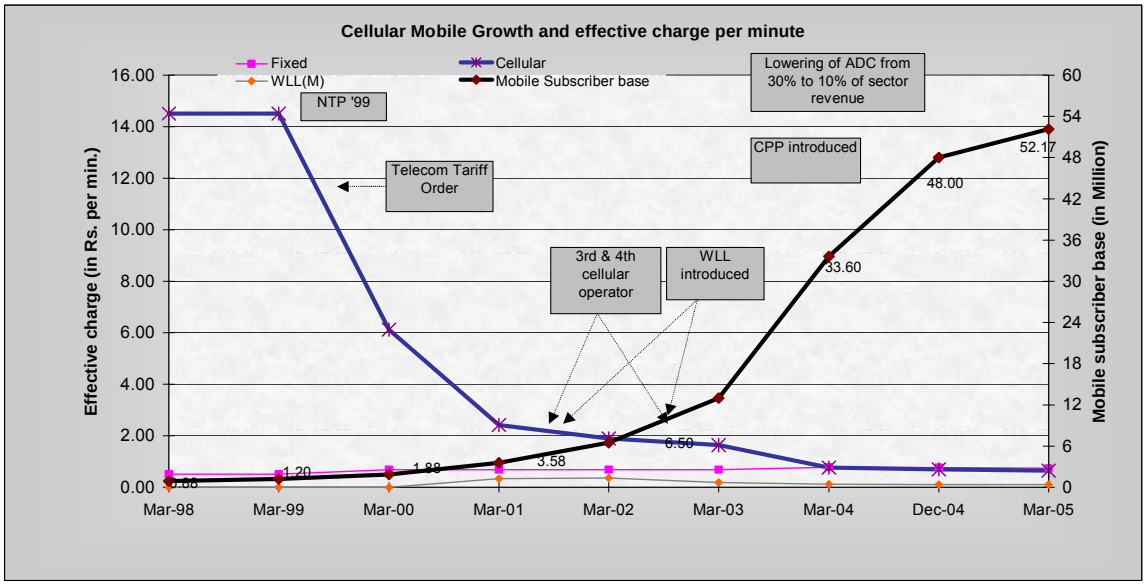

Figure 1.2: Growth in Mobile Subscriber Base, and Effective Charge Per Minute

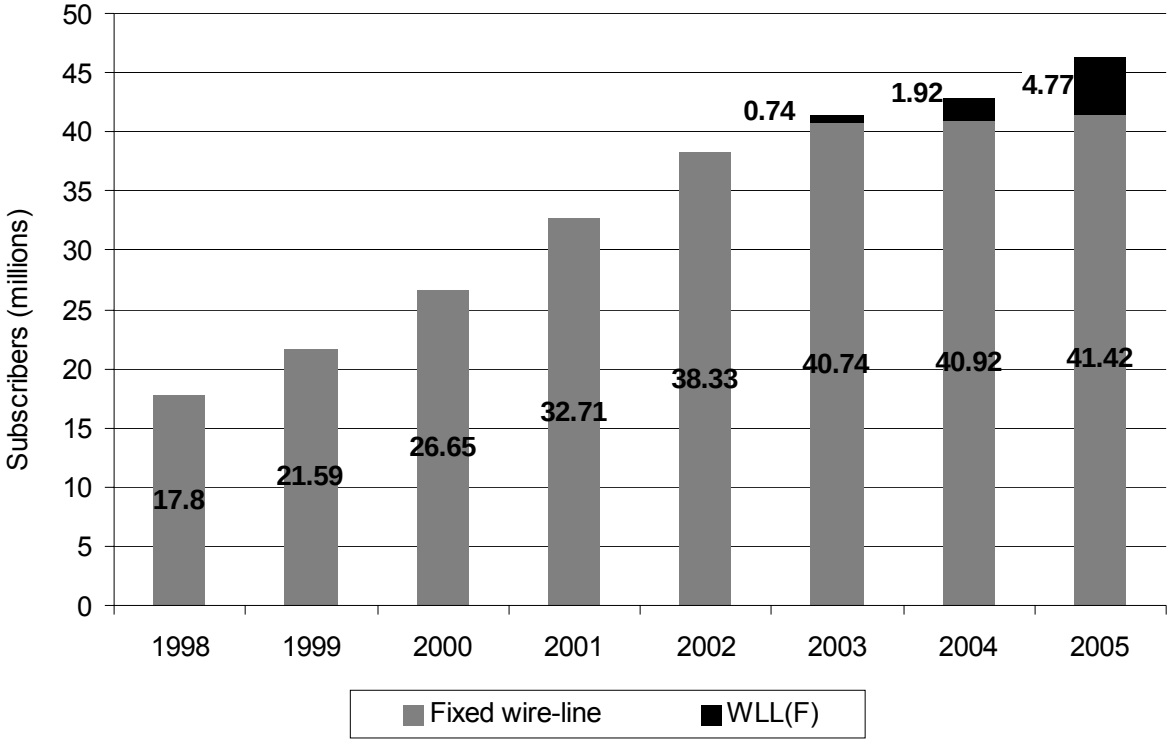

Figure 1.3: Growth in Fixed Telephony is concentrated in WLL(F)
Note: Prior to 2003, WLL(F) was counted as fixed wire-line.

As of July 1, 2005, India's teledensity (fixed and mobile combined) is 9.26%. As of March 31, 2005, the subscriber base for WLL(F) had grown to 4.77 million, an increase of 148% over one year. When compared with the 1.22% growth of wire-line fixed phones, it becomes obvious that the 7.82% annual growth up till March 31, 2005 in fixed telephony is concentrated in WLL(F).

As of July 1, 2005, 57.4 million cellular mobile subscribers are connected through four to seven cellular mobile operators within each service area. In each service area, Unified Access Service providers can offer both fixed and mobile services. The subscriber base of mobile services has grown by 55% for the financial year ending March 31, 2005.

Subscribers have a significant choice of services to choose from and move between, if they so desire. However, the inability of the subscriber to retain her or his telephone number when she or he wishes to change operators presents an obstacle to competition. The introduction of number portability will overcome this barrier to competition.

1.3. Structure of the Consultation Paper

The rest of this paper is organized as follows. Chapter 2 introduces the concept of number portability, defines its types, and the benefits it brings for users and service providers. Chapter 3 describes the related technical, operational, and economic issues. Chapter 4 provides an overview of the implementation of number portability internationally and draws lessons for India. Chapter 5 presents the current Indian scenario. Chapter 6 lists all the consultation questions.

Chapter 2. Number Portability: Definition, Types, and Benefits

2.1. Number Portability: Definition

Number portability enables a subscriber to switch between services, locations, or operators while retaining the original telephone number, without compromising on quality, reliability, and operational convenience. There are three basic types of number portability: operator, location, and service portability.

2.1.1. Operator Portability

This is the ability of a subscriber to retain within the same service area, an existing telephone number even if they change from one service provider/operator to another. This type of portability is for the same service, i.e. fixed to fixed, or mobile-to-mobile.

Operator portability can be implemented for geographic, non-geographic, or mobile numbers contained in the National Numbering Plan. Geographic numbers for fixed lines convey the subscriber's location, and convey the location of the customer. A non-geographic number does not imply the location of the customer. Mobile numbers are reserved for subscribers of mobile services.

Different categories of operator portability follow from these different types of numbers, and are:

a. Fixed Number Portability (FNP) is the portability of fixed geographic numbers.

b. Mobile Number Portability (MNP) is the portability of mobile telephone numbers.

c. Intelligent Number Portability (INP) is the portability of non-geographic Intelligent Network (IN) number.

Till date, operator portability has been the major type of number portability implemented internationally. India does not have a significant volume of

non-geographic numbers. Therefore, the following discussion does not consider INP.

2.1.1.1. Fixed Number Portability

For FNP, all fixed networks will have to be able to access porting information and route calls correctly. Mobile operators will also have to be involved in routing calls correctly to ensure the success of FNP. Technically, the minimum requirements for a fixed network to support number portability would be either:

a. the fixed network operator equipped all of its switches with CCS7 signaling; or

b. the fixed network operator equipped some of its switches (particularly those higher in the network switching hierarchy) with CCS7, and switched all calls through these equipped switches; or

c. the fixed network operator switched all calls to another operator with CCS7 signaling that was willing to provide a third-party transit service of this kind.

As of March 31, 2005, fixed line incumbents BSNL and MTNL have 89% of the total fixed-line subscribers, with the rest shared by private operators. However, the annual growth of private operators in the year ending March 31, 2005 has been 116.6% as opposed to 1.5% of the incumbents. This significant different indicates that there is potential for the growth of private operators, and this growth can introduce competition in the fixed line market.

TRAI considered the implementation of FNP at this stage. As mentioned above, 89% of fixed subscribers are with incumbent operators that have a large number of exchanges scattered through out the country. The technical capabilities of these exchanges vary to a large extent.

Except for WLL(F), the growth in fixed number subscribers is not very high in the recent years. For implementation of fixed number portability, the status of fixed networks needs detailed consideration and its suitability for the implementation of FNP will also need to be examined in detail.

In fixed telephony, the numbering is based on SDCA and it has to be seen that for implementation of FNP whether any change in the National Numbering Plan (NNP) is required.

Keeping in mind all the issues, Authority considered that at this stage, the Consultation process should be for MNP and the issue of FNP may not be considered at this stage and this could be taken up separately after seeing the experience in the MNP.

2.1.1.2. Mobile Number Portability

MNP is operator portability applied to a mobile-to-mobile porting process. There is a latent demand for MNP in India. International Data Corporation (IDC) India conducted a survey and found that "30% of mobile subscribers are likely to shift to an operator offering better service, if given the option."[1]

Figure 3.1 shows the market share of all mobile operators in India.

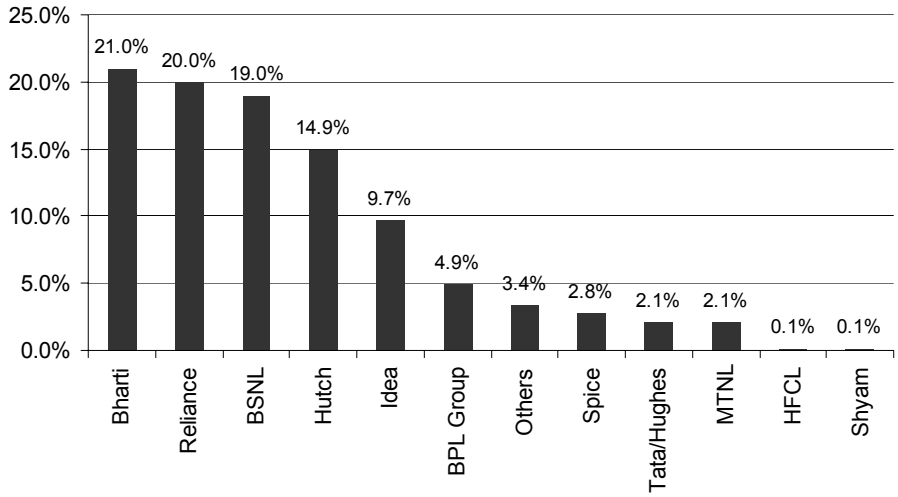

Figure 3.1: Market Shares of Cellular Operators as of March 31, 2005

Fixed operators will also have to be involved in routing calls correctly to ensure the success of MNP. The options for fixed network operators are simple since all calls addressed to mobile operators will, by definition, be interconnected calls and will be conveyed to a gateway exchange, the fixed operator can either -

[1] The Hindu Business Line, 30% of mobile users look for better operators: IDC, March 16, 2005

a. undertake a data base inquiry at the gateway, using its own gateway switch equipped with CCS7 signaling; or

b. make arrangements for the data base inquiry to be undertaken by another operator on its behalf at that point, and purchase a related transit service; or

c. connect to the donor network that routes the call to the recipient network.

Competition between mobile service providers in India is already intense. The beneficiary of this competition would be the Indian consumer, and MNP may increase the level of competition further.

2.1.2. Location Portability

Location portability is the ability of a subscriber to retain an existing telephone number when changing from one physical location to another. Location portability is the porting of a geographic number from one location to another. Location portability can be within exchange area, within numbering area, within charging area, or anywhere.

Unless combined with other types of portability such as service or operator portability, it remains an internal network operator issue.[2] Location portability becomes complex in the Indian situation if the subscriber moves to a region where her or his original network operator has no footprint.

Location portability has varying levels of complexity depending on whether the porting is occurring within or outside an exchange area and/or charging area. There might be differing impacts of routing and billing depending on the new location of the number.[3]

It might be comparatively simpler to implement location portability in an area such as short distance charging area (SDCA) by fixed operator that will benefit the customers as long as customer changes location within SDCA. The details of this type of number portability are not being discussed at this stage.

---

[2] ETSI TR 101 119 v1.1.1, Network Aspects (NA); High level description of number portability, 1997

[3] ETSI TR 101 119 v1.1.1, Network Aspects (NA); High level description of number portability, 1997

Location portability is not required in the existing mobile services as long as subscriber moves within the service area, i.e. circle or metro.

The overwhelming proportion of porting activity may be expected to occur when customers change to another service provider within the service area, i.e. perform operator porting, rather than when they move to live or work for extended periods in another service area. Internal migration patterns in India suggest that migration is "predominantly short distance, with around 60% of migrants changing their residence within the district of enumeration and over 20% within the state of enumeration while the rest move across the state boundaries."[4] TRAI did not come across any current implementation of location portability and it is generally considered a futuristic arrangement.

2.1.3. Service Portability

Service Portability is the ability of a subscriber to retain the existing telephone number when changing from one service to another service, say from fixed to mobile services.

The United States allows for "'intermodal' local number portability (LNP), i.e., the ability of customers to switch from a wireline carrier to a wireless carrier, or from a wireless to a wireline carrier, without changing telephone numbers."[5] In the United States, until November 25, 2004, 732,000 fixed-line telephone users had moved to mobile phones,[6] and up till April 2004, 1,000 subscribers had ported their numbers from mobile to wire-line service.[7]

Implementing service portability might be useful for users who wish to newer telecom services, but value their telephone numbers immensely, such as businesses. Service portability might allow these users to migrate to high-end telecom technologies providing data or mobile connectivity, and simultaneously not lose their existing phone number.

---

[4] Srivastava, R. & Sasikumar, S.K., *An overview of migration in India, its impacts and key issues*, Regional Conference on Migration, Development and Pro-Poor Policy Choices in Asia, June 2003

[5] FCC News Release, FCC Clears Way For Local Number Portability Between Wire-line And Wireless Carriers, November 10, 2003

[6] Financial Times, November 25, 2004

[7] FCC, Number Portability: Implementation and Progress, Presentation, May 13, 2004

In the Indian context, service portability will encourage the introduction and adoption of new telecom services and technologies. This will not only benefit users but also those service providers who continually upgrade and innovate. Additionally, it is a source of competition between all telecommunications operators – whether fixed or mobile.

However, there might be concerns about possible confusion for callers about the charges for different phone calls – i.e. tariff transparency is affected. In the current context, this is especially true when wire-line numbers become wireless numbers. A caller would no longer be able to estimate call charges based on the format of the phone number. For introduction of service portability, the capabilities of fixed networks are to be studied in detail. Therefore, this is not being discussed further in this consultation paper.

2.2. The Benefits of Number Portability

Number portability implementation removes barriers to competition between operators and services and ensures a dynamic, fully competitive market. The two constituencies that will benefit most from the introduction of number portability in India will be subscribers, and operators who price competitively and provide quality service.

Currently in India, subscribers are required to change their telephone numbers when changing operators. Changing a telephone number can be a major inconvenience and a barrier preventing them from exercising the choice of changing operators. As a result, the customer may be unable to take full advantage of the growing competition among operators or the introduction of new services and technologies.

Number portability eliminates these hurdles, and subscriber benefits may be categorized as:

a. **Type 1 benefits** accrue to subscribers who retain their telephone number when switching an operator, and include cost savings from having to change mobile number. Such subscribers are able to avoid the costs of reprinting stationary, informing callers, changing signs and lost business.

b. **Type 2 benefits** are those that arise out of efficiency and service quality improvements and any associated price reductions resulting from increased competition.

c. **Type 3 benefits** are those that accrue to callers to porting users who are able to avoid the need to change entries in their diaries, directories, databases and abbreviated dialers. They would also dial fewer wrong numbers and make fewer directory inquiries

Additionally, subscriber will be benefited from lower prices (Eg. Hong Kong, Australia etc.) by the competition between operators to provide the best service packages, customer service, or other benefits. Introducing number portability will allow some of subscribers to shift between operators and could improve subscriber satisfaction once it is introduced.

Operators who provide the best quality of service and coverage, and highest 'value-for-money' will benefit because consumers will prefer to begin service with them and will no longer hesitate because of changing phone numbers. In the United States, for example, "when unsatisfied cell phone customers want to change their service but not their phone number, more switch to Verizon Wireless than other major carriers." Verizon had the best porting-in to porting-out ratio of 3:1 while AT&T Wireless was the worst at 1:5. According to Tole Hart, principal analyst with Gartner, "Verizon is doing well because of the quality of their network and customer service."[8]

2.3. Terms Used in Number Portability

a. **Donor network**: The initial network where the number was located before ever being ported.

b. **Originating network**: The network where the calling party is connected.

c. **Recipient network**: The network where a number is located after being ported.

d. **Database**: The store of ported numbers with their relevant routing numbers.

---

[8] The Houston Chronicle, Cell Phone Wars, June 26, 2004

e. **Routing number**: A specific number that is derived and used by the network to route the call towards a ported number.

2.4. Issues for Consultation

1. What is the anticipated impact of number portability on customer satisfaction and increased competition between services and operators?

Chapter 3. Implementing Number Portability

In this chapter, we outline some of the possible technical options to implement number portability.

3.1. Technical Options

The technical solution adopted for the implementation of number portability is important as it will have cost implications on service providers/network operators, and will affect the services offered and the performance of these services made available to the subscriber. Technical solutions may influence, or be influenced by, cost allocation arrangements and form an essential background to questions of cost assessment and recovery.

Deciding between different technical options requires us to consider a whole range of issues. These include roaming, operational support system modifications, call charging arrangements, routing arrangements in the National Numbering Plan, interconnection between networks, support of number portability within and across mobile technologies, the timeframes involved in the introduction of solutions, the cost-effectiveness of different solutions, handling of voicemail, data and fax numbers, and routing of SMS traffic in the case of MNP.

A key question that needs early resolution is the method used for routing of calls from an originating network to the recipient network. Number portability can be provided by two broad categories of methods: off-switch solutions or on-switch solutions.

3.1.1. Off-switch Solutions

Off-switch solutions transfer the knowledge of porting information into one or more external databases that all network switches can access for query. Interception is performed at the originating switch or at some transit switch. This type of solution allows for the efficient routing of the call towards the recipient switch.

The originating switch (or some transit switch) can intercept a call to a ported number by querying the database that contains the list of all ported numbers plus routing information associated with each ported number.

There could be two ways to access the database, using the All-Call-Query, or the Query-on-Release methods.

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

Query-on-Release: The originating network first checks the status of dialed number with the donor network. The donor network returns a message to the originating network identifying if the number has been ported or not. The originating network then queries the central database to obtain the information regarding the recipient network and routes the call directly to the recipient network.

3.1.2. On-switch Solutions

In the case of on-switch solutions, the donor network manages the routing information for a ported number. Thus, the donor switch performs the interception, either routing the call itself, or providing routing information to the originating network that then routes the call to the recipient network. Consequently, this involves the use of internal databases.

The two ways to implement on-switch solutions are:

Onward routing (**call forwarding**): Here, the originating network connects to the donor network. If the dialed number has been ported, the donor network itself routes the call to the recipient network.

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

On-switch solutions are usually seen as a short-term interim solution for number portability. They are relatively easy and quick to implement compared to off-switch solutions.

Some countries initially chose a transient, short-term solution. This was not necessarily the most technically efficient solution, but allowed implementation

in a timely way and with minimum investment. Simultaneously, a long-term solution was also studied and deployed progressively.

3.1.3. Database Management

The various technical options related to the implementation of MNP mentioned above involve the use of databases that contain routing information. The databases can be centralized or distributed.

The centralized model involves a single reference database containing data for all mobile numbers or alternately, all ported numbers. This reference data is usually copied to operational databases in each participating network on a frequent basis. A consortium of network operators may manage this centralized number database for mobile number portability, or it may be out-sourced to a third party.

The distributed model involves multiple databases containing subsets of the total data. For example, in the on-switch case each separate database in the distributed model may comprise only the numbers ported from a particular mobile network operator. The full set of information about all mobile numbers (or all ported mobile numbers) is only available from these separate databases when taken as a whole.

3.1.4. Comparing the Technical Options

Onward routing is often regarded as the simplest routing method to implement and the all call query method as the most complex, with the other methods lying between these two extremes. This is also reflected in the costs of establishment, with onward routing regarded as cheaper to establish than the all call query method. By contrast, the ongoing costs associated with the all call query method are usually regarded as less than those of the onward routing method. Again, the costs associated with the other two methods lie between those of all call query and onward routing.

The centralized database solution is perceived as a long-term target solution for number portability. It supports optimal call routing and is adapted to an environment where all operators share number information. However, it is technically much more complicated to implement, involves significant investment (even from operators who are not directly concerned with number

portability such as national long distance operators selected as indirect access providers), and requires considerable national co-ordination.

Alternatively, distributed database solutions might need less coordination because every operator will have to handle the information only of their ported out or ported in numbers.

Annexure A provides a summary of the technical evaluation of each solution, and gives an overview of the compatibility and migration issues between the various implementation methods.

3.2. Operational Aspects

Although the technical implementation of number portability involves particular challenges, the challenges in devising the administrative arrangements facilitating porting of numbers may need equal, if not more, attention. Inefficiently designed, complex or flawed procedures for porting of mobile numbers may act as a bottleneck to the successful implementation of portability and severely affect the expected benefits.

Designing efficient, simple, secure and yet practical porting procedures for number portability may involve addressing issues such as the role of retailers, the need to change SIM cards or handsets, existing customer obligations, authentication of customers requesting a port, communication arrangements between entities during the porting process, refusal to port, time to port, and procedures for porting large quantities of numbers at a given time. These issues can be addressed through a Consultation at a later stage.

3.3. Economic Aspects

The success of introduction of any service in a telecom network is highly dependent on how cost-effective it is to the end users, and the cost burden it imposes on the concerned parties for its implementation. In this respect, the implementation of number portability should be cost-effective to ensure its success.

3.3.1. Costs associated with Number Portability

The costs incurred in the provision of number portability may be broadly divided into three categories:

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

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

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

3.3.2. Cost Allocation Matters

As already discussed, there are three main components of costs, the set up cost, the call conveyance cost and the administration cost. It is clear from the discussions so far that the proportion of each of these costs would be different for different methodologies or technical solutions adopted for achieving number portability. In a off-switch system which requires a centralized data base there would be a need for someone to set up the data base and then administer it. As already indicated, there is considerable cost associated with this.

The other possibility is to use Distributed Data Base solution where the system set up cost is not as high and is necessarily borne by each operator himself. In this situation, it may happen that Call Conveyance Cost may be of high proportion.

The next issue is whether these are to be considered as recoverable cost from the tariffs set up by the operators or they are to be taken as customer acquisition cost in the hope of capturing more customers. A question may

arise whether such a decision should a regulatory decision or a decision taken by individual operators.

Determination of such a cost if it is to be part of the tariffs for the customers, has to be carried out on a cost based analysis by the regulator.

The setup, conveyance, and administration costs may be allocated according to different cost allocation mechanisms. Some of these mechanisms are introduced in Annexure B.

3.4. Other Issues

3.4.1. Tariff Transparency

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

For example, some cellular service providers charge less for calls within their network, and more for calls to phones on other networks. If portability is implemented, then it may not be possible for a caller to determine what the tariff for a call might be. This could lead to confusion for the calling subscriber, and implementing tariff transparency will help avoid this situation.

Tariff transparency can be achieved through the use of recorded announcements at the start of a call or when the caller has a terminal with a screen where the tariff or service information could be displayed.

3.4.2. National Numbering Plan

Since a database query returns the routing information in the form of a re-routing number (which may be a pre-fixed original called party number), it is important that this re-routing number is recognizable and routable by the transit switches and fits into the National Numbering Plan.

Additionally, the National Numbering Plan needs modification because after introduction of number portability, the recipient network should be allowed to use numbers originally assigned to the donor network.

When customers are allowed to port their directory number between operators, the number of customers per number series in a given exchange

may become lower, since the total number of connected customers to a particular number series will then be shared by the number of exchanges and operators.

3.4.3. Routing of NLD and ILD Calls

The methods used for routing a call to a ported number that originates on another network within the same service area, a network elsewhere in the country, or a network in another country may be distinct.

For calls originating in another country, the foreign network will forward the calls to an ILDO in India, which may have to route the call to the recipient network. For domestic long-distance calls, the NLDO or the originating network may take responsibility for routing the calls. This procedure will depend on the technical solution chosen.

3.4.4. Short Messaging Services

SMS messages are routed between mobile networks via signaling paths rather than over voice circuits and so the methods used for routing of calls to ported numbers are not applicable to handling of SMS messages forwarded to ported numbers. Service providers may have to use a separate solution for handling SMS traffic for ported numbers.

Specific situation existing in India regarding the above issues are discussed in Chapter 5.

3.5. Issues for Consultation

2. The following technical options have been discussed in the consultation paper. Please indicate your preference with reasons:

    a. All-Call-Query
    b. Query-On-Release
    c. Onward Routing (Call Forwarding)
    d. Call-Drop-Back
    e. Any other solution

3. In the past, some countries have followed the approach of implementation of a short-term solution, with parallel planning for a long-term solution. Several other countries have opted directly for a long-term solution. The

issues associated with either approach are discussed in this paper. Please give your opinion, with reasons, on the path India should adopt.

4. In case of a centralized database approach, who should be responsible for the setup, ownership, administration, and management of such a database? Should the administration and operation of a centralized database be assigned to a third party duly licensed by the licensor as an other service provider (OSP) on the lines of a clearing-house, or should some other approach be adopted?

5. How should the database updates between different operators be synchronized? Where could the central database be located?

6. What should be the level of centralization (metro, circle, national) for a centralized database? Should this be a permanent arrangement, or be subject to later revision?

7. How should NLDOs and ILDOs handle the routing of calls to support number portability?

8. Are the existing interconnection arrangements (such as signaling) between mobile-to-mobile, mobile-to-fixed networks sufficient to achieve number portability, or are any changes required?

9. Are there any technical issues in the portability of services such as SMS, data, voicemail, or fax?

10. What problems do you foresee with the current National Numbering Plan in implementing number portability that may necessitate the modification of the existing National Numbering Plan?

11. Should number portability related charges be regulated? If not, then what measures will ensure that the portability charges are not set such as to discourage portability?

12. What measures will ensure tariff transparency?

13. Considering that the Indian market is a growing market and number portability offers the possibility of attracting customers by an efficient operator, should it be mandated that the cost of the number portability should be absorbed by recipient network?

Chapter 4. Lessons from International Experiences

4.1. Introduction

Over the past decade, number portability of various types has been implemented in a range of countries, and Annexure C summarizes and compares some of the key features associated with number portability in some international jurisdictions. In this chapter we briefly describe some of the experiences from other countries that may inform how number portability could be implemented in India. Table 4.1 provides information about countries that have implemented both MNP and FNP in their telecom markets.

Economy	**FNP**	**MNP**
Hong Kong , SAR	1996	1999
United Kingdom	1996	1999
Australia	1997	2001
United States	1997	2003
Germany	1998	2002
France	1998	2003
Netherlands	1999	1999
Singapore	2001	1997

Table 4.1: FNP and MNP implementations internationally
Source: Ovum Consulting Report, 2004

The detailed history of number portability implementation in each country is unique, but later implementations had the advantage of being able to take into account the experiences of earlier implementations.

Early problems – such as those that occurred in the Netherlands and UK in relation to MNP – have resulted in interventions by the regulatory agency. These have included adjustments to various aspects of the porting process, the technical solution, or the way in which calls are routed to ported numbers. The approach to implementing number portability is therefore, still evolving.

The remainder of this chapter introduces the process by which number portability was introduced in different jurisdictions around the world, and draws lessons from each example that might be applicable to India.

4.2. Overview of Technical Choices in Other Countries

Call routing to ported mobile numbers planned or adopted in European countries vary considerably in technique. Table 4.2 below illustrates this variation across various countries and for which information is available:

	Routing from a fixed network to a mobile network	**Routing from a mobile network to another mobile network**
Belgium	all call query	all call query & query on release
Denmark	all call query & query on release	all call query & query on release
Finland	onward routing	onward routing
France	Phase 1: onward routing, phase 2: all call query	phase 1: onward routing, phase 2: all call query
Germany	onward routing & all call query	all call query
Hungary	all call query & query on release	phase 1: onward routing & all call query, phase 2: all call query
Ireland	onward routing	all call query
Italy	onward routing & all call query	all call query
Netherlands	all call query	all call query
Norway	all call query	all call query
Portugal	all call query & query on release	all call query
Spain	Onward routing	onward outing
Sweden	onward routing & all call query	onward routing & all call query
Switzerland	Onward routing	onward routing
United Kingdom	Onward routing	onward routing

Table 4.2: Technical solutions for MNP used in various countries
Source: ECC CEPT Report, March 2003

Most European countries have adopted a centralized approach to management of a number database. For example Belgium, Denmark, France, Germany, Hungary, Ireland, Italy, Norway, Portugal, Sweden, Switzerland have chosen to implement centralized databases. The Netherlands is the only exception, and has implemented a hybrid distributed and centralized database system.

4.3. The Netherlands

Dutch law mandates that service providers port fixed, digital mobile, and non-geographic numbers on request from the subscriber. The first steps were taken towards number portability in October 1995, and the legal obligation to port non-geographic and fixed numbers became effective in March 1998. By April 1999, number portability was a legal obligation for all fixed and digital mobile numbers.

The Dutch market was in its early growth phase for 2G mobile services at the time the decision in favour of number portability was made. At the time of introduction, the total subscriber base for mobile telephones was 4.3 million. This was equivalent to a 27.37% penetration. This was a time when competition was largely for a share of new subscribers, rather than to promote increased competition in the context of a more saturated market. As of February 2004, the penetration of mobile phones is 83.2%.

Application to India: The experience of the Dutch in introducing number portability is useful for India because the Netherlands introduced the concept of portability and implemented it even when the market was not mature or saturated. India's telecom services market is not yet saturated, and competition still focuses on increasing market-share. However, the Dutch example shows us that market maturity is not a precondition for the introduction of number portability.

4.4. European Union (EU)

Regulatory authorities in EU states are mandated to encourage the introduction of operator portability for geographic and non-geographic numbers. The target date for introduction was fixed for January 1, 2000. With regard to the implementation of number portability, the framework left

sufficient room for national variations on the technical, administrative, and organizational level. Extensions of two years were given to some of the member states such as Ireland, Greece, and Spain to introduce local number portability.

Application to India: Phased implementation might allow for regional variations in implementation, depending on the demand, state of the network, and possibility of competition. However, an overall framework can guide the implementation, even if phased.

4.5. Denmark

The National IT and Telecom Agency (NITA) has imposed number portability on all operators and service providers. The technical solution has been agreed upon by those players themselves with no intervention from the regulator.

The technical solution for number portability in Denmark is based on IN-Query from the first exchange of the carrier responsible for the call. New entrants for normally use All-Call-Query. The incumbent, TDC Tele Danmark, uses Query-on-Release for calls to own numbers and All-Call-Query for calls to other numbers.

FNP was introduced in October 15, 1999. MNP was introduced in July 2001, and the deadline for providing FNP and MNP is December 31, 2005.

Application to India: The Government, TRAI, and industry should work together to establish number portability in India. Each should have its individual responsibilities and adhere to an overall framework of rules, rights, and obligations.

4.6. United Kingdom

Early number portability implementations, such as in the cased of FNP in the UK in 1996, had a particularly long period of gestation and of preparation for implementation. This was partly the result of factors that no longer apply, such as:

a. the lack of any experience at that stage with number portability implementation anywhere in the world

b. the need to gain industry and public understanding and acceptance of the concepts involved

c. the need to exhaust legal and appeal processes

d. the state of the BT fixed network, and the existence of substantial numbers of analogue switches

More recent implementations typically involve much shorter periods. In the case of MNP, the typical time between the formal decision to proceed, and the nomination of a date for full market operation to commence is 12-18 months. However, this timetable depends on a number of other matters being in place, such as:

a. a culture of effective technical cooperation between industry participants

b. suitable forums within which industry participation can sensibly occur.

Application to India: The state of networks, relations between participants, and a culture of cooperation will determine the speed of implementing number portability.

4.7. Australia

In May 1997, the ACCC released for comment a draft direction to the ACA on number portability. Following industry input a revised direction was issued to the ACA in September 1997. Under this direction, local wire-line services, free phone and local rate services were declared portable services. However, the ACCC reserved its position on MNP. It wished to further consider whether or not number portability within the GSM network or across all digital networks was required in order to promote the long-term interests of end-users. In October 1997, the ACCC requested that the ACA, in consultation with the industry, enquire into and report on the issues surrounding MNP, and by April 1998, the ACA published a report on 'Technical Options for Mobile Number Portability Implementation'. In December 1998, the ACA published an updated report which included the results of further investigative work into the options available for MNP, together with consideration of the implementation issues associated with each option.

In October 1999. the ACCC determined that there should be MNP across all technologies, and directed the ACA to amend the National Numbering Plan accordingly, and to set the earliest practicable date by which MNP should be available. In December 1999, the ACA issued a Public Discussion Paper inviting submissions on fixing the date for MNP implementation. It also engaged consultants to determine whether international and domestic trends, developments and applications in mobile technology would be helpful in reaching a conclusion on this matter.

Finally, in May 2000, after further consideration, the ACA made public its final view that MNP must be made available by all Australian mobile carriage service providers by September 2001.

Prior to the implementing MNP, the ACCC observed that the penetration of cellular phones in Australia had reached 50% and more than 10 million users. Following MNP, by June 2003 the penetration of cellular phones had reached 66% and more than 14 million users. In the six months immediately following the implementation of MNP, each of the three carriers increased average retail prices by varying amounts but reduced them by varying amounts in the following two periods.

Application to India: Detailed consultation and discussion with industry will enable the implementation of number portability in the most efficient and timely manner.

4.8. United States

Porting among wire-line carriers has been occurring since 1998. To facilitate greater competition in the telecom industry, the US Federal Communications Commission (FCC) mandated service providers to ensure portability if a subscriber moved wireless carriers, or between a landline and wireless phone, from November 24, 2003.

The 1996 Telecommunications Act requires all wireline local exchange carriers to provide local number portability (LNP), and the Commission has mandated that wireless carriers provide wireless LNP (WLNP) as well. On November 24, 2003, wireless carriers began porting in the top 100 markets, and porting also began in those markets between wireline and wireless

carriers. On May 24, 2004, wireless local number portability became available in the rest of the country outside the top 100 markets.[9] By November 25, 2004, one year after the introduction of WLNP, 7.8 million users ported their numbers.[10] In tracking ratios of customers porting-in to porting-out for major carriers in the United States, the Yankee Group noted that Verizon Wireless had the best ratio at 3:1, and AT&T Wireless had the worst at 1:5.[11]

Application to India: With a latent demand for MNP at this stage, subscribers and best service operators will be benefited by the introduction of MNP. The US example explains the implications of FNP and service portability.

4.9. Other Countries

Recently, many more countries have either implemented or are planning to implement MNP. For example, Japan, Canada, New Zealand, Israel, and Pakistan have in 2005 made progress towards implementing their MNP programs.

As of April 2005, the penetration of cellular telephones in Pakistan was 6.91%.[12] Even so, the Pakistan Telecommunication Authority (PTA) constituted a supervisory board to provide MNP in May 2005. Pakistan expects MNP to be introduced by the end of the current year.[13]

4.10. Issues for Consultation

14. Please share any additional information that you might have about number portability implementations in countries and jurisdictions around the world, and what we might learn from these experiences.

---

[9] FCC, FCC Reports On Status Of Local Number Portability, Press Release, May 13, 2004

[10] Financial Times, November 25, 2004

[11] Houston Chronicle, June 26, 2004

[12] Pakistan Telecommunication Authority, Telecom Indicators, www.pta.gov.pk

[13] Business Recorder, PTA Constitutes Supervisory Board, Associated Press of Pakistan, May 25, 2005

Chapter 5. The Indian Scenario

The existing licensing regime divides the country into service areas within which a number of operators are licensed on a non-exclusive basis to provide range of services. In the current licensing regime Unified Access Service provider can provide both fixed and cellular mobile services. In addition, National Long Distance Operators (NLDOs) and International Long Distance Operators (ILDO) are separately licensed for the carriage of domestic and international long distance traffic respectively.

5.1. The State of Networks

Indian mobile network operators have deployed the bulk of their networks over the past five years. The network technology, customer care, and operational support processes applied by Indian mobile operators are comparable with those throughout the world. As such, there should not be any unusual requirement in implementing MNP not already addressed in other countries. This does not mean that the mobile networks would not require upgrading to support MNP, but that the scale of changes required, the timeframes involved and the costs of upgrading may be reasonably low.

5.2. The Possibility of Phased Implementation

Existing licensing structure creates the possibility of implementing number portability on a progressive basis, by service area. Implementing number portability initially within service areas on a progressive basis may be appropriate for the following reasons:

a. Some service areas may have relatively higher levels of business subscribers and so the benefits to customers may be higher in such areas than others.

b. Some service areas may have more modern network infrastructure resulting in lower system set-up costs to operators than in other areas.

c. The early experience gained may be helpful in quicker and smoother implementation in the remaining service areas and eventually the national

level. Any technical and procedural hitches may be removed before proceeding for implementation in the remaining service areas.

d. The overwhelming proportion of porting activity may be expected to occur when customers change to another service provider within the service area, rather than when they move to live or work for extended periods in another service area.

A phased implementation might result in a technical implementation that is less efficient than a national implementation. However, the national implementation might need a greater level of coordination and a higher one-time investment by participants. Thus, the choice between the phased or national-level implementations is an important one.

Whether a phased rollout or a national rollout is adopted, the technical implementation would have to be such as to cater for either eventuality.

5.3. Benefits for India

Subscribers and service providers will benefit from the introduction of number portability as mentioned earlier. All countries where cost benefit analysis was carried out showed a net benefit due to the introduction of number portability.

The ACCC, when it mandated the implementation of MNP in Australia, believed that there was a clear case that MNP is in the long-term interest of end users and that a detailed cost study would only add unnecessary costs and delay to MNP implementation.

5.4. Timing the Introduction of Number Portability

India's teledensity for fixed and mobile combined is currently 9.26%. Competition is currently focussed on increasing market share and penetration of telecom services. Some might suggest that number portability should be introduced in a more mature market.

As mentioned earlier, Netherlands decided to implement MNP when cellular penetration was under 10%, and Pakistan initiated the process even with cellular penetration of 6.91%.

Given these examples, it is possible to suggest that India can begin discussing the implementation of number portability, even though the market

is not mature or saturated. By the time number portability will be implemented, the market will also expand, and at that time, number portability will add to the benefits of competition.

5.5. Issues for Consultation

15. Give your comments, with reasons, as to when number portability should be introduced in India?

16. Should MNP be implemented progressively by service area or directly across the nation at one time?

17. What will be the effect, if any, on the different aspects of implementation if phased roll-out is adopted?

Chapter 6. Issues for Consultation

1. What is the anticipated impact of number portability on customer satisfaction and increased competition between services and operators?

2. The following technical options have been discussed in the consultation paper. Please indicate your preference with reasons:

   a. All-Call-Query

   b. Query-On-Release

   c. Onward Routing (Call Forwarding)

   d. Call-Drop-Back

   e. Any other solution

3. In the past, some countries have followed the approach of implementation of a short-term solution, with parallel planning for a long-term solution. Several other countries have opted directly for a long-term solution. The issues associated with either approach are discussed in this paper. Please give your opinion, with reasons, on the path India should adopt.

4. In case of a centralized database approach, who should be responsible for the setup, ownership, administration, and management of such a database? Should the administration and operation of a centralized database be assigned to a third party duly licensed by the licensor as an other service provider (OSP) on the lines of a clearing-house, or should some other approach be adopted?

5. How should the database updates between different operators be synchronized? Where could the central database be located?

6. What should be the level of centralization (metro, circle, national) for a centralized database? Should this be a permanent arrangement, or be subject to later revision?

7. How should NLDOs and ILDOs handle the routing of calls to support number portability?

8. Are the existing interconnection arrangements (such as signaling) between mobile-to-mobile, mobile-to-fixed networks sufficient to achieve number portability, or are any changes required?

9. Are there any technical issues in the portability of services such as SMS, data, voicemail, or fax?

10. What problems do you foresee with the current National Numbering Plan in implementing number portability that may necessitate the modification of the existing National Numbering Plan?

11. Should number portability related charges be regulated? If not, then what measures will ensure that the portability charges are not set such as to discourage portability?

12. What measures will ensure tariff transparency?

13. Considering that the Indian market is a growing market and number portability offers the possibility of attracting customers by an efficient operator, should it be mandated that the cost of the number portability should be absorbed by recipient network?

14. Please share any additional information that you might have about number portability implementations in countries and jurisdictions around the world, and what we might learn from these experiences.

15. Give your comments, with reasons, as to when number portability should be introduced in India?

16. Should MNP be implemented progressively by service area or directly across the nation at one time?

17. What will be the effect, if any, on the different aspects of implementation if phased roll-out is adopted?

Annexure A. Comparing Technical Options for Number Portability

Technical Characteristics of the Various Number Portability Solutions							
IMPACTS	**On-Switch Solutions**					**Off-Switch Solutions**	
	1. Onward Routing Solutions (Call Forwarding and Derivatives)				2. Number Translation Solutions	Database query solutions with use of a prefixed number	
	Variant 1a: use of a 2nd number	Variant 1b: use of a generic number	Variant 1c: use of a prefix	Variant 1d: transparent call forwarding (prefix)	Translation to a prefixed number	Variant 3a: query by default	Variant 3b: query on release
Services							
* right Calling Line Identification (for outgoing calls)	No	Yes: since the ported number's block is handled			Yes: since the ported number's block is handled	Yes: since the ported number's block is handled	
* Direct Dial Inbound (DDI)	No: wrong called number passed onto user interface	Yes			Yes	Yes	
* call forwarding (for incoming calls)	There is an interface and it would not work if the maximum number of hops is 1 (in any case it reduces this limit)			Yes	Yes	Yes	

Performance * routing efficiency (for incoming calls)	Very bad: systematic routing via the donor switch	Bad: routing via the door switch, except for calls local to the recipient switch Optimisation solution: call drop-back (requires signaling development)		Bad: routing via the donor switch, except for calls local to the recipient switch. Optimisation solution: call-drop back (requires signaling development)	Excellent: optimised		
* numbering resources	Very bad: one additional number per ported number	Bad: one number per switch	Good: one per switch from an extra-numbering space, but large digit length	Good: one per switch from an extra-numbering space, but large digit length	Good: one per switch from an extra-numbering space, but large digit length		
* IN query/additional call set up delay due to IN query	(not applicable)			(not applicable)	Query: systematic Delay: all calls	Query: optimised Delay: only calls to ported numbers	
* Best adapted for individual/grouped numbers	Best adapted for individual numbers			Best adapted for grouped numbers	Best adapted for individual and grouped numbers		
Co-existence with other methods - Implementation experience							
* Compatibility between solutions	Bad: 1a and 2a are compatible	Very bad: No compatibility	Good: 1c, 1d, 3a and 3b are compatible	Good: 1c, 1d, 3a and 3b are compatible	Good: 1c, 1d, 3a and 3b are compatible	Good: 1c, 1d, 3a and 3b are compatible	Good: 1c, 1d, 3a and 3b are compatible

* Implementation feedback (input from country survey)	Not used	Not used ?	Frequent choice for short term solution	Used for example in UK ('data decode') or in France ("RGA")	Used for porting of DDI number blocks	Long term solution Used for example in USA	Long term solution Used for example in Finland
Boxes in grey indicate solutions that are technically satisfactory and acceptable							

Source: Report for European Commission by Europe Economics and ARCOME SA, October 1999

Annexure B. Possible Cost Allocation Mechanisms

There are different methods by which the setup, administration, and conveyance costs of porting might be allocated. This annexure presents some of the possible mechanisms of allocating these costs among different participants.

Setup and Management Costs

A key cost allocation principle that has been a feature of many implementations in other countries is that each network operator bears its own system set-up costs, including the costs associated with upgrading network exchanges to support number portability. This approach may encourage network operators to adopt the most cost effective means of setting up systems and networks, and to minimize the costs that they themselves will have to bear.

In the case of off-switch distributed or centralized database implementations, operators use a look-up database for routing information of ported numbers. A third party or network operator(s) may setup and manage this database. The recovery of the establishment and operating costs could be either through:

a. the third party which, in turn, recovers the costs by imposing fees on users of the database (the network operators concerned), or
b. the network operators, which are subject to number portability obligations, contribute to meeting the costs, which may be on the basis of market share, or
c. quantities of numbers in the database for which each is responsible, or
d. some other mechanism.

In case of an on-switch distributed database solution each operator may be required to bear its own database related costs.

Administration Cost

The administrative process of porting a number involves various costs for the recipient network operator, the donor network operator, and potentially for mobile dealers or mobile resellers which may be involved in the porting

process, and for the operator of a number database. The actual cost of a single port of a mobile number in CEPT countries for which information is available ranges from €10 up to €31(the average cost is €22).

Following the principle of cost-oriented charging, the following scenarios may arise for allocating the per-line administration costs:

a. The donor network may pass costs of porting to the recipient network operator. The recipient network operator may make a commercial decision whether to recover the costs from end-users. In practice, though, they tend not to do so to promote the service and do not want to deter customers from joining their networks.

b. The donor network operator charges the user for the costs of a port. It may become necessary to regulate this charge to ensure that an inflated price charged by the donor network does not discourage users from porting to a competitor.

c. The administrative costs of the recipient network and the donor network could pass on to the user requesting a port. These prices may need to be regulated to ensure that subscribers are not overcharged.

As of 2004, the fee charged to users for porting a mobile number among CEPT countries for which information is available ranges from zero up to €47(the average charge is €14) as shown below in Table B.1.

Country	**Porting Fee Charged to User**
Belgium	maximum EUR 15
Denmark	no fee*
Netherlands	EUR 9.08
Norway	approximately NOK 85
Switzerland	no fee
United Kingdom	up to GBP 30

* Some recipient service providers charge a small fee

Table B.1: Fee Charged per port
Source: ECC CEPT Report, March 2003

Charges should reasonably reflect the likely level of costs for an efficient operator, and any direct charges to customers should not act as a disincentive for porting.

Conveyance Costs

The additional conveyance costs may be quite appreciable and are generally relevant in on-switch solutions. The donor and the recipient network operator may have to bear the additional conveyance costs associated with some on-switch solutions. European countries have adopted various approaches for apportioning additional conveyance costs between operators. Table B.2 below shows the different parties that bear the costs.

	originating network	**split between originating network & donor network**	**donor network**	**recipient network**	**network undertaking additional conveyance**
Belgium	√ ~				
Germany					
Italy				√	
Portugal	√ *				
Sweden		√			
Switzerland			√		
United Kingdom					√

~ Except if network originally associated with number prescribes less eficient method for routing of calls, in which case it pays difference between cost of method it prescribes and cost of most efficient method.

* Except if costs are negligible, in which case they are borne by each network that incurs costs.

Table B.2: Approaches to apportioning additional conveyance costs
Source: ECC CEPT Report, March 2003

Annexure C. Number Portability Implementations in Different Jurisdictions

	Australia	**Hong Kong**	**Netherlands**	**UK**
Policy objectives	Promotion of competition	Promotion of competition	Promotion of competition	Promotion of competition
Date of Implementation	2001	1998	1999	1999
Technical solution	Data base solution, with independent databases organized by each operator.	Common distributed database solution used for both fixed and MNP.	Common database operated by independent organization, used for both fixed and MNP.	Call routing solution, with responsibility for completion of calls to ported numbers remaining on the donor operator.
Cost benefit analysis	Not undertaken by regulator – net benefit assumed.	Undertaken by regulator – positive net benefits.	Undertaken by regulator – positive net benefits.	Undertaken by regulator – positive net benefits.
Review of costs or benefits by regulator	No	No	No	No
Reported significant early problems	No	No	Yes	Yes
Subsequent intervention by	No	No	Yes	Yes

	Australia	**Hong Kong**	**Netherlands**	**UK**
intervention by regulator to revise arrangements				
Industry consultation prior to decision to proceed	Yes	Yes	Yes	Yes
Industry involvement in detailed porting procedures and other arrangements	Industry forum (ACIF) responsible for developing all procedures and codes, subject to ACA approval. ACA staff on all working groups	Industry involved and opinions regularly sought. Initiative with OFTA however	Industry pro-active when regulatory agency not fully up and running. Industry took initiative with regulatory oversight	Industry heavily involved in development of procedures through existing groups and forums

Table C.1: Key features associated with number portability in different jurisdictions
Source: Ovum Consulting Report, 2004