



Telecom Regulatory Authority of India

Recommendations

on

Mobile Number Portability

March 8, 2006

List of Abbreviations Used

	Abbreviation	Expansion
1.	BSNL	Bharat Sanchar Nigam Limited
2.	CCS7	Common Channel Signaling System 7
3.	CDMA	Code Division Multiple Access
4.	CEPT	European Conference on Postal and Telecommunications Administrations
5.	CLI	Caller Line Identification
6.	ECC	Electronic communication Committee with in the European Conference of Postal and Telecommunications Administrations(CEPT)
7.	FNP	Fixed number Portability
8.	GSM	Global System for Mobile Communication
9.	ILDO	International Long Distance Operator
10.	IN	Intelligent Network
11.	MMS	Multimedia Messaging Service
12.	MNP	Mobile Number Portability
13.	MSC	Mobile Switching Center
14.	MTNL	Mahanagar Telephone Nigam Limited
15.	NLDO	National Long Distance Operators
16.	NPAC	Number Portability Administration Center
17.	QOS	Quality of Service
18.	SCP	Service Control Point
19.	SDCA	Short Distance Charging Area
20.	SIM	Subscriber Identity Module
21.	SMS	Short Message Service
22.	SS7	Signaling System 7
23.	STP	Signal Transfer Point
24.	TEC	Telecom Engineering Center
25.	TRAI	Telecom Regulatory Authority of India

Executive Summary

Mobile Number Portability (MNP) allows Mobile subscribers to change their service provider while retaining their subscriber number. Portability benefits subscribers and increases the level of competition between service providers, rewarding those operators having better customer service, network coverage, and service quality.

Keeping in view the growth of telecom services in India, TRAI considers it an appropriate time to initiate process for implementing Mobile Number Portability so as to further enhance competition among service providers in the Mobile sector and also to improve quality of service and satisfaction of the Mobile Subscribers.

The following are the gist of TRAI recommendation on Mobile Number Portability:

- ❖ Mobile Number Portability implementation process should be initiated in our country. A time frame of 12 months between the acceptance of recommendation by the Government and launch of this facility is recommended. It is recommended that this facility should be available to mobile subscribers tentatively by 1st April 2007.
- ❖ Government may mandate all UASLs/CMSPs to implement Mobile Number Portability. Further, it is recommended that initially MNP be introduced within the service Area only.
- ❖ It is appropriate to implement MNP in phased manner starting from metros and A category service areas followed by B then C category service areas within the interval of six months.
- ❖ A direct solution i.e. All Call Query Method be implemented for mobile number portability in India.

- ❖ In multi-operator scenario when N operators are involved in the complete call setup considering 1 being the originating operator and N being Terminating operator, (N-1)th operator shall be responsible for routing the call to ported numbers.
- ❖ Mobile Operators through neutral third party shall establish logically centralised database with not more than 5 regionally located databases. Cost of this database shall be borne proportionately based on subscriber base by each operator. This database shall be the depository for the ported numbers.
- ❖ Any other issues relating to creation of database, interfaces, performance parameters, service levels shall be resolved by discussion and coordination among all the stakeholders. A steering committee consisting of operators, industry association and TEC under the aegis of TRAI shall be constituted to workout the details of these implementation issues.
- ❖ Mobile Operators shall adopt Centralised Clearing house preferably electronic processing approach for processing porting requests. Cost of such central clearing house shall be borne by all the operators. A neutral third party will administer such clearing house.
- ❖ The design of clearing House will be such that total time to port should not exceed three working days initially but up gradable to much faster levels.
- ❖ Any other operational and administrative aspects relating to centralized clearing house shall be worked out by steering committee.
- ❖ Customer shall approach the recipient operator for porting his number

- ❖ In respect of porting charges, only Recipient operator shall be permitted to charge a fee for successful porting.
- ❖ Donor operator shall not use ported out numbers till such time it is in use by the ported subscriber. After the surrendering of number by ported subscriber the number shall revert back to the original donor operator.
- ❖ The method of tariff transparency will be decided by the Steering Committee after due consultation and also considering the cost aspects of different solutions
- ❖ Licensor shall provide Unique operator code to enable routing to ported numbers.
- ❖ Provision may be made by the licensor in the license for TRAI to issue regulation in this regard
- ❖ The up-gradation cost of their network shall be borne by the operators
- ❖ Common setup costs for Number Portability Administration Center (NPAC), Clearing House would be borne by operators based on the subscriber market share of operators as on 1st Jan 2007.

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Chapter 1.

Introduction

1.1. Background

1.1.1. 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.

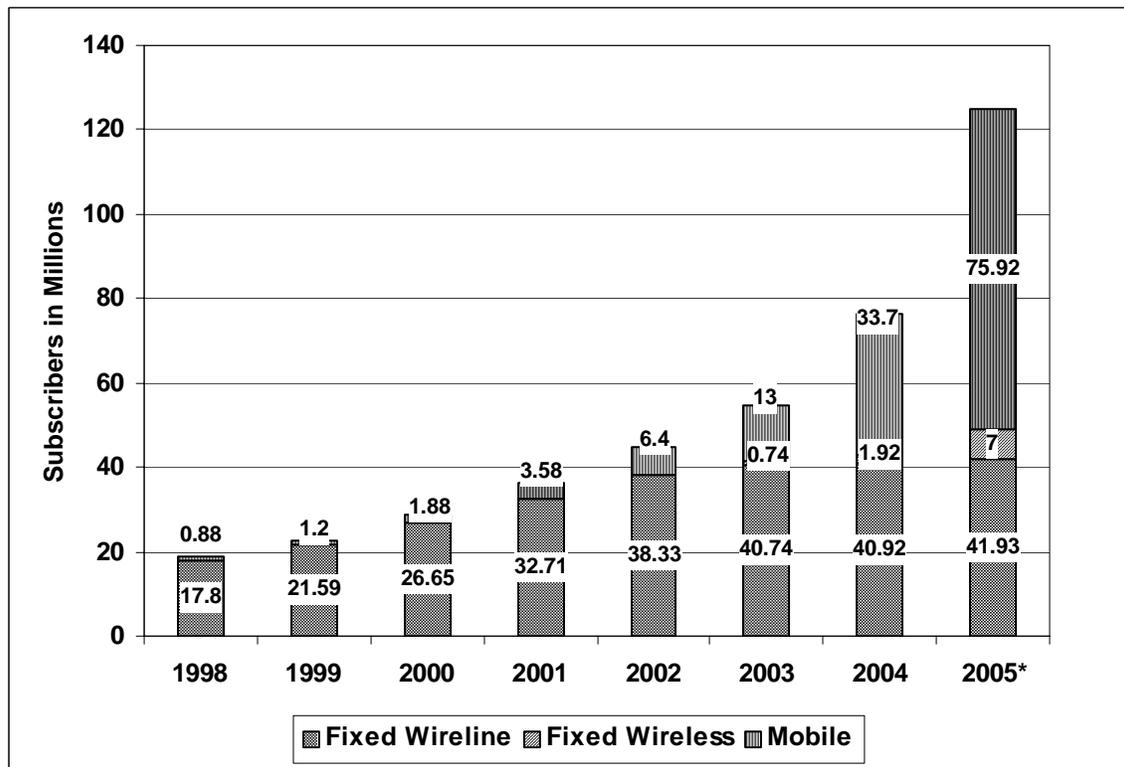
1.1.2. Additionally, as per the Act, TRAI has to lay-down the standards of quality of service to be provided by the service providers and ensure the quality of service and conduct the periodical survey of such service provided by the service providers so as to protect interest of the consumers of telecommunication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

1.1.3. Considering the growth of telecom services in India, it was felt appropriate at this stage to start deliberation on the issue of number portability so as to ensure further increase in the competition in the telecom industry based on all issues of concern to subscribers viz. QoS, customer service, tariffs, variety of services being offered etc. As per the laid down practice, TRAI issued a Consultation Paper on Mobile Number Portability on July 22, 2005. Subsequently, Open House Discussions were held in Hyderabad, Kolkata, Mumbai and Delhi on 21st Sept, 23rd Sept, 4th Oct and 6th Oct 2005 respectively. Based on the comments received in the Consultation process and its own analysis, TRAI has finalised its recommendations on Mobile Number Portability.

1.2. Growth of Telecom Services in India

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

1.2.2. The growth of wireless services, both in mobile and fixed – has led the overall growth in telecom services which is evident from the graph below

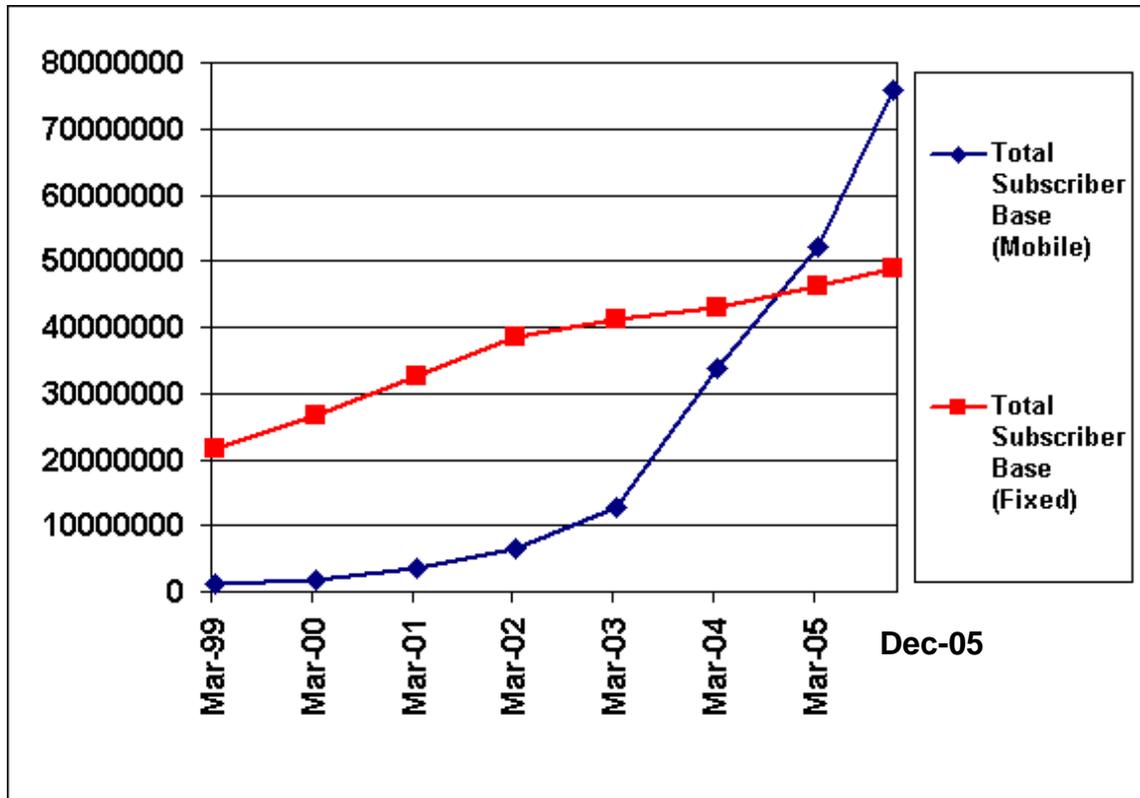


*Data up to December 2005

Figure 1.3: Growth in Fixed Telephony is concentrated in fixed wireless

Note: Prior to 2003, fixed wireless was included with fixed wireline .

1.2.3. The following figure indicates that mobile is dominating & surpassed the growth of fixed line.



1.2.4. As of January 2006, India's teledensity (fixed and mobile combined) has reached 12%. There are about 81 million mobile subscribers and 49.21 million fixed subscribers in the country with most of the license areas having four to seven mobile service providers, out of which 3-4 operators also provide fixed service. In the fixed service segment, in spite of having 3-4 operators in each service area, barring the incumbent ie. BSNL, none of the operator is present in all the SDCA's of the country. As far as Mobile service segment is concerned, though the Subscribers have a significant choice of service providers in all the service areas, but still the freedom to change the operators in case the subscriber is not satisfied with the service including quality of service provided by the operator or for any other reason, is limited. The main obstacle to do so is the inability to retain her or his telephone number on change. Introduction of

number portability will overcome this barrier and will allow them to freely move to any operator of their choice and thus derive the full benefit of the competition through low tariff, high quality of service, wide coverage and enhanced features of services offered by the particular operator.

1.3. Number portability:

1.3.1. 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: service, location and operator portability. Details / description of these types are given at **Annex-A**.

1.3.2. In most of the countries, location portability and service portability are not enforced, and only operator portability is implemented because operator portability is considered essential for fair competition among operators, while location portability and service portability are typically treated as value-added services. Secondly, the implementation and operational costs of operator portability are significantly lower if service portability and location portability are not considered. Therefore, Fixed Number Portability (FNP) and Mobile Number Portability (MNP) are the major types of Operator Portability implemented internationally.

1.3.3 During the consultation process on MNP, though the consumer organizations and the vendors/solution providers welcomed the need for the introduction of MNP, however, most of the operators including their Associations were against the MNP. Some of the stakeholders were in favour of simultaneous implementation of both FNP and MNP in India. The reasons given by most of the operators including their associations against MNP implementation mainly related to:

- a) Implementation of MNP prior to FNP.
- b) Timing for implementation of Number portability.

1.3.4 The argument given by them for a) above are

- I. Most of the countries implemented FNP first.
- II. Compared to fixed service sector, enough competition in mobile sector already exists. Number portability is needed in fixed sector where even after 10 years of privatization, about 85% of the subscribers are still with the incumbent operators.

The reasons cited by the operators for b) above are discussed in detail in Chapter-2. Regarding implementation of MNP ahead of FNP, most of the developed countries adopted FNP first, because at that time, the mobile services were in the developing stage and penetration of fixed services had reached its saturation levels. On the other hand, in India, mobile penetration has already taken over the fixed telephony. The main growth is happening in the mobile sector and the growth in the fixed services is marginal. In addition, the incumbent (which has around 85% market share of fixed sector) has legacy network with technical/feasibility limitations and in case of FNP implementation it will need huge investment for up gradation as compared to the mobile networks having State-of-the-Art technologies. Thus, MNP with the current available infrastructure would be easier than the FNP. Another reason for implementation of MNP prior to FNP is non-availability of directory and directory enquiry service for mobile numbers. Mobile customers especially business customers with high mobility usually distribute their number through word of mouth and in the absence of MNP they find it difficult to switch service providers unlike fixed line subscribers whose changed numbers can always be found through the directory enquiry service. Other major reasons for not considering the FNP at this stage are given below:

- ❖ The existing numbering for fixed phones in India is SDCA based. Therefore if Fixed Number Portability (FNP) is implemented it will be limited to the SDCA level only until numbering scheme is modified.
- ❖ Apart from the incumbent, other fixed line service providers are not present in all the SDCAs of a circle, hence even after FNP implementation

in such SDCAs the subscribers will not be having the choice to change their service providers.

- ❖ The present trends indicate that there is growth in the mobile segment and not in the landline segment.

Therefore, Authority is of the view that FNP may not be considered at this stage.

This may be reviewed after seeing experience in MNP.

1.3.5 Recommendation:

In view of the above, Authority recommends that only, MNP is taken up at this stage and portability in fixed numbers may be considered later.

Chapter 2 Mobile Number Portability

2.1 Background:

2.1.1 MNP is operator portability applied to a mobile-to-mobile porting process. The rationale for providing MNP are:

- a. Removes a barrier to switching networks, thereby increasing subscriber choice
- b. more choice means greater competition which should lead to improved customer service and reduced cost to the subscriber
- c. Facilitates competition in saturated markets
- d. Reduces the subscriber's cost of switching networks because there is no need to circulate new number
- e. Results in more effective use of numbering resources

2.1.2 In this chapter various issues relating to Mobile Number Portability such as need and timing of introduction of this facility, technical and operational issues involved in the implementation have been discussed and some recommendations covering these issues have been proposed.

2.2 Need and Timing of Introduction of Mobile Number Portability

2.2.1 It is an established fact, that today in India the major share of growth in the telecom sector is due to the unprecedented growth in the mobile sector. As on January 2006, there were 81 million mobile subscribers as compared to 49.21 million fixed subscribers as discussed in Chapter 1. Between the two kinds of Number Portability, Mobile Number Portability is more essential, keeping in mind the factors such as improvement in quality of service, need of the consumer interest, capital expenditure required for implementation and international practices. In view of the above, the demand expected in mobile sector for porting number will also be more in comparison to the fixed sector.

2.2.2 During the consultation process, in the Open House Discussion and in their written responses, some of the stakeholders have stated that:

1. In most of the countries the Mobile Number Portability was introduced at a time when the tele-density was around 25 to 30%.
2. Most of the mobile operators are at present involved in rolling out of their network in the semi urban / rural areas and hence it is not the right time to introduce Mobile Number Portability as they will have to incur heavy expenditure on upgradation of their network / switches for Mobile Number Portability.
3. There is enough competition in all the license areas and hence the introduction of Mobile Number Portability will not yield major benefit to the customer.

2.2.3 As per the reports of various consultants and international experience, it has been seen that the whole process of implementation of Number Portability from the stage of taking a decision to actual implementation varies from 12 to 18 months. The mobile tele density as on December was about 7.0 and it is expected to cross 20% by the end of 2007 which will be comparable to the teledensity in the countries at the time of implementation of Mobile Number Portability.

2.2.4 Secondly, if we compare the subscriber base in absolute number, it can be seen that today itself, the mobile subscriber base of India is comparable or even higher than those of other developed nations where Mobile Number Portability has been implemented. Most of the mobile operators are at present either in the process of or have already upgraded their networks for 3G services and are planning for NGN in next 1- 3 years. TRAI is of the firm view that the cost of additional upgradation for implementation of Mobile Number Portability in such a scenario will be marginal and in case Mobile Number Portability is not implemented now then subsequently with the increase of mobile subscribers base to approximately 250 to 300 million, it may become difficult to implement.

- 2.2.5 Thirdly, though it is correct to say that there is enough competition in the market however, with all the mobile operators offering similar kind of service and low tariffs, the customer actually do not have any choice between the operators. Introduction of Mobile Number Portability will give incentive to the operators to improve their quality of service and also to provide more cost benefit tariff plans to the customers and one of the major barrier for the consumers, for migrating to more efficient and cost beneficial operator, will be removed.
- 2.2.6 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 Further it has been experienced that significant price reductions were observed amongst mobile operators in places such as Hong Kong after the introduction of MNP. Operators who provide the best quality of service and coverage, and highest ‘value-for-money’ will benefit because consumers will prefer to migrate to them and will no longer hesitate as no change in the phone number will be involved. 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.”²
- 2.2.7 During the consultation process one of the CDMA operators had stated that in case of portability between GSM and CDMA operators, the non-availability of solution for handset portability may limit their choice for the consumers. Authority feels this may not be a major issue for the customer in view of benefits offered by MNP and technology advancement in the Handset manufacturing and the availability of dual Tech handsets, it is expected that the market forces will take care of this aspect.

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

² The Houston Chronicle, Cell Phone Wars, June 26, 2004

2.2.8 Many countries have implemented mobile number portability during the past 3 years which may be seen in the following table.

Country	Date of implementation	MNP
Austria	16 Oct 2004	
Belgium	Sep2002	
Cyprus	July 2004	
Estonia	1 Jan 2005	
Finland	Jul 2003	
France	June 2003	
Germany	Nov 2002	
Greece	Sep 2003	
Hungary	May 2004	
Iceland	Oct 2004	
Ireland	Jul 2003	
Italy	Apr 2002	
Lituania	Jan2004	
Luxemburg	Feb 2005	
Malta	Jul 2005	
Slovak Republic	May 2004	
United States	Nov 2003	

2.2.9 Number Portability is normally not desired by those operators who feel that they will lose customers because of their poor quality of service. MNP will be a stimuli for improving quality of service for the operator & it will give a choice to the subscriber for opting an efficient operator. Mobile Number Portability will provide customers true benefit of competition, rewarding operators with the best customer service, coverage and service quality.

2.3 Area of Operation for MNP

2.3.1 In India, area specific licenses to the operators have been issued for operation of telecom mobile services. The Numbering Plan being used by mobile services is also circle based. Further, the trend of subscribers changing operators is seen more within the 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 80% within the state. Therefore it is expected that the overwhelming proportion of porting activity will occur within the service area only. As such the Authority feels that initially the mobile number portability should be restricted to the service area only.

2.4 Recommendations:

- 1. Authority is of the opinion that MNP implementation process should be initiated in our country. Adequate time is required to be provided to the industry to agree on architecture and System upgrades. As such, a time frame of 12 months between the announcement about MNP and launch of this facility is recommended. It is recommended that Government may mandate all cellular mobile service providers to implement Mobile Number Portability. Further, it is recommended that MNP be introduced initially within the service Area only.**
- 2. In the light of the above Authority recommends that all UASLs/CMSPs shall start providing this facility by 1st April 2007 and perform porting process of subscriber who request porting.**

2.5 Implementation issues

2.5.1 The implementation issues involve mainly technical solution, provisioning processes and administrative issues.

2.6 Terms Used in Number Portability

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

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

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

Database: The database of ported numbers with their relevant routing numbers.

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

2.7 Technical Solutions

2.7.1 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 quality 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.

2.7.2 Deciding between different technical options requires consideration of 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 routing of SMS traffic.

2.7.3 In order to arrive at a suitable technical solution, the Authority noted that there are broadly two methods available for routing of calls in a mobile number portability environment:

a. Direct routing: Routing of a call directly from the originating network to the terminating mobile network, which requires the former to determine the correct destination for a given number (“ALL CALL QUERY”)-DIRECT ROUTING; or

b. Interdependent routing:

The involvement of the donor network in the routing of a call to the correct terminating mobile network – INTERDEPENDENT ROUTING.

This method can be further divided into three different forms:

- The donor network identifies the correct terminating mobile network and routes the call onward to that network (“ONWARD ROUTING”);
- The Donor network after confirming that the number is ported, releases the call back to the originating network together with information identifying the correct terminating network (“CALL DROP BACK”); or
- The Donor network after confirming that the number is ported, returns a message to the originating network indicating that the number has moved. The originating network then queries a database to obtain information identifying the correct terminating network (“QUERY ON RELEASE”).

A schematic summary of the different technical solutions are enclosed at **Annexure B:**

2.7.4 The following table gives the pros and cons of these technical methods along with its implementation in some of the countries:

Method	Pros	Cons	International Implementations
Direct Routing or All Call Query:	<ul style="list-style-type: none"> - Only Option that does not involve the donor network and therefore the most efficient from a call routing perspective. This being direct routing, gives ability to access services such as MMS, data calls after porting. - Centralised number portability database (containing ported number information for multiple networks) is used for call routing. - Does not place a call routing burden on the donor network 	<ul style="list-style-type: none"> - Requires a number portability implementation that supports a centralized number portability database -Setup cost is comparatively high 	USA, Belgium, Denmark, Finland, Italy, Germany, Malta

	<ul style="list-style-type: none"> -operational cost is less -Long term solution 		
Query on Release:	<ul style="list-style-type: none"> - Centralised number portability database is used for call routing -Operational cost is medium -Long term solution 	<ul style="list-style-type: none"> - Requires a number portability implementation that supports a centralized number portability database - some what inefficient in using network facilities since a call segment must be setup from the originating network to the donor network. - Places a call routing burden on the donor network -setup cost is high 	Hungary, Portugal
Onward Routing:	<ul style="list-style-type: none"> -Simple number portability implementation. since no centralized number portability database need be maintained. The donor network can implement one or many number portability databases to suit its network set up. -setup cost is lower -short term solution 	<ul style="list-style-type: none"> - Least efficient in using network facilities since it requires the setup of two physical call segments (one from the originating network to the donor network and the other from the donor network to the recipient network) - Places call burden on the donor network. -Operational cost is higher 	UK, Singapore, Switzerland, Spain etc
Call Drop Back	<ul style="list-style-type: none"> Simplified number portability implementation needed since no centralized number portability database need to be maintained. The donor network can implement one or many number portability databases to suit its network setup 	<ul style="list-style-type: none"> - Somewhat inefficient in using network facilities since a call segment must be setup from the originating network to the donor network - Places a call routing burden on the donor network 	No country using this approach

- 2.7.5 Onward Routing is often regarded as the simplest routing method to implement whereas the Direct routing (or All Call Query method) is considered as the most complex. The other methods are in between these two extremes. If these methods are seen with regard to the capital cost of the establishment then also onward routing is regarded as cheaper than the All Call Query method. By contrast, the operational cost associated with the onward routing method is usually observed more than All Call Query method. Further, the costs associated with the other two methods lie in between of all call query and onward routing.
- 2.7.6 The Direct routing solution / All Call Query is perceived as a long-term solution for number portability whereas Call Forwarding solution was adopted initially when the estimated number of portings are less. The key advantage of Direct routing (or All Call Query) is that it does not increase network congestion between originating operator and the donor operator as the ported calls are directly routed to recipient network. Further, this method eliminates dependence on the donor network operator, thereby providing the ability to maintain portability in the event of donor network operator's failure or exit from business. Therefore, direct routing is considered as more optimized with more efficient call routing.
- 2.7.7 In the consultation paper comments on selection of technical options described above or any other solution for implementation of MNP was called for. Majority of the stakeholders stated that long term solution (All Call Query) should be adopted. Further, It was suggested that the query should be based on the standard protocol preferably [IS 41 CDMA) / MAP (GSM)] acceptable to the Mobile Operator. Only a few stakeholders suggested interdependent method viz Onward Routing or Query-On-Release.

2.7.8 Selection of a solution for long-term such as All Call Query would ensure that service providers have the ability to route telephone calls and provide services to their customers independently from the networks of other service providers in contrast to the onward routing where service provider is to rely on the networks of their competitors in order to route calls which can have several undesirable effects. Such dependence creates the potential for call blocking by donor operator.

2.7.9 Some countries initially chose Call Forwarding solution that allowed implementation in a timely way and with minimum investment yet this was not most technically efficient solution. The experiences in the countries like UK and Singapore indicated that the migration between solutions were not only expensive but also time consuming. The following shortcomings were brought out by call forwarding solution initially adopted by Singapore.

- Inefficient use of network resources and mobile telephone numbers (it uses one additional number for routing calls to ported numbers)
- Incorrect Caller Line Identification (CLI) display
- Inability to port MMS and IP based solutions.

2.8 International practices on selection of MNP solution:

2.8.1 The following table indicates the routing method in the CEPT countries

Country	How calls are routed from a fixed network to a mobile network	How calls are routed from a mobile network to another mobile network
Austria	Onward routing or all call query	All call query
Belgium	All call query	All call query & query on release
Croatia	All call query	All call query
Cyprus	All call query	All call query
Denmark	All call query	All call query
Estonia	All call query	All call query
Finland	All call query(1.10.05)	All call query
France	Phase 1: onward routing	Phase 1: Onward routing

	Phase 2: All call query	Phase 2: All call query
Germany	Onward routing & All call query	All call query
Hungary	All call query & query on release	Phase 1: All call query & query on release
Iceland	All call query	All call query
Ireland	Onward routing	All call query
Italy	All call query	All call query
Lithuania	All call query	All call query
Luxembourg	Onward routing	All call query
Malta	Onward routing but ACQ may also be used	All call query
Netherlands	All call query	All call query
Norway	All call query	All call query
Poland	All call query	All call query
Portugal	All call query & query on release	All call query & query on release
Slovenia	All call query	All call query
Spain	Onward routing	Onward routing
Sweden	Onward routing & all call query	Onward routing & all call query
Switzerland	Onward routing	Onward routing
United Kingdom	Onward routing	Onward routing

Source: Electronic Communications Committee (ECC), within the European Conference of Postal and Telecommunications Administrations (CEPT), Mobile number Portability in CEPT countries updated October 2005

1. Singapore and UK are migrating to direct routing/ All Call Query from call forward solutions. South Africa adopted neutral approach. However, mobile operators in South Africa are in favour of implementing direct solution whereas the incumbent fixed operator Telkom is in favour of onward routing for calls from fixed network to a mobile network.

2.8.3 While choosing one of the above method by mobile operators, 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 -

- Undertake a data base inquiry at the gateway using its own gateway switch equipped with CCS7 signaling; or
- 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
- Connect to the donor network that routes the call to the recipient network.

2.9 Domestic long-distance calls are routed through NLDOs. NLDOs or the originating network should take responsibility for routing the calls to ported numbers. In order to make the routing of calls to ported numbers efficient, it would be preferable if the query with regard to ported number is generated from NLD TAX rather than originating network as the latter one has to undergo voluminous database containing porting numbers of all circles. As such (N-1)th operator would be responsible to locate the correct terminating network of a ported number.

2.10 The international long distance calls originating in another country, the foreign network will forward the calls to an ILDO in India. In the normal course, the ILDO may either route the call to NLDO or directly to terminating network (Access provider). If the routing of the call is done through NLDO, then the NLDO would route the call to the correct terminating network of a ported number. In case where the ILDO gateways are directly connected with Access providers, ILDO would take responsibility to route the calls to correct terminating network of a ported number. As such (N-1)th operator

would be responsible to locate the correct terminating network of a ported number.

2.11 Recommendations:

- 1. Therefore Authority recommends that a direct solution i.e. All Call Query method be implemented for mobile number portability in India. Regarding calls from Fixed network to Mobile network, Fixed operators, NLDOs, ILDOs have the option to participate in the All Call Query method or any other method in agreement with Mobile operators.**
- 2. Authority also recommends that in a multioperator scenario when N operators are involved in the complete call setup, considering 1 being the originating operator and N being Terminating operator, (N-1)th operator shall be responsible for routing the call to the ported numbers.**

2.12 Database Management

- 2.12.1** All implementations of mobile number portability involve the use of databases which contain information of the networks and associated ported numbers. This information is used for a call to determine the correct terminating network of a ported number. Databases relating to Number Portability are typically managed either in a centralised or in a distributed manner.
- 2.12.2** The centralised model involves a single reference database containing data for all ported numbers. Usually this database contains reference data, which may be copied to operational databases of each participating network on a frequent basis. A centralised database for mobile number portability is generally managed by a consortium of network operators, which may be comprised of only the mobile network operators or all network operators which may be involved in routing of calls to mobile numbers. The actual operation and maintenance of a centralised number database may be outsourced to a third party company, which has experience in database operations. In the centralized database approach, all operators communicate independently to third party for number portability and porting

process. Also, Centralised approach may also serve as a common platform for ordering, provisioning, and notification process of number portability.

2.12.3 The distributed database contains subsets of the total data in different locations. Distributed database may be managed by each network operator. The full set of information about all ported mobile numbers is only available from these separate databases when taken as a whole.

2.12.4 The following table indicates that most of the CEPT countries adopted centralized database approach.

Country	Type of ported mobile number database
Austria	Distributed
Belgium	Centralized
Croatia	Centralized
Cyprus	Distributed
Denmark	Centralized
Estonia	Centralized
Finland	Centralized
France	Centralized
Germany	Centralized
Hungary	Centralized
Iceland	Centralized
Ireland	Centralized
Italy	Centralized
Lithuania	Centralized
Luxembourg	Centralized
Malta	Distributed
Netherlands	Hybrid Distributed and centralized
Norway	Centralized
Portugal	Centralized
Poland	Centralized
Slovenia	Centralized
Sweden	Centralized
Switzerland	Centralized

Source: Electronic Communications Committee (ECC), within the European Conference of Postal and Telecommunications Administrations (CEPT), Mobile number Portability in CEPT countries updated October 2005

- 2.12.5 In addition, USA, Taiwan, Greece and Lithuania is adopting the centralized database solution. Singapore is planning to migrate to centralized solution. IDA in its consultation paper on the Review of Number Portability in Singapore dated 6th September 2005 stated” IDA believes that the centralized database approach will provide a more robust number portability technical solution than our existing solutions”. As mentioned earlier Singapore initially adopted call forwarding solution for MNP.
- 2.12.6 Pakistan vide their Gazzette notification dated 3rd August 2005 on the Regulation on Mobile Number Portability, has mandated operators to establish a central data base to implement mobile number portability.
- 2.12.7 Considering the number of operators and the expected number of portings, India may also adopt centralized database, which supports automatic updation. Further, Centralised Clearing House ordering system (discussed later) would also form part of the centralised database architecture.
- 2.12.8 During the consultation process many stakeholders were of the view that central database be created and maintained which would contain ported numbers of all operators and a neutral third party should manage the centralised database.
- 2.12.9 The issues relating to setup, ownership administration and management of databases, interconnect and clearing house may be managed by a single agency as decided by operators. Service providers should workout inter-alia the following issues:
- The centralized database architecture, functional requirements (including database security, redundancy) and technical interfaces with service providers including Fixed, NLD, ILD Operators.
 - The nature and structure of the independent third party to operate the centralized database.
 - The cost of the centralized database infrastructure, apportionment of cost amongst the service providers, number portability performance standards and service levels.

2.13 Level of Centralization of Database

- 2.13.1 Licensing structure in India being Circle wise/ metro-wise licence, the level of centralisation of database could be region wise OR a single database at national level.
- 2.13.2 The database at circle/metro-wise is easier to implement from the angle of scalability, connectivity by the networks of the operators. The cost of connectivity to the database will also be less in this approach. Moreover, at present, the licensing / numbering scheme is also circle/metro-wise, which enable the implementation of database & co-ordination among licensed operators much faster in circle-wise database. However, having a number of small databases will increase the cost of implementation and also subsequent administration cost. It will also involve too many agencies leading to coordination problems and will also be cumbersome to administer.
- 2.13.3 The national level database could be a single point of contact to ported numbers. However, the Implementation of such a nation-wide database raise concerns regarding scalability, performance and availability. There will be additional connectivity cost associated with national-wise database. Besides, there may be requirement of higher dimensioning and multiple databases at later stage.
- 2.13.4 During the consultation process some of the operators opined that circle level centralisation of database would lead to simplicity of implementation. This is also in line with the licenses which is service area based. It was further argued that a national level centralisation will lead to higher dimensioning requirement and will also be prone to the factors like single point failure and vulnerability of information leak out.
- 2.13.6.A national centralized database that transmits data updates to operator specific regional or local databases provides the most comprehensive

solution. However, the level of centralization in the Number Portability database should be the maximum reasonable area. In the United States the country was divided into seven regional areas that were matched to the regional incumbent local operating areas. However, in most European and Asian implementations of Number Portability, a centralized database is used for the entire nation with a second database provided for back-up and fail-over purposes. Implementation of a long-term nation wide Number Portability solution in India may raise concerns regarding scalability, performance and availability. These issues can be mitigated with the implementation of multiple physical databases that provide a single logical database. Data consistency across multiple databases will require synchronization. Use of a centralized logical database solution involves data replication by the centralized database, geographic data partitioning and geographic data distribution as dictated by the needs. In India 5 such regional databases are considered for implementing MNP.

Database Size Requirements

	Total No. of Mobile Subscribers	Expected Number Ports per year	Total Number Ports	Record Size	No. of Transactions per Record	Database Size	Year 2015 Database Size
Nation	150,000,000	5%	7,500,000	500 bytes (0.5 KB)	4	15GB	100 GB
Typical Region	30,000,000 ^c	5%	1,500,000	500 bytes (0.5 KB)	4	3 GB	20 GB

a) Source: Hong Kong document “cte_20031010_2.pdf” Pages 11, 54 & based on 10% of averaged Churn ratio per year

2.13.5 Recommendations

- 1. The Authority recommends that Mobile Operators through neutral third party shall establish logically centralised database with not more than 5 regionally located databases. Cost of this database shall be borne proportionately based on subscriber base by each operator. This database shall be depository for ported numbers.**

2. **Any other issues relating to creation of database, interfaces, performance parameters, service levels shall be resolved by discussion and coordination among all the stakeholders. A steering committee consisting of operators, industry association and TEC under the aegis of TRAI shall be constituted to workout the details of these implementation issues.**

2.14 Phased implementation Vs National implementation

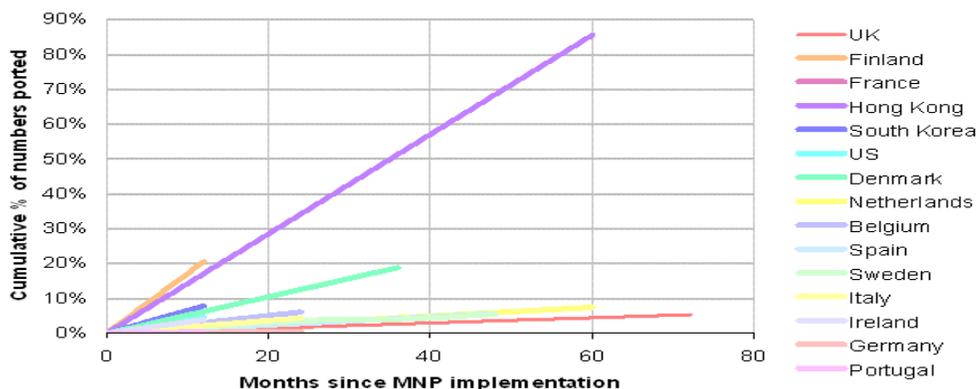
- 2.14.1 In the consultation paper issued by TRAI, comments were sought on whether MNP be implemented progressively by service area or directly across the nation at a time. During the consultation process some of the stakeholders opined that the categorization for phased implementation be based on business potential of circles such as Metro, category A, B and C. On the other hand some of the stakeholders argued in favour of one time national implementation, which would greatly protect against possible canvassing against MNP due to possible glitches in the initial implementation.
- 2.14.2 Every service area has got different business proposition and network infrastructure. It may be mentioned that metros are better placed in terms of business proposition as well as awareness about new facility (MNP) and likely to use more such facility than the other service areas. Further, metros have got better infrastructure such as availability of CCS 7 signaling, IN capabilities, which is one of the prime requirement for implementing MNP.
- 2.14.3 Licenses for telecom services have been issued on the basis of service areas that prompt possibility of implementing number portability in a phased manner. Some of the factors favouring implementation in a phased manner are:-
 - ❖ 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.

- ❖ Some service areas may have more modern network infrastructure resulting in lower system set-up costs to operators than in other areas.
- ❖ The experience gained during initial phase of implementation may be helpful in quicker and smoother implementation in the remaining service areas and eventually countrywide. Any technical and procedural hitches may be removed before proceeding for implementation in the remaining service areas.
- ❖ National implementation might need a greater level of coordination and a higher one-time investment by participants.

2.14.4 Recommendation:- In view of the above facts, the Authority feels appropriate to implement MNP in phased manner starting from metros and A category service areas followed by B then C category service areas within the interval of six months.

2.15 Administrative arrangement of porting process

2.15.1 It is observed that the success of number portability depends not only on the choice of technical issues but administrative issues play equally important role. Figure below is the graph showing the success of the Mobile Number Portability in different countries where it was implemented. Cumulative percentage of numbers ported in places where MNP is implemented indicates that countries such as Finland and Hong Kong recorded highest rate of porting than countries like UK, Netherland etc. because of easy porting procedures, good coordination among operators, less porting time etc.



Source: Analysys research 2005

2.15.2 Apart from technical implementation, administrative arrangements are equally important for achieving full benefit of number portability to the customer. The administrative arrangements like Porting time, and porting charges etc. should not be a barrier to customer to port in case customer is dissatisfied with existing operator. International experience from countries such as Netherlands, and UK where Number portability is considered unsuccessful is because of the lack of proper administrative arrangements. It could be a success if appropriate coordination among the operators are in place for effective implementation of MNP.

2.15.3 Poorly designed, complex or easily-abused procedures for porting of mobile numbers are less likely to result in a successful implementation of portability or to produce the benefits that portability is intended to deliver.

2.15.4 Other important factors in designing porting procedures include the method by which the user requesting a port is verified as the holder of a number, arrangements for communication between entities involved in porting a number during the porting process, and procedures for porting large quantities of numbers at one time.

2.16 Provisioning Processes:

2.16.1 In order to successfully provision the ported number end-to-end, the following tasks are necessary:

- Order Processing: the subscriber's request to a service provider to have a number ported,
- Port Provisioning: Provisioning of service provider's Operational Support System (OSS), Business Support Systems (BSS), and network(s), and
- Port Notification for Network(s) Synchronization: informing all service providers about the port.

2.16.2 Number portability normally starts with a subscriber requesting that the recipient network initiate the port of their number. The recipient operator is

then faced with the task of interacting with the donor operator to decide on how and when to port the number. Two scenarios are possible: Bi-Lateral / Peer-to-Peer Approach and Centralized Clearinghouse Approach.

2.16.3 Bi-Lateral/Peer-to-Peer Approach: With this approach, service providers communicate directly with each other under individual commercial bilateral agreements or service level agreements that are contracted between service providers. These agreements cover exchange of customer data, validation of customer data, and notification of executed ports.

2.16.4 Centralized Clearinghouse Approach: The Centralized Clearinghouse is a message processing system through which service providers communicate using the same set of rules for handling porting requests and exchanging information required for porting numbers. This centralized clearing house will be managed by third party, which has the following key capabilities:

- Supports the exchange of information among all number portability processes across service providers, and provides a single central point of contact, allowing the use of a common protocol for initiating and responding to port requests. The common processes include the exchange of messages among participants, validation of these messages, and the notification of executed ports to all service providers.
- Maintains a reference database of mappings from directory number to routing number for all ported telephone numbers. The mappings are periodically broadcast and updated to all service providers as part of the number portability processes. Service providers may also, at any time, request data in order to synchronize their local routing database with the centralized reference database.

- Provides reports to the service providers and government agencies, including such information as porting history, and statistical summaries of ports initiated, ports completed, and ports rejected.

2.16.5 Recommendation:

- a. Mobile Operators shall adopt Centralised Clearing house preferably electronic processing approach for processing porting requests. Cost of such central clearing house shall be borne by all the operators in a similar way as in the case of establishing central database mentioned in para 2.13.5.**
- b. The administration of such clearing house shall also be by a neutral third party.**
- c. The design of clearing House should be such that total time to port should not exceed three working days initially but up gradable to much faster levels.**
- d. Any other operational and administrative aspects relating to centralized clearing house shall be worked out by steering committee.**

2.17 Entities handling porting Requests

2.17.1 Most mobile users deal exclusively with retail outlets in establishing their mobile service. Accordingly, Mobile number Portability request can be handled with the existing way through retailers.

2.18 Porting procedures

2.18.1 Authentication

2.18.1.1 An authentication procedure is usually built into porting processes to ensure that the person requesting that a number be ported is authorized to do so. The way in which this is implemented can have significant effects on the robustness of the porting process, how convenient it is to users, and how long it takes to complete.

2.18.1.2 The most important variables are:

- Whether authentication is performed via reference to account records, relies on some form of documentary evidence supplied by the person requesting the port (such as a bill), or uses some other technique;
- Who performs the authentication — whether a recipient network or donor network operator (one-stop shopping or two stop shopping)
- How communication between the various parties which are involved in authentication occurs — for example, electronically, by fax, or by letter;
- The level of trust between the various parties involved in a porting request, which itself may influence the need for an effective reversal procedure in the event that an unauthorized porting occurs.

2.19 Porting Process:- One –stop versus two-stop shopping process

2.19.1 One-stop shopping process

- The customer only needs to contact the recipient operator (new operator) and authorise this operator to handle the porting
- Number Portability porting process is very easy, simple, fast and safe for the end-user
- it is easy to end a customer relation with one operator and move to another operator
- operators tend to go out with heavy campaigns to attract new customers
- Increasingly used in most countries

2.19.2 Two-stop shopping process

The customer must take two steps in order to port his/her number/s:

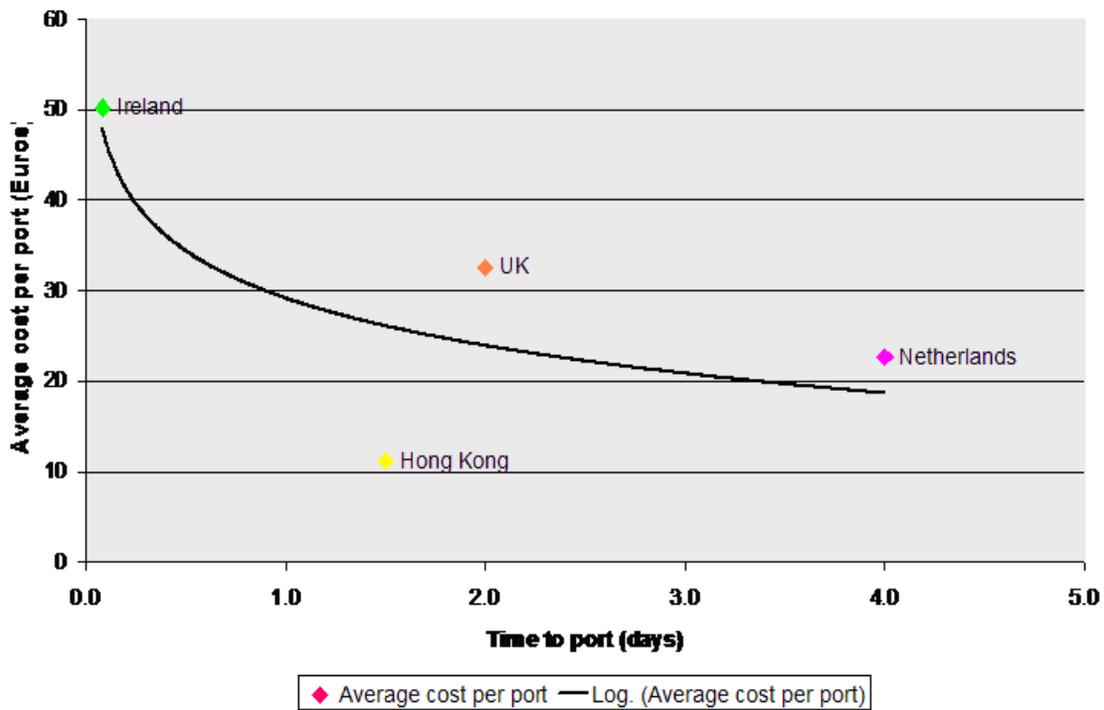
- 1st step: the customer request the existing mobile operator (i.e donor operator), the cancellation of his contract and an Porting Authorisation Code (PAC);
- 2nd step: the customers apply for new contract with the new operator (recipient operator) and ask him to port his number with the PAC

This process allows the donor to make an even better offer to the customer (Win-Back Situation)

Time to port:

2.19.3 A porting process that takes many days or weeks to port a number would become very lengthy compared with porting that takes minutes or. A lengthy porting period may discourage users from porting at all. A very short porting period, however, may allow insufficient time for proper checks at all stages of the porting process to avoid fraud and ensure proper completion of a port. It may also increase the costs of porting — for example, the costs associated with making a porting process available on a 24×7 basis, extra manpower to handle the requests etc.

The following graph indicates the cost relationship with increases of the time to port :



Source:Ovum

2.20.2 The majority of CEPT countries have instituted target periods within which porting of a number must be completed. There is enormous variation in the length of this period, which ranges from 2 hours to 30 days; the average target

period is 7-8 days. There is no discernible trend regarding the length of the target-porting period among CEPT countries, either towards the period becoming shorter or becoming longer. In fact, both the shortest and the longest target periods are in countries in which mobile number portability is currently in the planning stages.

2.20.3 Porting time of various CEPT countries are given below:

Country	Target maximum porting period
Austria	3 working days
Belgium	2 days ¹
Croatia	5 days
Cyprus	14 dyas ³
Estonia	7 working days
Finland	5 working days
France	30 days
Germany	4 working days + 2 further days
Hungary	14 working days
Iceland	10 days
Ireland	2 hours single line / 8 hours multi line ports
Italy	5 working days ¹
Lithuania	28 days
Malta	4 hours ²
Netherlands	10 working days
Norway	7 days
Portugal	5-20 working days
Slovenia	5 working days
Sweden	5 working days
Switzerland	5 working days ¹
United Kingdom	2 working days + 1 calendar week ²

1. Different period applies to complex ports
2. Different period applies to bulk ports
3. Practically is never more than 8 days.

Source: Electronic Communications Committee (ECC), within the European Conference of Postal and Telecommunications Administrations (CEPT), Mobile number Portability in CEPT countries updated October 2005

2.20.4 A comparative table of processes in various countries are given below:

Country	Porting process	Minimum number of customer interactions to port	Remarks on process
Australia	Via recipient	1	The porting process has been built to operate without manual intervention. The target is for 99% of ports to be processed within two days and 90% within 3 hours. In fact practice has fallen well short of these targets (especially the latter) and the ACA launched a public enquiry in December 2004.
Germany	Via recipient	1	The customer cannot terminate the contract with the donor operator for porting purposes except under the terms of the contract.
Hong Kong	Via recipient	1	No contact between the donor and the customer is permitted during the porting process.(subscriber approaches recipient operator for porting. On average, approximately 95% of porting requests per month are completed successfully.
Ireland	Via recipient	1	Electronic process with strict information requirements from the mobile service provider which reduces the number of unsuccessful porting applications.

Nether-lands	Via recipient	1	Fully automated electronic system. About 60% of porting requests are blocked due to invalid customer information
UK	Via donor	2	The porting process was originally faxed base with unsuccessful ports between 10-12% of requests. A new web based porting process in October 2001.

Authority considered that large porting time is a barrier for opting number portability. However very short porting time leads to increase in setup cost of such process.

Recommendation:

- 1. Authority is of the view that total time to port should not exceed three working days.**
- 2. Authority recommends that one stop shopping should be adopted in our country wherein customer approaches recipient operator.**
- 3. The donor operator shall not use ported out numbers till such time it is in use by the ported subscriber. After the surrendering of number by ported subscriber the number shall revert back to the original donor operator.**

2.21 Tariff Transparency:

2.21.1 It is important that Users should be able to predict the price of calls to mobile numbers. Mobile number portability may, however, potentially reduce tariff transparency for mobile users due to the price difference that commonly exists between on-net and off-net calls from mobile networks. This is because, in a mobile number portability environment, users lose the capacity to distinguish between on-net and off-net calls on the basis of the prefix of the number.

2.21.2 Methods followed in various countries to address the tariff transparency is given below:

- Voice based service indicating network to which specified number belongs
- SMS based service of the above

- Tariff information service in operator website or voice
- Audible warning for off-net calls

Recommendation: The Authority recommends that the method to be implemented for tariff transparency will be decided by the Steering Committee after due consultation and also considering the cost aspects of different solutions

2.22 National Numbering Plan and amendment to license agreement:

2.22.1 The national numbering plan envisages unique code for each operator thus identifying the operator. In a number portability environment operator code loses its significance and there is a necessity to assign a separate code to mobile operators. 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

2.22.2 As per license agreement each operator should adhere to National Numbering Plan. Currently, National Numbering Plan envisages Access codes, MSC codes and subscriber number for Mobile subscribers. Licensor allocates access codes and MSC codes to each operator based on their demand keeping in view of the area of operation. With introduction of Number Portability, operators are supposed to route calls to ported numbers based on the unique prefix attached to MSISDN. This prefix is a unique code of 2-3 characters with the ported number identifying the recipient operator to enable success routing of such calls. Therefore, it is essential to amend license conditions permitting operator to use unique codes.

2.22.3 It is also essential to state that donor operator should not use ported out numbers till such time it is in use by subscriber and information regarding the surrendering of that number.

2.22.4 Amendment of License of access providers:

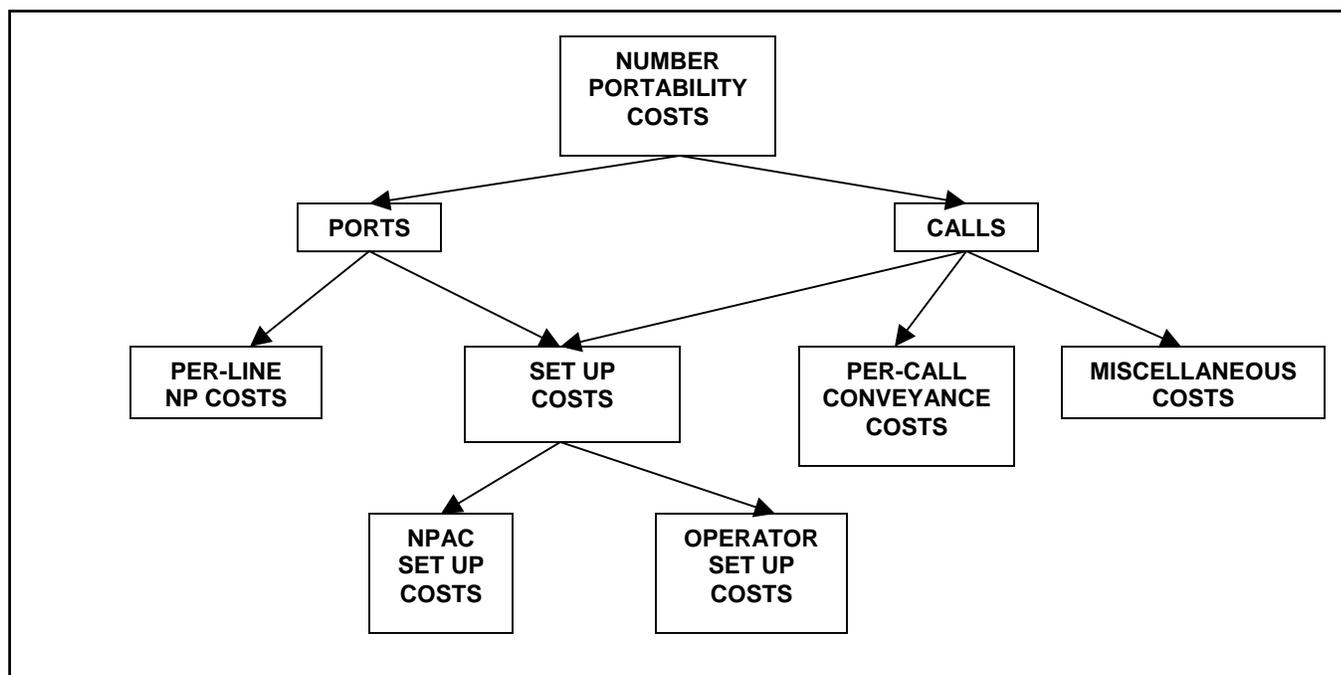
It is recommended that Licenses may be amended to enable the following:

- **Mandating Mobile Number Portability to all existing mobile operators in line with the recommendation.**
- **Provide Unique operator code to enable routing to ported numbers**
- **The donor operator shall not use ported out numbers till such time it is in use by the ported subscriber. After the surrendering of number by ported subscriber the number shall revert back to the original donor operator**
- **Provision may be made in the licence indicating TRAI shall issue regulation in this regard. Central Government may also consider entrusting the function of implementation of MNP to TRAI under section 11 (1) (d) of the TRAI Act**

Chapter 3. Economic issues

- 3.1 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. The costs associated with number portability and its provisioning may be broadly divided into three categories:
- a. **System set-up costs:** These may be the costs of establishing/maintaining routing databases, conditioning existing networks, upgrading network switches, and modifying existing software. These costs are to be incurred in establishing the capacity to provide number portability on its own network and in its associated operational support and administration.
 - b. **Administration costs:** These costs include cost of Number Portability Administration Center (NPAC) besides 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). This also includes the operating expenditure likely to be incurred on the number portability infrastructure.
 - c. **Call Conveyance costs:** This is the additional conveyance cost of calls for routing through donor network to ported numbers. In case of All Call Query this may not be significant except for small operators who may hire services of third party to get call routing data.

3.2 The NP Costing Model structure is as follows:



The flow of information through the model is as follows - Data flows from the bottom of the tree to the top – starting from the leaf-nodes, traversing through the nodes, up the branches to generate a final total cost associated with Number Portability.

The two main branches of the Number Portability Costing model are:

- Ports
- Calls

The essence of these branches follows from established Number Portability costing studies conducted in several countries by consultants and regulatory authorities. Number Portability involves two actions and their subsequent effects

and reactions. The two actions are in separate domains – one action is that of the actual number porting infrastructure required to support calls placed to ported numbers and the second action is that of the initial storage and subsequent notifications of the new routing information of a ported Customer.

It should be noted very clearly here that both these actions are neither complimentary nor inclusive in any sense. They are two different actions with totally different performance characteristics. That is the reason for keeping them in two different domains.

3.3 System Setup Cost:

3.3.1 As mentioned above, the system setup costs primarily consists of Capital expenditure involved in the up gradation of operators networks / switches so as to enable it to implement number portability. Therefore, the quantum of this cost will depend to a very large extent on the present status of the switches and networks of the service providers. In countries where number portability was introduced early, the up gradation cost of the network and the switches were comparatively high. In India the age of major part of present mobile network is about 1- 4 years, therefore it can be safely presumed that major part of the mobile networks would require minor up gradation for becoming number portability compliant. The system setup cost depends primarily on

- Technology option selected for NP
- Age of the switching equipment & network
- State of the switching equipment & network
- Age of the signaling equipment & network
- State of the signaling equipment & network
- Software systems in use & their upgrade ability

3.3.2 In a recent study done in UK in the year 2004, the total capital expenditure for implementing number portability with all call query option was estimated as about £106.6 Millions The number of subscribers in UK is 58,000,000. Costing table related to the study is enclosed at Annexure-C.

3.4 Costing model for MNP in India

3.4.1 In order to assess the system up gradation required by service provider for the implementation of MNP and to know their existing network configuration, a questionnaire was developed and forwarded to all service providers. Some of the service providers, viz –M/s Tata Teleservices, M/s BPL, M/s Spice, M/s Dishnet, M/s Reliance Infocomm and M/s HFCL have furnished their feed back on the above questionnaire. Based on their feedback and the following assumptions, the costing figure for implementation of MNP in India has been arrived:-

1. Large Operators in India averaged 4 MSCs within a Circle.
2. Smaller Operators averaged 2 MSCs within a Circle.
3. Large Operators averaged 80 MSCs nation wide.
4. Most of the Operators have SS7 signaling networks that are used for lookups, routing and call termination.
5. Most of the Operators have Service Control Points (SCPs) that are capable of handling large number of transactions per second.
6. Additional capital expenses will be required to add SS7 links and hardware.
7. Additional capital expenses will be required to add extra lines to existing switches.

3.5 Estimated System Set up costs of MNP in India

3.5.1 While making the cost assessment for implementing MNP, two categories of infrastructure owned by service providers have been identified. In the first category, those Operators who have SS7 signaling network infrastructure but no STP infrastructure in place and own/use SCP database on a regular basis. In the second category, those Operators who have SS7 signaling network infrastructure and own/use STPs on a regular basis. In India there are six mobile operators with more or less all India footprints and small operators having operations in service areas ranging from 1-7.

3.5.2 As per the feedback received it has been presumed that all the large and most of the minor operators are having all India SS7 networks with STP functionality for implementing number portability. These networks will have to only upgrade the switch, STP / SCP and associated software. Only 1-2 standalone operators who had got CMTS licenses in early stage of mobile service operation, may fall in the first category, rest of operators can be in second category:

- In the first category, Operator's network is equipped with signaling network infrastructure (SS7) and no STP infrastructure. In this category, regional MNP Database Administration Center & Single Circle expenses for an Operator would be incurred for the following
 - Procuring STP functionality
 - Upgrading and using own network and software to connect to NPAC for porting information; and
 - Upgrading and using own SS7 network for routing calls to the ported numbers based on porting information

- In the second category, Operator's network is equipped with signaling network infrastructure (SS7) and own/use STPs on a regular basis. Regional MNP Database Administration Center & Single Circle expenses for an Operator would be incurred for the following:-
 - Upgrading and using own network and software to connect to NPAC for porting information ; and
 - Upgrading and using own SS7 network for routing calls to the ported numbers based on porting information

3.6 Various elements considered for estimating the MNP cost by using "All Call Query " method are mentioned below:

- 3.6.1 **Operator Costs:** This gives an estimate of the costs that an Operator will have to incur for implementing number portability. Costs are based on USA/Europe prices. Indian prices may be substantially lower (40% lower so). Operators costs can be broadly categorized as Exchange/ Central office cost, Signaling Network Cost and software costs. The details of cost estimates of these components costs are enclosed at Annexure-D. In order to arrive at the setup cost of operators in India, cost have been calculated separately for small operators who do not have STP infrastructure and large operators having STP infrastructure but need some up gradation to incorporate MNP facility . It has been considered for estimation purpose that two small operators in two circles each (four licenses) and 13 large operators (129 licensees) will implement MNP in India. The total setup cost has been estimated for small operators is Rs.27.5 crore for each license area, however in case of large operators it is about Rs.12 .6 crore. Detailed calculations are enclosed at Annexure-E.
- 3.6.2 SS7 over IP provides an alternate solution over legacy TDM platforms for providing high speed links. SS7 over IP offers dramatic cost savings for carriers. In order to accommodate escalating data growth while reducing operational and capital costs on SS7 overlay networks, operators have two options. They can either add new, very costly links based on legacy TDM platforms or move SS7 traffic to IP networks using SS7 over IP. This solution eliminates the need to upgrade expensive and specialized signaling transfer points (STP). The benefits of SS7 over IP include reduced infrastructure costs, enhanced efficiency and new opportunities to deploy revenue generating applications and services. The costing table given at Annexure-F indicates, SS7 over IP is cost effective solution, which is now proven as mature, reliable, standards based signaling technology. In this approach estimated setup cost for small operator and large operator comes out to be Rs.13.5 crore and Rs.12.1 crore respectively for each license.

3.7 Administrative Costs

3.7.1 Number Portability Administration Center Costs: Number Portability Administration Center (NPAC) can be setup with physically separate but logically integrated regional number ports databases (say 5 regions) interconnecting to Carriers, Service Providers, Operators and Service bureaus (Clearing Houses) for providing information about ported numbers and also interfaces to address and resolve all issues arising out of Number Portability.

The estimated costs of setting up Number Portability Administration Center include cost of hardware (servers), redundant database software in a fail safe redundant mode, backup software system, setting up the network infrastructure – equipment, cables and POIs. The costs will also depend on establishing high-speed links (say E1 or ISDN) between the Operators and the Administration Center and cost of software for deployment and licensing for each Number Portability Administration Center region. Besides above, the costs of land, buildings, interiors, exteriors are also to be included under the NPAC cost. The above costs are dependant on a number of factors, some of which are:

- o whether all the 5 regions will be collocated in the same location
- o whether backup systems will be collocated in the same location
- o cities in which these Centers will be located

The cost of setting up of such one regional NPAC is estimated Rs.9.49 crores. In order to set up NPAC at all the 5 regions the cost would be Rs.47.45 crores. This NPAC implementation cost per operator per licensed area would be only around 36 lakhs The detailed table of estimation is at Annexure-G

3.8 If the NPAC is also borne by all the operators then, the cost to the operators for implementing MNP nationwide would be Rs. 27.9 crore and Rs. 13.4 crore for small and large operator per license area-wise respectively. If the same is implemented through SS7 over IP infrastructure the expenditure involved is reduced to Rs.13.9 crore and 12.5 crore respectively. As mentioned earlier, these costs are based on the assumptions that small operator would additionally incur STP infrastructure cost. In case, they already possess this infrastructure the MNP cost to them will be much lower than the above estimated figure.

3.9 Estimated Operational Costs of NP

3.9.1 The operating expenditure (opex) likely to be incurred on the items is given below-

- **Network Operating Expenditure:** The major item of network operating expense will depend on the capacity and other characteristics of the platform required of the intelligent network and the nature of the support contract with the IN vendor. Costs vary from 5% to 25% of the total IN capital costs payable per annum. It is felt that **10%** of cumulative IN capex is a reasonable figure to use for IN support.
- **Porting Process (Operator-side):** It is felt that in the long term, there would be no obvious increase or decrease in the number of staff required to Mobile Number Portability with a centralized database solution. Even if Operators faced such an expenditure, the costs would be somewhere in the range of 0% to 2%. However, zero incremental cost has been assumed for ongoing process support.
- **Porting Service Charge:** These are costs incurred by all those smaller Operators who rely on Service Bureaus/Clearing

Houses/3rd Party for number port request transactions with the centralized number port database administration center. One way of recovering these porting service charges is a tariff structure in which recipient operators pay a fee per number ported to cover the administrative costs of porting the number; another way of recovering these charges is by levying a flat tariff on all subscribers equally and in small monthly installments.

- **Additional Conveyance Costs:** These are costs incurred by all those smaller Operators who rely on Service Bureaus/Clearing Houses/3rd Party for per call routing “dips” to get call routing data (use someone else’s SS7 network and pay them).

As already discussed there are three main cost components- setup cost, Administrative and operational cost. The issue of these costs 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 be a regulatory decision or a decision taken by individual operators.

3.10 Cost recovery

In order to calculate the operator’s cash flow for small and large operator in a Circle the following assumptions have been made:

- Discount factor of 7% per annum to determine the Present Values and Net Present Values.
- For a Smaller Operator 1% of total market share in wishing to setup a SS7 network of new STP/SCPs & NGN network.
- For a Larger Operator 15% or lesser market share wishing to upgrade SS7 network & equipment& NGN network.

- Total Subscriber base of 150 million is considered by the time MNP will be implemented
- Operating expense is assumed as 10% of capital expense
- Large operator is presumed to have operations in 15 circles
- 10% porting subscriber every year has been considered. (Based on average 6% per month churn of the subscriber)

Following two models for the recovery of cost has been assumed:

- 1) Rs.200 as a one time charge only be taken from ported customers only. In this model, instead of charging from the subscriber, either the whole amount or a part can be charged from the recipient operator as subscriber acquisition charge. Details of estimation are enclosed at Annexure -H
- 2) Rs. 300 as one time charge only be taken from ported customers. In this model also instead of charging from the subscriber, either the whole amount or a part can be charged from the recipient operator as subscriber acquisition charge. Details of estimation are enclosed at Annexure -I

3.11 Administrative Costs in other countries:

3.11.1 The allocation of administration and operational 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.
- In Switzerland, transport 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 transport. As the United Kingdom uses SRF, originating networks have no extra costs. The United Kingdom has allocated these costs to the recipient party. In the United Kingdom, 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.

- 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: 5 - 6 US\$ per month. As a result of the monthly charge, the number of customers who have ported is low.
- The study report for Sweden proposes to allocate these costs to the recipient operator. But the Swedish regulator acknowledges that allowing recovery of extra transport costs from the recipient operator may be inhibiting MNP.
- In Hong Kong, the mobile operators are expected to bear their own transport 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.

3.11.2 Based on the information available, the actual cost of a single port of a mobile number in the CEPT countries in which mobile number portability is implemented, ranges from 5,30 € up to 29 €.

Actual administrative costs per port

Country	Year of implementation	Original announced costs	Costs in Euros
Belgium	Sep 2002	Simple port 3,86 € Complex port 23,41 € Average 11,50 €	11,50 €
Croatia)	Oct 2005	5,30 € (recipient pays donor operator)	5,30 €
Cyprus	Jul 2004	5,52 CYP	9,7 €
Denmark	Jul 2001	72 DKK	9,65 €

		(tax excluded)	
Estonia	Jan 2005	Not available	—
Finland	Jul 2003	10 €	(about) 10 €
France	Jun 2003	15,20 €	15,20 €
Germany	Nov 2002	22,50 – 29,95 € Average 26 €	26 €
Ireland	Oct 2005	20 €	20 €
Italy	Apr 2002	10,02 €	10,02 €
Lithuania	Jan 2004	No fee	—
Netherlands €	Apr 1999	23,89 €	23,89 €
Norway	Nov 2001	10 €	10 €
Portugal	Jan 2002	15 €	15 €
Spain	Oct 2000	No fee	—
Sweden	Sep 2001	36 SEK	3,84 €
Switzerland	Mar 2000	29 CHF	18,62 €
United Kingdom	Jan 1999	20 GBP (Estimated, 1997 figure)	29,04 €

Source: Electronic Communications Committee (ECC), within the European Conference of Postal and Telecommunications Administrations (CEPT), Mobile number Portability in CEPT countries updated October 2005

3.11.3 In virtually all CEPT countries, the administrative costs associated with porting a number are attributed to the recipient network. It is likely that this charge will be waived for many or most ports in order not to discourage the user from switching to the recipient's network.

3.11.4 The fee charged from users for porting a mobile number among CEPT countries for which information is available ranges from 0 € up to 43,55 €; the average charge is 8,38 €. The following table gives the porting charges in CEPT countries:

Country	Original announced charges	Charges in Euros (rates from 3 rd Aug 2005)
Austria	19 Euro	19
Belgium	No fee	-
Croatia	No fee	-
Cyprus	No fee	-
Denmark	No fee	-
Estonia	No fee	-

Finland	No fee	-
Hungary	No fee	-
Ireland	No fee	-
Italy	10 Euro	10
Lithuania	No fee	-
Netherlands	9.08 Euro	9.08
Norway	About 85 NOK	10,82
Portugal	40 Euro	40
Slovenia	10 Euro	10
Switzerland	No fee	-
United Kingdom	Upto 30 GBP	43,55

Source: Electronic Communications Committee (ECC), within the European Conference of Postal and Telecommunications Administrations (CEPT), Mobile number Portability in CEPT countries updated October 2005

3.11.5 Allowing the donor network operator to charge the user for the costs of a port may require the necessity of regulating this charge. If the charge is not regulated, it is possible for the donor network operator to inflate it in order to discourage users from switching to a competitor's network. In view of this, it may be necessary either to regulate the charges levied by donor operator or waive the same. Considering the above aspects, Authority recommends that the donor and recipient operators should enter into commercial agreement failing which the charges levied by the donor operator would be waived.

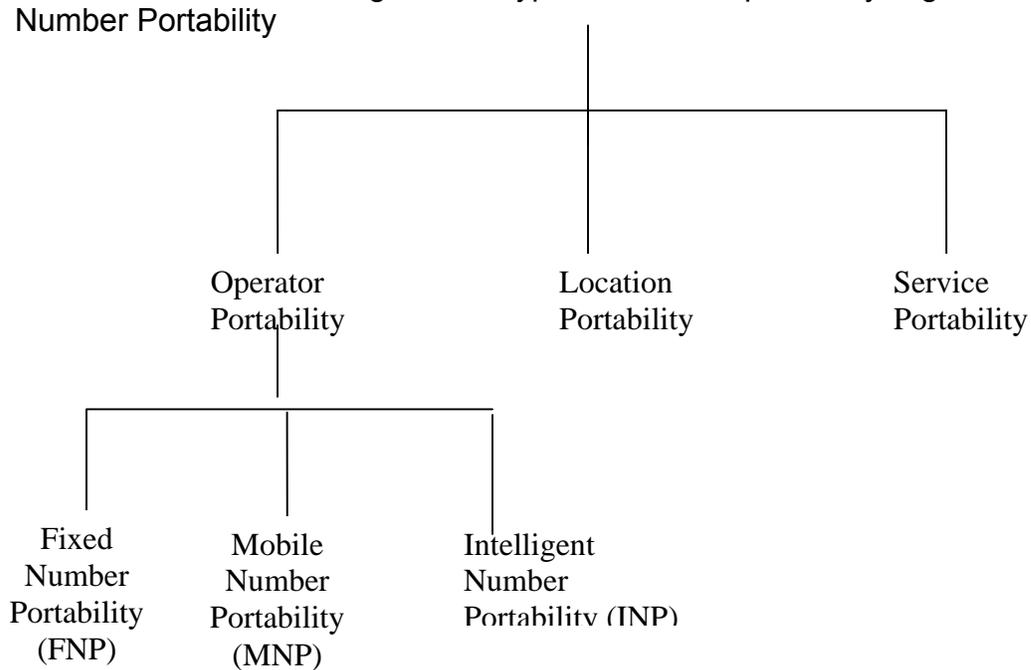
3.11.6 Regarding cost in respect of establishment of infrastructure and operational costs of MNP, the Authority is of the view that Operators have to bear the up-gradation cost of their network by themselves whereas common costs involved with the setting of NPAC and Clearing House required for implementation of MNP will have to apportion among themselves. However, the operational cost would be borne by the benefited constituents through mutual understanding, commercial agreements or service level agreements. If operators fail to do so TRAI may intervene to provide guidelines on the same. Further, in respect of porting charges, Recipient operator may be permitted to charge a fee for successful porting.

Recommendation : In view of the above Authority recommends the following:

- I. The up-gradation cost of their network will be borne by themselves**
- II. Common setup costs would be borne by operators based on the subscriber market share of operators as on 1st Jan 2007.**
- III. In respect of porting charges, only Recipient operator shall be permitted to charge a fee for successful porting.**

Categories of Number Portability

A schematic view showing various types of number portability is given below:



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:

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

Mobile Number Portability (MNP) is the portability of mobile telephone numbers. Intelligent Number Portability (INP) is the portability of non-geographic Intelligent Network (IN) number.

Comparison of Number Portability Types:

Item	Geographic PSTN Individual Nos. (FNP)	Non-geographic (INP)	Mobile (MNP)
Cost of portability	High	Medium	Medium
Availability to customers	Limited by roll out of private operators	Limited by roll out of private operators	Unlimited
Requires	New entrant to rollout fixed lines	New entrant to have wide coverage	(Ready now)
Requirement and its timing	Presence of new entrant operator significantly	Coverage of network competitor comparable to incumbent	As soon as possible

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.

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 on the routing and billing depending on the new location of the number. TRAI did not come across any current implementation of location portability and it is generally considered a futuristic arrangement

Unless combined with other types of portability such as service or operator portability, it remains an internal network operator issue³. 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.

Service Portability

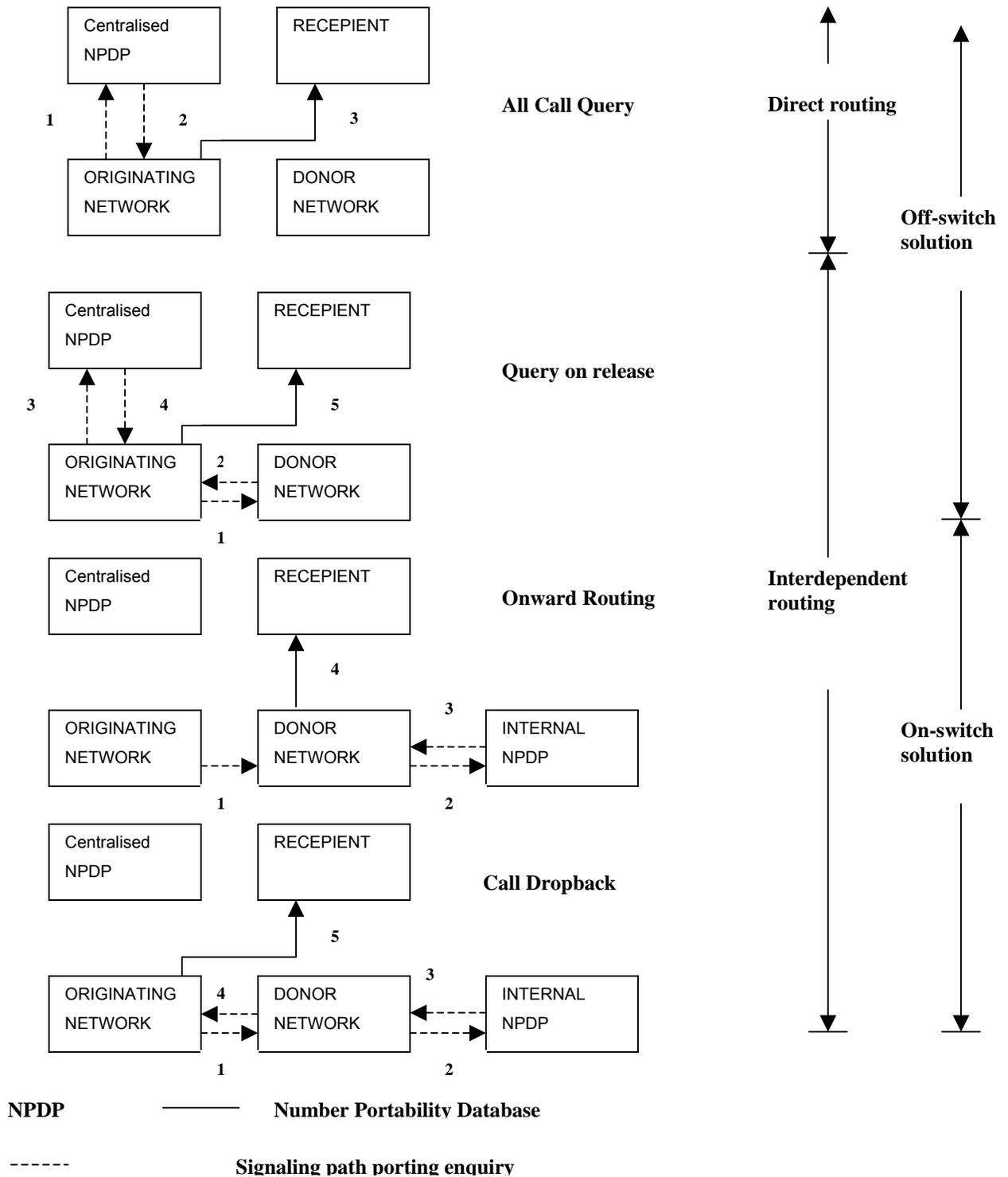
Service Portability is the ability of a subscriber to retain the existing telephone number when changing from one service to another service, say from fixed to mobile services.

As per the present National Numbering Plan, the numbering for fixed phones is SDCA based whereas mobile numbers are circle based. Therefore, it may not be feasible at the present stage to implement it. Therefore, the Authority is of the view that this portability may not be considered at this stage.

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

Annexure-B

A schematic summary of technical solutions are given below:



Annexure-C

Cost Estimate for Implementation of MNP in UK

All figures are in Pound Sterlings.

£ million	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
capex	53.3	53.3	-	-	-	-	-	-	-	-
opex	-	1.8	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
Cash Flow	(53.3)	(108.5)	(112.1)	6.6	8.2	9.8	11.5	13.1	14.8	16.4
Cash Flow (PV)	(53.3)	(101.4)	(97.9)	5.4	6.3	7.0	7.6	8.2	8.6	8.9
NPV	(53.3)	(154.7)	(252.6)	(247.2)	(241.0)	(234.0)	(226.3)	(218.2)	(209.6)	(200.6)

Annexure-D

Exchanges /Central Office Costs: . These costs involve for upgrading both hardware and software in the existing switches, Hardware upgrade costs involve adding additional line cards, additional interface cards, database modifications etc. required for making a switch NP-Query capable. It is assumed that Operators having a STP in their SS7 signaling networks will have lower upgrade costs.

Software upgrade costs fall into two categories – basic up gradation and license costs. Software licensing is one of the hidden costs of a switch.

Additional signaling network and circuits would be the incremental costs, as new circuits would be needed between switches and the SS7 network. These costs would be halved, if there are existing circuits between switches and STP/SCPs. The following table indicates the estimate cost of various components:

Switching Network Costs

Component	Actual Costs	Estimated Upgradation cost for Number Portability
MSC/Switch	2,500,000 ^e	500,000 ^f
Software on Switch	1,000,000 ^g	200,000 ^h
Software Licensing		200,000 ⁱ
Additional Signaling Circuits	200,000 ^j	100,000 ^k

(e) (g) (j) Source: European document "2001_mobilecosts_final.pdf" Page 97

(f) (h) Estimated at 20% of Actual Costs

(i) One of the "hidden" costs (unsubstantiated)

(k) Costs could rise as high as 50% of existing signaling circuit costs (unsubstantiated)

Signaling Network Costs:

These include cost of new/additional STP/SCP system, cost for upgrading existing STP/SCP, and additional signaling costs.

New/additional STP/SCP system cost is for establishing required STP/SCPs to support Number Portability database and has all the circuits required for extremely fast lookups of the correct routing data required for proper termination of a call. The cost of a STP/SCP combination depends on a number of parameters, some of which are - the number of switches that are connected to a STP/SCP, number of SS7 messages, size of SS7 messages, traffic density etc.

The cost for upgrading an existing SS7 network with an addition of a Number Portability SCP database and modifying the existing equipment to support Number Portability are estimated at about 20% of the Actual Original Equipment Costs.

The cost for either establishing or upgrading circuits for a SS7 network depends on a number of parameters such as – TCAP traffic per switch, number of switches connected to the STP/SCP, type of link (for link rate) etc. Annexure-D refers the list of various parameters taken into account for arriving at the STP requirement.

It must be noted here that network circuits contribute to as much as 65% of the total network establishment costs. An E3 circuit will be more expensive than an E1 circuit, which in turn will be more expensive than an ISDN line. Cable lengths will add to the cost. Operators will have to work out the benefits of regional STPs versus a national STP mated pair.

SS7 Network Costs

Component	Actual Costs ^l	Estimated Up gradation cost for Number Portability
STP	1,500,000 ⁿ	300,000
SCP	1,000,000	200,000
Software Licensing	100,000	100,000
Additional Signaling Circuits	1,000,000	200,000

(l) Source: USA Docs "nlmp.pdf" Page 18

(m) Estimated as 20% of the Actual Costs

(n) Costs of a STP depend upon the number of Translation cards, Signaling link line cards, protocols supported. Typically around \$1,600,000 including the Service Management System software

Software costs:

These software costs are for changing and modifying the software at the Operational Support Systems that will drive and implement Number Portability for an Operator. These will include software that may be required for porting order requests/responses between Operators; software that will be required for number port creates/receives between Operators and the Number Portability Administration Center; any changes in the existing Order Management or CRM systems, Billing system for lookup, routing and other costs from a SS7 based database (SCPs), new Charging Data Records retrieval, any other software costs incurred towards existing SS7 network software etc. These costs would also cover the implementation of a Service management System that will ensure receipt of the Number Portability Administration Center notifications (with new routing data) for Circle/Regions of interest, provision this data (i.e download it to the STP/SCP NP database) and perform routine audit functions. Table given below gives the cost of software.

Software Costs

Component	Estimated Up gradation cost for Number Portability
Software Costs	1,500,000

(p) Source: Internal

Annexure-E

Details of Setup Costs (All Call Query) for Implementation of MNP

Operator Costs			<i>Region/Circle wide: Operators with existing SS7 signaling systems and no STP/SCP infrastructure(5 regional databases) (A)</i>	<i>Region/Circle wide: Operators with existing SS7 signaling systems and core STP/SCP infrastructure(5 regional databases) (B)</i>
1	Exchanges /Central Office Costs			
1.1	Switch Upgrade Costs	Operator Setup Costs	\$500,000.00	\$250,000.00
1.2	Software upgrade costs	Operator Setup Costs	\$400,000.00	\$200,000.00
1.3	Additional costs incurred for new circuits, interconnections etc.	Operator Setup Costs	\$100,000.00	\$50,000.00
2	Signaling Network Costs			
2.1	New/additional STP/SCP system cost	Operator Setup Costs	\$2,600,000.00	
2.2	Existing STP/SCP Upgradation costs	Operator Setup Costs		\$600,000.00
2.3	Additional signaling costs (including additional circuits, interconnection charges etc.)	Operator Setup Costs	\$1,000,000.00	\$200,000.00
3	Software costs			
3.1	Changes in Order management systems, Provisioning	Operator & Call Setup Costs	\$500,000.00	\$500,000.00
3.2	Changes in Billing systems	Operator Setup Costs	\$500,000.00	\$500,000.00
3.3	Additional Software Charges (database updation etc.)	Operator Setup Costs	\$500,000.00	\$500,000.00
4	Hardware costs US\$ (1.1+1.2+1.3+2.3)		2,000,000.00	1,300,000.00
5	Software Costs US\$(3.1+3.2+3.3)		1,500,000.00	1,500,000.00

6	STP/SCP cost US\$ (2.1)	2,600,000.00	
	Total setup cost per circle per operatorUS\$	6,100,000.00	2,800,000.00
	Rupees in crores	27.5	12.6
7	No. of Licenses	4	129
8	No. of Operators	2	13
9	Total Hardware costs US\$ (4 x 7)	8,000,000.00	167,700,000.00
10	Total Software costs US\$ (5 x 8)	3,000,000.00	19,500,000.00
11	Total SCP/STP costs US\$ (6x 7)	10,400,000.00	
12	Total cost US\$ (9+10+11)	21,400,000.00	187,200,000.00
13	Rupees in Crores	96.3	842.4
14	Setup costs Nationwide US\$ (Total Cost of A+Total Cost of B)	208,600,000.00	
	Setup costs Nationwide (Rs) in Crores	938.7	
	1 operators have operations in 23 circles, 2 operators in 21 circles, one in 20 circles, one in 16 circles,one in 8 circles, two in 7 circles, three in 2 circles, and four in 1 circle .		

Annexure-F

Setup Costs (All Call Query) using SS7 over IP

Cost Estimate of Setup Costs for Implementation of MNP (All Call Query) in India using SS7 over IP (NGN)				
Operator Costs			<i>Region/Circle wide: Operators with existing SS7 signaling systems and no STP/SCP infrastructure</i>	<i>Region/Circle wide: Operators with existing SS7 signaling systems and core STP/SCP infrastructure</i>
1	Exchanges /Central Office Costs			
1.1	Switch Upgrade Costs	Operator Setup Costs	\$125,000.00	\$62,500.00
1.2	Software upgrade costs	Operator Setup Costs	\$100,000.00	\$50,000.00
1.3	Additional costs incurred for new circuits, interconnections etc.	Operator Setup Costs	\$25,000.00	\$25,000.00
2	Signaling Network Costs			
2.1	New/additional STP/SCP system cost	Operator Setup Costs	\$1,000,000.00	
2.2	Existing STP/SCP Upgradation costs	Operator Setup Costs		\$10,000.00
2.3	Additional signaling costs (including additional circuits, interconnection charges etc.)	Operator Setup Costs	\$250,000.00	\$50,000.00
3	Software costs			
3.1	Changes in Order management systems, Provisioning	Operator & Call Setup Costs	\$500,000.00	\$500,000.00
3.2	Changes in billing systems	Operator Setup Costs	\$500,000.00	\$500,000.00
3.3	Additional Software Charges (database updation etc.)	Operator Setup Costs	\$500,000.00	\$500,000.00
4	Hardware costs US\$ (1.1+1.2+1.3+2.2+2.3)		500,000.00	1,197,500.00
5	Software Costs US\$(3.1+3.2+3.3)		1,500,000.00	1,500,000.00
6	STP/SCP cost US\$ (2.1)		1,000,000.00	
	Total setup cost per circle per operatorUS\$		3,000,000.00	2,697,500.00
	Rupees in crores		13.5	12.1

7	No. of Licenses	4	129
8	No. of Operators	2	13
9	Total Hardware costs US\$ (4 x 7)	2,000,000.00	154,477,500.00
10	Total Software costs US\$ (5 x 8)	3,000,000.00	19,500,000.00
11	Total SCP/STP costs US\$ (6x 7)	4,000,000.00	
12	Total cost US\$ (9+10+11)	9,000,000.00	173,977,500.00
13	Rupees in Crores	40.50	782.90
14	Setup costs Nationwide US\$ (Total Cost of A+Total Cost of B)	182,977,500.00	
15	Setup costs Nationwide (Rs) in Crores	823.40	
1 operators have operations in 23 circles, 2 operators in 21 circles, one in 20 circles, one in 16 circles, one in 8 circles, two in 7 circles, three in 2 circles, and four in 1 circle.			

Annexure-G

Details of Number Portability Administration Centre (NPAC) Costs using All Call Query				
	MNP Database Administration Center Costs			
	NPAC System Costs			
	Hardware Costs (6 IBM Blade Servers)	NAPC Setup Costs	\$120,000.00	
	SunFire 4800/RAID 5 Regional redundant databases	NAPC Setup Costs	\$100,000.00	
	Veritas Backup System	NAPC Setup Costs		\$20,000.00
	Network equipment (Firewall, Routers, Switches etc.) and Circuits for interconnections	NAPC Setup Costs		\$30,000.00
	Test Center Setup Costs	NAPC Setup Costs		\$40,000.00
	Software Costs	NAPC Setup Costs		\$1,000,000.00
	NPAC Administration Costs			
	Infrastructure (Land, Building etc.)	NAPC Setup Costs		\$500,000.00
	Interiors	NAPC Setup Costs		\$250,000.00
	Utilities	NAPC Setup Costs		\$50,000.00
	Total NPAC COSTS			\$2,110,000.00
	Total NPAC COSTS (Rs.) in Crores			9.49
	Costs for 5 Regional NPAC in crores			47.45

Annexure H

Model-1-Rental Model(Rs.200 from ported subscribers):

For Small operator– SS7 infrastructure:

- Operating Income:=Number of porting subscribers (i.e 10% (1% of 150,000,000 = 1,500,000)) x one time rental of Rs200=Rs 3.00 crore
- Operating Income per circle=3/2=Rs.1.5 crore
- Incremental Operating income = Operating income of the previous year x 1.5
- Capital expenditure incurred =Rs 27.5 Crore
- Operating Expenses=10% of the Capital expenditure= 10% of 27.5= Rs 2.75 crore
- Incremental Operating Expenses = Operating expenses of previous year x 1.1

Rupees in crores	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Operating Income		1.50	2.25	3.38	5.06	7.59	11.39	17.09	25.63	38.44
Operating Expense	2.75	3.03	3.33	3.66	4.03	4.43	4.87	5.36	5.89	6.48
EBITDA	-2.75	-1.53	-1.08	-0.29	1.04	3.16	6.52	11.73	19.73	31.96
Capital Expense	13.75	13.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cash Flow	-16.50	-15.28	-1.08	-0.29	1.04	3.16	6.52	11.73	19.73	31.96
NPV	-15.42	-28.76	-29.64	-29.86	-29.12	-27.01	-22.95	-16.13	-5.39	10.85

NPV-Net Present Value at the beginning of first financial year

For Small operator–SS7 over IP infrastructure:

- Operating Income:=Number of porting subscribers (i.e 10% (1% of 150,000,000 = 1,500,000)) x one time rental of Rs200=Rs 3.00 crore
- Operating Income per circle=3/2=Rs.1.5 crore
- Incremental Operating income = Operating income of the previous year x 1.5
- Capital expenditure incurred =Rs 12.1 Crore
- Operating Expenses=10% of the Capital expenditure= 10% of 12.1= Rs 1.21 crore
- Incremental Operating Expenses = Operating expenses of previous year x 1.1

Rupees in crores	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Operating Income		1.50	2.10	2.94	4.12	5.76	8.07	11.29	15.81	22.14
Operating Expense	1.35	1.49	1.63	1.80	1.98	2.17	2.39	2.63	2.89	3.18
EBITDA	-1.35	0.01	0.47	1.14	2.14	3.59	5.68	8.66	12.92	18.95
Capital Expense	6.75	6.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cash Flow	-8.10	-6.74	0.47	1.14	2.14	3.59	5.68	8.66	12.92	18.95
NPV	-7.57	-13.45	-13.07	-12.20	-10.67	-8.28	-4.75	0.29	7.32	16.96

NPV-Net Present Value at the beginning of first financial year

For Large operator– SS7 infrastructure:

- Operating Income:=Number of subscribers (i.e 10% of (15% of 150,000,000 = 22,500,000)) x one time rental of Rs200=Rs 45.00 crore
- Operating income per circle=45/15=Rs. 3 crore
- Incremental Operating income = Operating income of the previous year x 1.5
- Capital expenditure incurred =Rs 12.6 Crore
- Operating Expenses=10% of the Capital expenditure= 10% of 24.4= Rs 1.26 crore
- Incremental Operating Expenses = Operating expenses of previous year x 1.1

Rupees in crores	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Operating Income		3.00	4.50	6.75	10.13	15.19	22.78	34.17	51.26	76.89
Operating Expense	1.26	1.39	1.52	1.68	1.84	2.03	2.23	2.46	2.70	2.97
EBITDA	-1.26	1.61	2.98	5.07	8.28	13.16	20.55	31.72	48.56	73.92
Capital Expense	6.30	6.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cash Flow	-7.56	-4.69	2.98	5.07	8.28	13.16	20.55	31.72	48.56	73.92
NPV	-7.07	-11.16	-8.73	-4.86	1.04	9.81	22.61	41.07	67.48	105.06

NPV-Net Present Value at the beginning of first financial year

For Large operator– SS7 over IP infrastructure:

- Operating Income:=Number of subscribers (i.e 10% of (15% of 150,000,000 = 22,500,000)) x one time rental of Rs200=Rs 45.00 crore
- Operating income per circle=45/15=Rs. 3 crore
- Incremental Operating income = Operating income of the previous year x 1.5
- Capital expenditure incurred =Rs 12.1 Crore
- Operating Expenses=10% of the Capital expenditure= 10% of 12.1= Rs 1.21 crore
- Incremental Operating Expenses = Operating expenses of previous year x 1.1

Rupees in crores	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Operating Income		3.00	4.50	6.75	10.13	15.19	22.78	34.17	51.26	76.89
Operating Expense	1.21	1.33	1.46	1.61	1.77	1.95	2.14	2.36	2.59	2.85
EBITDA	-1.21	1.67	3.04	5.14	8.35	13.24	20.64	31.81	48.66	74.03
Capital Expense	6.05	6.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cash Flow	-7.26	-4.38	3.04	5.14	8.35	13.24	20.64	31.81	48.66	74.03
NPV	-6.79	-10.61	-8.13	-4.21	1.74	10.56	23.42	41.93	68.40	106.04

NPV-Net Present Value at the beginning of first financial year

Annexure I

Model-2-Rental Model(Rs.300 from ported subscribers):

For Small operator– SS7 infrastructure:

- Operating Income:=Number of porting subscribers (i.e 10% (1% of 150,000,000 = 1,500,000)) x one time rental of Rs300=Rs 4.5 crore
- Operating Income per circle=4.5/2=Rs.2.25 crore
- Incremental Operating income = Operating income of the previous year x 1.5
- Capital expenditure incurred =Rs 27.5 Crore
- Operating Expenses=10% of the Capital expenditure= 10% of 27.5= Rs 2.75 crore
- Incremental Operating Expenses = Operating expenses of previous year x 1.1

Rupees in crores	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Operating Income		2.25	3.38	5.06	7.59	11.39	17.09	25.63	38.44	57.67
Operating Expense	2.75	3.03	3.33	3.66	4.03	4.43	4.87	5.36	5.89	6.48
EBITDA	-2.75	-0.78	0.05	1.40	3.57	6.96	12.21	20.27	32.55	51.18
Capital Expense	13.75	13.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cash Flow	-16.50	-14.53	0.05	1.40	3.57	6.96	12.21	20.27	32.55	51.18
NPV	-15.42	-28.11	-28.07	-27.00	-24.46	-19.82	-12.21	-0.41	17.29	43.31

NPV-Net Present Value at the beginning of first financial year

For Small operator–SS7 over IP infrastructure:

- Operating Income:=Number of porting subscribers (i.e 10% (1% of 150,000,000 = 1,500,000)) x one time rental of Rs300=Rs 3.00 crore
- Operating Income per circle=4.5/2=Rs.2.25 crore
- Incremental Operating income = Operating income of the previous year x 1.5
- Capital expenditure incurred =Rs 12.1 Crore
- Operating Expenses=10% of the Capital expenditure= 10% of 12.1= Rs 1.21 crore
- Incremental Operating Expenses = Operating expenses of previous year x 1.1

Rupees in crores	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Operating Income		2.25	3.15	4.41	6.17	8.64	12.10	16.94	23.72	33.21
Operating Expense	1.35	1.49	1.63	1.80	1.98	2.17	2.39	2.63	2.89	3.18
EBITDA	-1.35	0.77	1.52	2.61	4.20	6.47	9.71	14.31	20.82	30.02
Capital Expense	6.75	6.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cash Flow	-8.10	-5.99	1.52	2.61	4.20	6.47	9.71	14.31	20.82	30.02
NPV	-7.57	-12.80	-11.56	-9.57	-6.57	-2.26	3.78	12.11	23.44	38.70

NPV-Net Present Value at the beginning of first financial year

For Large operator– SS7 infrastructure:

- Operating Income:=Number of subscribers (i.e 10% of (15% of 150,000,000 = 22,500,000)) x one time rental of Rs300=Rs 67.5 crore
- Operating income per circle=67.5/15=Rs. 4.5 crore
- Incremental Operating income = Operating income of the previous year x 1.5
- Capital expenditure incurred =Rs 12.6 Crore
- Operating Expenses=10% of the Capital expenditure= 10% of 12.6= Rs 1.26 crore
- Incremental Operating Expenses = Operating expenses of previous year x 1.1

Rupees in crores	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Operating Income		4.50	6.75	10.13	15.19	22.78	34.17	51.26	76.89	115.33
Operating Expense	1.26	1.39	1.52	1.68	1.84	2.03	2.23	2.46	2.70	2.97
EBITDA	-1.26	3.11	5.23	8.45	13.34	20.75	31.94	48.80	74.19	112.36
Capital Expense	6.30	6.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cash Flow	-7.56	-3.19	5.23	8.45	13.34	20.75	31.94	48.80	74.19	112.36
NPV	-7.07	-9.85	-5.58	0.86	10.38	24.20	44.09	72.50	112.85	169.97

NPV-Net Present Value at the beginning of first financial year

For Large operator– SS7 over IP infrastructure:

- Operating Income:=Number of subscribers (i.e 10% of (15% of 150,000,000 = 22,500,000)) x one time rental of Rs200=Rs 67.5 crore
- Operating income per circle=67.5/15=Rs. 4.5 crore
- Incremental Operating income = Operating income of the previous year x 1.5
- Capital expenditure incurred =Rs 12.1 Crore
- Operating Expenses=10% of the Capital expenditure= 10% of 12.1= Rs 1.21 crore
- Incremental Operating Expenses = Operating expenses of previous year x 1.1

Rupees in crores	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Operating Income		4.50	6.75	10.13	15.19	22.78	34.17	51.26	76.89	115.33
Operating Expense	1.21	1.33	1.46	1.61	1.77	1.95	2.14	2.36	2.59	2.85
EBITDA	-1.21	3.17	5.29	8.51	13.42	20.83	32.03	48.90	74.29	112.48
Capital Expense	6.05	6.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cash Flow	-7.26	-2.88	5.29	8.51	13.42	20.83	32.03	48.90	74.29	112.48
NPV	-6.79	-9.30	-4.99	1.51	11.07	24.96	44.90	73.36	113.77	170.95

NPV-Net Present Value at the beginning of first financial year