

INFO-COMMUNICATION DEVELOPMENT AUTHORITY OF SINGAPORE

**PUBLIC CONSULTATION ON
THE REVIEW OF NUMBER PORTABILITY IN SINGAPORE**

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REVIEW OF NUMBER PORTABILITY IN SINGAPORE

PART I

OBJECTIVE

1. IDA intends to review the implementation of number portability for fixed line and mobile telecommunications services in Singapore. The review is in line with IDA's policy objectives of promoting competition in the information communications sector to the benefit of consumers and businesses in Singapore.
2. This public consultation paper seeks to obtain views from the industry and members of the public on the following:
 - (i) The existing implementation of number portability for both fixed line and mobile telecommunication services in Singapore; and
 - (ii) The proposed approach to improve number portability in Singapore.

PART II

BACKGROUND

3. Number portability is used by consumers and businesses when they choose to retain their phone numbers when they switch from one service provider to another. Consumers and businesses benefit from number portability as it eliminates the need for them to inform their contacts of a change of phone numbers when they switch service providers. This reduces switching costs and potential loss of business opportunities. Number portability reduces the barrier to switch service providers and therefore increases competition as service providers would need to actively compete and innovate to retain and grow their customer base.
4. Fixed line and mobile service providers have a regulatory obligation to provide number portability service in Singapore. Fixed line Number Portability ("FNP") allows end-users to retain their fixed line phone numbers when these users switch from one fixed line service provider to another. Mobile Number Portability ("MNP") allows end-users to retain their mobile phone numbers when these users switch from one mobile service provider to another.
5. FNP was introduced in April 2000 at the launch of fixed line competition. The FNP solution was agreed upon and implemented by Singapore Telecommunications Limited ("SingTel") and StarHub Ltd ("StarHub"). The FNP solution uses an Intelligent Network ("IN") technical platform, known as Query-on-Release ("QoR"). To subscribe to FNP service, fixed line users are

required to pay a one-time administrative charge and a monthly recurring charge¹.

6. MNP was introduced in April 1997 by Singapore Telecom Mobile Pte Ltd (“SingTel Mobile”) and MobileOne Ltd (“M1”), when Singapore liberalised its mobile telecommunication market. The MNP solution is based on the Call Forwarding solution. When StarHub Mobile Pte Ltd (“StarHub Mobile”) entered the mobile market in April 2000, all the mobile operators agreed to continue to use the Call Forwarding solution. In June 2003, IDA required the mobile operators to implement the porting of Short Messaging Service (“SMS”) messages. The Call Forwarding solution was thus enhanced to include the porting of SMS message in addition to voice calls. IDA also required the mobile operators to cease charging their ported customers a monthly MNP charge, as the recurrent charge was deemed a barrier to effective competition, as it reduced the incentive for customers to switch mobile service providers. Ported mobile customers now only pay a one-time administrative fee for MNP service². The Call Forwarding solution has since also been extended to support 3G mobile voice calls when the mobile operators launched their 3G services.
7. For more information on the FNP and MNP technical solutions implemented in Singapore, please refer to [Annex 1](#).

PART III

REASONS FOR NUMBER PORTABILITY REVIEW

Technological and market developments

8. The info-communications sector has undergone rapid technological and market developments. The sector is experiencing the emergence of low cost Internet and other IP-based communications services that are increasingly being used as alternatives to traditional circuit-switched telephone services. Greater emphasis on information knowledge and mobility has led to increasing use of mobile and data communications. Technological and market developments are also driving fixed and mobile convergence in the info-communication sector.

¹ For fixed line or Direct Exchange Line (DEL) number porting from SingTel to StarHub, StarHub has waived the one-time charge and charges a monthly charge of \$8.40. For Direct Dialling Inward (DDI) or Direct Inward Dialling (DID) number porting, there is a one-time charge of \$8 and a monthly charge of \$10. For a DEL number porting from StarHub to SingTel, SingTel charges a one-time charge of \$21 and monthly charge of \$10.50. For DDI or DID number porting, the same charges for DEL number porting apply. The timeframe to complete porting of DEL numbers is about 5 working days. The timeframe to complete porting of DDI or DID numbers is longer, depending on the number of DDI or DID numbers to be ported.

² M1 and SingTel Mobile impose a one-time charge of \$21 and StarHub imposes a one-time charge of \$10.50. The timeframe to complete mobile porting is about 7 working days.

9. Such transformations are reflected in recent regulatory developments in the Singapore info-communication sector. On 24 May 2005, IDA issued 6 Wireless Broadband Access (“WBA”) spectrum rights to companies through the WBA auction. On 14 June 2005, IDA issued its policy framework on IP Telephony and Electronic Numbering in Singapore. IDA is expecting WBA and IP Telephony service providers to start offering services in the near future. There is also an increasing trend of fixed-to-mobile substitution, where end-users rely on mobile phones for voice calls in place of fixed line phones. This may translate, in future, to consumers wanting to retain and use their fixed line phone numbers as their mobile phone numbers³ when they substitute their fixed line phones for mobile phones. This is known in some countries as “inter-modal porting”.
10. In light of these technological and market developments, IDA is reviewing the fixed and mobile NP solutions implemented in Singapore to assess whether they remain relevant and able to support industry and market needs going forward. IDA’s position is that a long-term, robust and forward-looking number portability solution, formulated with future industry developments and market trends in mind, is critical in promoting growth and enhancing competition in the info-communications sector. In this regard, IDA considers a number portability solution that can support mobile, fixed and IP Telephony services, such as a **centralised database approach**, will address the shortcomings in the current implementation and bring about greater benefits to the industry and consumers in the long run.

Questions (1)

IDA has identified that developments in the info-communications sector, namely the development of technologies, increasing competition within the same markets, and fixed-to-mobile substitution, warrant a review of our existing number portability implementation for fixed and mobile services.

IDA welcomes views and comments on whether the existing number portability implementation for fixed and mobile services remains relevant and able to support future industry and market needs.

Shortcomings in the existing number portability implementation

11. To encourage further competition in the mobile telecommunications market and to bring about greater benefits to end-users, in June 2003, IDA required the mobile operators to (i) implement the porting of SMS messages; and (ii) cease charging ported customers a monthly recurring MNP charge. These regulatory measures lowered the barriers faced by mobile customers wishing

³ This fixed-mobile substitution trend occurs as more end-users use their mobile phones as the primary form of voice communication instead of the fixed line phone. Therefore, it may be possible that consumers who substitute their fixed line phone with mobile phone may want to use their current fixed line number as their mobile phone number.

to switch service providers. It is interesting to note that on 1 August 2003, the date that the mobile operators were required to offer “free” MNP services, SingTel Mobile and M1 both launched “free incoming call plans”. Before that, only StarHub Mobile offered the innovative “free incoming calls” plan since April 2000.

12. IDA notes that there are shortcomings in the existing MNP solution:

Inefficient Use of Mobile Telephone Numbers

- (i) The current MNP solution based on Call Forwarding uses two mobile telephone numbers to route a call to a ported mobile customer. In other words, a call to a ported mobile customer will first be routed to his/her original phone number (“N1”) in the Donor Network⁴. The term Donor Network refers to the ported mobile customer’s former mobile service provider before he/she switched to the new mobile service provider (or the Recipient Network). The call is then forwarded to a new phone number (“N2”) in the Recipient Network. This solution results in an inefficient use of network resources and telephone numbers (i.e. it uses two mobile telephone numbers for routing calls to ported mobile customers);

“Incorrect” Caller Line Identification (“CLI”) Display

- (ii) While the existing MNP solution enables a ported mobile customer to continue to receive calls on his/her original phone number, N1, the new phone number, N2, would be displayed for his/her outgoing calls. As a result, the called party would receive an “incorrect” number display (i.e. N2) or an “incorrect” Caller Line Identification (“CLI”). This causes confusion and undermines the underlying intent and benefit of number portability; and

Inability to port Multimedia Media Messages (“MMS”) and IP-based Services

- (iii) Unlike SMS messages, the existing MNP solution cannot support the porting of MMS messages. That is, ported customers are unable to receive MMS messages on their ported phone numbers. Other emerging IP-based services such as mobile instant messaging and push-to-talk services also cannot be supported by the existing MNP solution.

13. IDA believes that with these shortcomings, the existing MNP solution does not provide a transparent and seamless porting experience for mobile customers. While the penetration rate in the mobile telecommunication market is high⁵,

⁴ Sometimes also known as the Number Range Holder, i.e. the operator which IDA assigns the phone numbers to.

⁵ As of July 2005, the mobile phone penetration rate is 97.5%. For more information, please refer to “Facts and Figures” on <http://www.ida.gov.sg>.

IDA views that a successful MNP implementation remains critical to long-term effective competition. With a better MNP solution, which lowers the barrier for switching, IDA believes that this will encourage mobile operators to be more innovative in packaging their mobile services and to compete more aggressively.

Questions (2)

IDA notes that there are several shortcomings in the existing MNP solution. While the penetration rate is high within the mobile telecommunication market, IDA believes that these shortcomings need to be addressed so that the barriers to switching (with the MNP solution) will be lowered and end-users will further benefit from enhanced competition.

IDA welcomes views and comments on IDA's assessment of the shortcomings on the existing MNP solution. Are there other shortcomings that need to be addressed?

IDA also welcomes industry and in particular, consumers' feedback on their views and experience with the existing MNP services in Singapore. Specifically, IDA requests feedback on the following:

- (i) Is the ability to retain your telephone number a critical consideration for switching from your current service provider to another service provider? What other factors would you consider before switching to another service provider?*
- (ii) Have you considered obtaining MNP service when switching to another service provider but have been reluctant or discouraged from doing so? What are the reasons for not using MNP service?*
- (iii) Do you think the existing MNP solution is adequate, e.g., pricing, porting timeframes, settlement of outstanding charges and other performance experience? What aspects of the MNP solution could be improved upon?*

Consumers may provide feedback to IDA by email to: info@ida.gov.sg

14. IDA notes that while we have FNP in Singapore, there is little competition in the fixed line telecommunication market. The entry of IP Telephony service providers however may increase competition in the fixed line telecommunication market. Therefore, as IP Telephony service providers enter the market, it is necessary to examine whether the existing FNP implementation⁶ would be able to effectively support more players. WBA

⁶ IDA does not mandate that IP Telephony service providers implement number portability, unless such service providers are allocated with number level "6". IDA reserves the right to do so at a later stage.

service providers may also require number portability service. IDA's objective is to ensure that, in a changing market environment driven by technological changes, number portability will be implemented by all market players, so that consumers can continue to benefit from retaining their phone numbers when they switch from one service provider to another. Furthermore, to lower the barriers for customers to switch service providers, IDA intends to require service providers to cease charging ported customers a monthly recurring FNP charge, similar to that for MNP service.

Questions (3)

IDA welcomes views and comments on the impact of the entry of IP Telephony and WBA players on the existing FNP implementation. Will the FNP solution be able to support these players effectively? What are the areas that IDA needs to consider and address in the FNP implementation?

IDA also welcomes industry and in particular consumers' feedback on their views and experience with the current FNP services in Singapore. Specifically, IDA requests feedback on the following:

- (i) Is the ability to retain your telephone number a critical consideration for switching from your current service provider to another service provider? What other factors will you consider in switching to another service provider?*
- (ii) Have you considered obtaining FNP service when switching to another service provider but have been reluctant or discouraged from doing so? What are the reasons for not using FNP service?*
- (iii) Do you think the existing FNP solution is adequate, e.g., pricing, porting timeframes, settlement of outstanding charges and other performance experiences? What aspects for FNP solution should be improved upon?*

Consumers or members of the public may provide feedback to IDA by email to: info@ida.gov.sg.

PART IV

ISSUES TO CONSIDER IN NUMBER PORTABILITY REVIEW

15. The number portability process starts with a customer's request to port a phone number. The service provider will then have to interact with the customer's former service provider to decide how and when to port the phone number. Number portability implementation generally involves the following steps:

- (i) The **administrative procedures**, which involves ordering, provisioning and notification. Ordering involves requesting the porting of a phone number from another operator, the time and date for the porting, and the validation of the customer's request and credit standing. Provisioning involves processing the request, updating business and operations support systems, and activating porting in the network. Notification involves communicating the porting information to all operators. Poorly designed or onerous procedures for porting are less likely to result in a successful implementation of number portability and undermine the desired benefit that number portability is intended to deliver. Currently, such procedures are governed by bilateral or peer-to-peer arrangements among the operators;
- (ii) The **appropriate technical routing solutions** in the operators' networks to correctly route calls to ported customers. This involves the operators establishing and running their databases, which contain details of ported numbers, and the routing of calls between their networks. The QoR and Call Forwarding technical routing solutions are currently used to support FNP and MNP respectively; and
- (iii) The **commercial arrangements**, e.g., the costs associated with implementing number portability (i.e. the administrative costs, and costs associated with establishing and operating databases, and routing solutions etc.), the apportionment of such costs between the operators, and cost recovery from end-users.

A centralised number portability database to administer and manage number portability

16. IDA notes that in many overseas jurisdictions, a common approach in implementing number portability involves the establishment of an independent or neutral third party to run a **centralised number portability database** and manage the porting processes and information among the operators. In this approach, all operators communicate with the independent third party to implement number portability. As the bilateral or peer-to-peer arrangements between operators can become more complex with increasing number of competing operators in the market, the centralised database approach can serve as a "common platform" to implement number portability requirements for all operators in a competitive environment, e.g., by providing a single and standardised mechanism supporting ordering, provisioning and notification processes. Some countries that have used the centralised database approach include the United States⁷, countries in Europe such as Sweden⁸

⁷ In US, the Federal Communication Commission ("FCC") has appointed NeuStar, who runs the Number Portability Administration Centre ("NPAC"), to manage number porting for the fixed line and mobile operators. Further information on NeuStar and NPAC can be found at <http://www.neustar.biz> and <http://www.npac.com>.

and Finland⁹, and Taiwan¹⁰. On the other hand, IDA also notes that there are other countries that do not implement a centralised database approach, such as the United Kingdom¹¹. IDA believes that the **centralised database approach** will provide a more robust number portability technical solution than our existing solutions.

17. The implementation of a centralised database involves detailed and complex considerations. These include:
- (i) The centralised database architecture, functional requirements (including database security and redundancy) and technical interfaces with operators;
 - (ii) The cost of the centralised database infrastructure, including costs of establishing and running the centralised database, and costs of establishing the technical interface to the operators' systems and the centralised database;
 - (iii) The nature and structure of the independent third party to operate the centralised database. E.g., this role can be outsourced to a third party vendor, or to a consortium jointly formed by the service providers. One of the benefits of having an independent third party is that it minimises the potential of anti-competitive abuse or discrimination against any service provider; and
 - (iv) Commercial arrangements that need to be put in place. E.g., how the costs should be apportioned amongst the service providers (e.g., equal sharing or apportioned by service providers' market shares and revenues?); and what the appropriate number portability performance standards and service levels should be set.

⁸ In Sweden, the Telecom and Post Authority PTS has appointed the Swedish Number Portability Administrative Centre AB ("SNPAC") as the sole provider of the reference database of ported numbers. SNPAC was jointly formed by operators. Further information on SNPAC can be found at <http://www.snpac.se>.

⁹ In Finland, the Finnish Communications Regulatory Authority ("FICORA") required the use of centralised database to implement number portability. The operators formed NUMPAC to manage the centralised database. Further information on NUMPAC can be found at <http://www.numpac.fi>.

¹⁰ In Taiwan, a Telecommunications Technology Centre ("TCC") was formed to manage the centralised database and implement number porting for fixed and mobile operators.

¹¹ OFCOM's review of fixed line number portability was triggered by the business failure of Atlantic Telecom in 2001, which resulted in service disruption and some ported customers having to switch to another provider and use a new phone number. OFCOM has considered the implementation of an IN centralised database, including the ACQ technical routing solution, to ensure that ported customers will not be affected from a similar incident in future. OFCOM concluded that it is not cost justified as the potential benefits are unable to offset the substantial cost set-up. For more information, please refer to OFCOM's consultation and policy statement on "An assessment of alternative solutions for UK number portability" on <http://www.ofcom.org.uk>.

Technical routing solutions

18. IDA has so far left it to the service providers to decide on the appropriate technical solutions to support number portability. However, such technical solutions must achieve the desired number portability requirements and policy outcomes.
19. IDA notes that there are various number portability technical solutions in the market¹². There are broadly two call routing methods: (i) where the Donor Network is involved in the routing of a ported call from the Originating Network to the Recipient Network (sometimes known as Indirect Routing); and (ii) where the Originating Network routes a ported call directly to the Recipient Network, without the involvement of the Donor Network (known as Direct Routing/All Call Query (“ACQ”).) Several advantages and disadvantages exist for both methods. However, on balance, it appears that the advantages of the Direct Routing/ACQ method outweigh the disadvantages. Therefore, **Direct Routing/ACQ** method appears to be the preferred method adopted in many countries, as it provides the most optimal call routing method in the long run¹³.
20. For more information on the centralised number portability database and technical routing solutions, please see [Annex 2](#).

Commercial arrangements

21. The operators will incur costs in implementing number portability. Where there are costs incurred within an operator’s network, these are usually borne by the individual operators. Where there are common elements and costs involved, e.g., in a centralised database, the operators involved would need to agree on issues such as cost apportionment or the charging model needed to set up and run the centralised database. With regard to the cost recovery of number portability implementation from ported customers, IDA has only allowed the mobile operators to impose a reasonable one-time administrative charge on ported customers (no recurring or monthly MNP charge is allowed).

Questions (4)

*IDA has identified various areas for review with regard to the existing number portability implementation. These include administrative arrangements, technical solutions and commercial arrangements. IDA notes that a **centralised database approach** has been adopted in many countries due to benefits it offers. IDA also*

¹² These would include the simple Call Forwarding solution, the standard-based solutions (e.g. the ETSI technical specifications for implementing MNP in GSM networks) and the proprietary IN-based solutions.

¹³ In ACQ, all calls to ported and non-porting numbers will require a database query. Therefore, while there will be efficiency improvements for calls to ported numbers, this improvement can be offset by inefficiency loss arising from unnecessary database queries for calls to non-porting numbers. However, as ported numbers increase, there will come a point where the efficiency improvement for calls to ported numbers will outweigh the efficiency loss for calls to non-porting numbers.

notes that with respect to the technical routing solutions, the **Direct Routing/ACQ method** has been adopted as the preferred method, as it provides a long-term, optimised call routing solution.

IDA welcomes views and comments on the use of **a centralised database approach** in implementing number portability and the **Direct Routing/ACQ** for routing calls. Specifically, IDA welcomes views and comments on the following:

- (i) *The advantages and disadvantages of implementing number portability using a centralised database approach;*
- (ii) *Should the centralised database be run by the operators (e.g. a consortium of the operators) or by an independent and neutral party (e.g. a third party vendor)? What are the pros and cons of each option identified or proposed?*
- (iii) *The likely cost components and cost estimates in implementing a centralised database in Singapore? What are the commercial or charging arrangements that can be considered when implementing a centralised database, e.g., should the charges be apportioned or recovered from operators based on equal sharing, usage, market share etc? What are the pros and cons of each of these options identified?*
- (iv) *What are the pros and cons of Direct Routing/ACQ versus Indirect Routing? What issues and factors need to be considered in deciding which method to adopt? What are the likely cost components and estimates in implementing a Direct Routing/ACQ in an operator's network?*
- (v) *What impact would the use of a centralised database and change in technical routing solutions have on other industry players, such as the mobile content and application service providers,? IDA notes that currently some mobile content and application providers rely on the phone numbers N1 (the ported customer's original phone number in the Donor Network) and N2 (the new phone number assigned to the ported customer in the Recipient Network) of a ported customer for proper authentication and billing purposes. Will mobile content and application providers benefit from a centralised database approach?*
- (vi) *What is the impact on downstream markets, e.g. telecom equipment dealers and existing ported customers? If so, who are the affected parties and what are these impact?*
- (vii) *Are there other implementation issues IDA should consider in its number portability review?*

Number assignments

22. IDA manages the national numbering resources and allocates the numbers to operators. Fixed line operators are issued with number level “6”, i.e. telephone numbers that start with “6”. Mobile operators are issued with number levels “9” and “8”. IP Telephony service providers will be issued with number levels “3” or “6”, and WBA service providers with number levels “3” or “8”. IDA notes that in Singapore, the number levels have been associated with the type of telecommunications service. E.g., consumers would associate a number level starting with “6” with a fixed line phone number and a number level starting with “9” or “8” with a mobile phone number.

23. However, the association of specific number levels with the underlying telecommunications service may no longer be significant in future due to technological and market developments. With the convergence of fixed line and mobile services on a communication device and fixed-to-mobile substitution, inter-modal porting (i.e. a mobile number may start with “6” after porting) will eliminate the association between number level and type of service.

Questions (5)

IDA notes that in Singapore, the number levels have been associated with the particular type of service. However, the association of number levels with a particular service may no longer be sustainable due to technological and market developments. Therefore, it may not be critical or useful for end-users to identify a particular number with the type of service. IDA welcomes views and comments on possible implications of allowing inter-modal number portability (i.e., porting numbers between different services) and the delinking of a particular number level with a type of service.

Other potential common platform services

24. If a centralised database infrastructure is used in implementing number portability, IDA notes that such infrastructure can be extended to support other value added services. This can in turn increase the attractiveness and cost effectiveness of the centralised database solution. These services may include:
 - (i) *Content Management Services Platform*: This can act as a common interface between the content and application providers and operators by providing value added services such as technical support, authentication and certification of content and applications that encourages the development of content development and improves time to market;

 - (ii) *Digital Rights Clearing Exchange*: This acts as a common digital rights clearing house for mobile content. Content providers can determine

the various content access policies, e.g. pay per play, monthly subscription, authorised devices, etc. including the digital rights technology used to protect the content. This will provide content providers with faster and feasible means to retail their content with adequate protection;

- (iii) *Open Service Exchange*: This provides a standardised interface for third party integration to mobile services (e.g. telephony, messaging or location based services) through Parlay or Web Services platform. It aims to simplify the communication service integration and allows third party application developers to develop richer applications at lower cost and faster time to market;
- (iv) *IP Multimedia Exchange*: This allows service providers to potentially share infrastructures for common multimedia or IP Multimedia Subsystem (“IMS”) type services with real-time authentication and dynamic billing support. The service will allow operators to share common infrastructure cost and encourage more content developers as well as service providers to develop more innovative 3G and IP based applications for next generation networks; and
- (v) *Common Billing Platform*: This provides a dynamic billing system that can act as a clearinghouse for inter-operator billing settlement and reconciliation.

Questions (6)

IDA notes that in addition to having a centralised database infrastructure for number portability, such infrastructure can be expanded to support other common platform services. IDA welcomes views and comments on how the centralised database infrastructure can support and develop other aspects of the info-communications market, in particular content development. Are there other services and applications that can leverage on such infrastructure?

PART V

PROPOSED APPROACH GOING FORWARD

25. The advancement of technological and market developments warrants a review of the number portability solution. Having considered these developments in the info-communication sector and the number portability solutions in other countries, IDA’s assessment is that a centralised database approach will provide a more robust and efficient number portability solution for Singapore in the long run. A number portability solution that readily supports competition in a multi-operator, converging market environment will benefit consumers going forward. In addition, IDA notes that a centralised

database approach offers the potential to support other value-added or common platform services. IDA believes that it is timely to address the shortcomings inherent in the current solution.

26. Therefore, subject to views and comments from the industry and members of the public, IDA proposes to adopt the following approach in implementing number portability for the info-communication sector:
- (i) A common centralised database infrastructure that provides a fair and robust number portability management and supports competition in a multi-operator, multi-network converging market environment;
 - (ii) The number portability implementation must fulfil the desired number portability requirements set out in Annex 3;
 - (iii) All existing fixed line operators, including IP Telephony service providers allocated with number level “6”, and mobile operators will be required to interface with the centralised database;
 - (iv) For MNP, mobile operators must address all shortcomings that have been identified;
 - (v) For FNP, the existing fixed line operators and additional IP Telephony service providers (i.e. IP Telephony service providers allocated with the number level “6”) must be able to implement number portability seamlessly and efficiently. Operators are also required to cease charging ported customers a monthly recurring FNP charge; and
 - (vi) After considering views submitted in this consultation exercise, if IDA decides to proceed with the implementation of a new number portability solution, the proposed timeframe for implementation of the new number portability solution would be 9 months from the date of IDA’s decision. Operators must comply with the number portability requirements set out in Annex 3 within this timeframe.

Questions (7)

IDA has proposed to adopt a centralised database approach for implementing number portability. The implementation of number portability must fulfil the number portability requirements set out by IDA. IDA also requires that mobile operators resolve all shortcomings in the MNP solution identified above. As a start, all existing fixed line operators (including IP Telephony service providers allocated with number level “6”) and mobile operators should interface with the centralised database to implement FNP and MNP.

IDA welcomes views and comments on IDA proposed approach set out above to implement the number portability in Singapore. Specifically, IDA welcomes views and comments on the following:

- (i) The feasibility of using a centralised database approach for fixed and mobile number portability services in Singapore, in light of technology and market developments;*
- (ii) IDA's proposed number portability requirements to achieve the desired outcomes of number portability as set out in Annex 3; and*
- (iii) IDA believes that 9 months is a reasonable and adequate time for implementation of a new number portability solution. If respondents feel otherwise, please justify in detail why the timeframe is insufficient.*

PART VI

INVITATION TO COMMENT

27. IDA would like to seek the views from the industry and members of the public on the issues and proposals raised in this consultation paper. This will allow IDA to have a better understanding of the issues and the needs of the interested parties. The questions are listed again below:

Questions (1)

IDA has identified that developments in the info-communications sector, namely the development of technologies, increasing competition within the same markets, and fixed-to-mobile substitution, warrant a review of our existing number portability implementation for fixed and mobile services.

IDA welcomes views and comments on whether the existing number portability implementation for fixed and mobile services remains relevant and able to support future industry and market needs.

Questions (2)

IDA notes that there are several shortcomings within the existing MNP solution. While the penetration rate is high in the mobile telecommunication market, IDA believes that these shortcomings need to be addressed so that the barriers to switching (with the MNP solution) will be lowered and end-users will further benefit from enhanced competition.

IDA welcomes views and comments on IDA's assessment of the shortcomings on the existing MNP solution. Are there other shortcomings that need to be addressed?

IDA also welcomes industry and in particular, consumers' feedback on their views and experience with the existing MNP services in Singapore. Specifically, IDA requests feedback on the following:

- (i) *Is the ability to retain your telephone number a critical consideration for switching from your current service provider to another service provider? What other factors would you consider before switching to another service provider?*
- (ii) *Have you considered obtaining MNP service when switching to another service provider but have been reluctant or discouraged from doing so? What are the reasons for not using MNP service?*
- (iii) *Do you think the existing MNP solution is adequate, e.g., pricing, porting timeframes, settlement of outstanding charges and other performance experience? What aspects of the MNP solution could be improved upon?*

Consumers may provide feedback to IDA by email to: info@ida.gov.sg

Questions (3)

IDA welcomes views and comments on the impact of the entry of IP Telephony and WBA players on the existing FNP implementation. Will the FNP solution be able to support these players effectively? What are the areas that IDA needs to consider and address in the FNP implementation?

IDA also welcomes industry and in particular consumers' feedback on their views and experience with the current FNP services in Singapore. Specifically, IDA requests feedback on the following:

- (i) *Is the ability to retain your telephone number a critical consideration for switching from your current service provider to another service provider? What other factors will you consider in switching to another service provider?*
- (ii) *Have you considered obtaining FNP service when switching to another service provider but have been reluctant or discouraged from doing so? What are the reasons for not using FNP service?*
- (iii) *Do you think the existing FNP solution is adequate, e.g., pricing, porting timeframes, settlement of outstanding charges and other performance experiences? What aspects for FNP solution should be improved upon?*

Consumers or members of the public may provide feedback to IDA by email to: info@ida.gov.sg.

Questions (4)

IDA has identified various areas for review with regard to the existing number portability implementation. These include administrative arrangements, technical solutions and commercial arrangements. IDA notes that a **centralised database approach** has been adopted in many countries due to benefits it offers. IDA also notes that with respect to the technical routing solutions, the **Direct Routing/ACQ method** has been adopted as the preferred method, as it provides a long-term, optimised call routing solution.

IDA welcomes views and comments on the use of a **centralised database approach** in implementing number portability and the **Direct Routing/ACQ** for routing calls. Specifically, IDA welcomes views and comments on the following:

- (i) *The advantages and disadvantages of implementing number portability using a centralised database approach;*
- (ii) *Should the centralised database be run by the operators (e.g. a consortium of the operators) or by an independent and neutral party (e.g. a third party vendor)? What are the pros and cons of each option identified or proposed?*
- (iii) *The likely cost components and cost estimates in implementing a centralised database in Singapore? What are the commercial or charging arrangements that can be considered when implementing a centralised database, e.g., should the charges be apportioned or recovered from operators based on equal sharing, usage, market share etc? What are the pros and cons of each of these options identified?*
- (iv) *What are the pros and cons of Direct Routing/ACQ versus Indirect Routing? What issues and factors need to be considered in deciding which method to adopt? What are the likely cost components and estimates in implementing a Direct Routing/ACQ in an operator's network?*
- (v) *What impact would the use of a centralised database and change in technical routing solutions have on other industry players, such as the mobile content and application service providers? IDA notes that currently some mobile content and application providers rely on the phone numbers N1 (the ported customer's original phone number in the Donor Network) and N2 (the new phone number assigned to the ported customer in the Recipient Network) of a ported customer for*

proper authentication and billing purposes. Will mobile content and application providers benefit from a centralised database approach?

- (vi) What is the impact on downstream markets, e.g. telecom equipment dealers and existing ported customers? If so, who are the affected parties and what are these impact?*
- (vii) Are there other implementation issues IDA should consider in its number portability review?*

Questions (5)

IDA notes that in Singapore, the number levels have been associated with the particular type of service. However, the association of number levels with a particular service may no longer be sustainable due to technological and market developments. Therefore, it may not be critical or useful for end-users to identify a particular number with the type of service. IDA welcomes views and comments on possible implications of allowing inter-modal number portability (i.e., porting numbers between different services) and the delinking of a particular number level with a type of service.

Questions (6)

IDA notes that in addition to having a centralised database infrastructure for number portability, such infrastructure can be expanded to support other common platform services. IDA welcomes views and comments on how the centralised database infrastructure can support and develop other aspects of the info-communications market, in particular content development. Are there other services and applications that can leverage on such infrastructure?

Questions (7)

IDA has proposed to adopt a centralised database approach for implementing number portability. The implementation of number portability must fulfil the number portability requirements set out by IDA. IDA also requires that mobile operators resolve all shortcomings in the MNP solution identified above. As a start, all existing fixed line operators (including IP Telephony service providers allocated with number level "6") and mobile operators should interface with the centralised database to implement FNP and MNP.

IDA welcomes views and comments on IDA proposed approach set out above to implement the number portability in Singapore. Specifically, IDA welcomes views and comments on the following:

- (i) The feasibility of using a centralised database approach for fixed and mobile number portability services in Singapore, in light of technology and market developments;*
 - (ii) IDA's proposed number portability requirements to achieve the desired outcomes of number portability as set out in Annex 3; and*
 - (iii) IDA believes that 9 months is a reasonable and adequate time for implementation of a new number portability solution. If respondents feel otherwise, please justify in detail why the timeframe is insufficient.*
28. Respondents are also invited to comment on any other issues not covered in this consultation document which they consider to be relevant to this review.
29. IDA will carefully consider all comments submitted and make its policy decision thereafter. IDA targets to announce its decisions by first half of 2006.
30. Respondents are required to include their personal/company particulars as well as the correspondence address in their submissions to this Consultation Paper. All comments should be submitted in writing and in both hard and soft copies (preferably in Microsoft Word Format), and should reach IDA by **12 noon, 5 October 2005**. Your submissions should be addressed to:

Mr. Andrew Haire
Assistant Director-General (Telecoms)
Infocomm Development Authority of Singapore
8 Temasek Boulevard
#14-00 Suntec Tower Three
Singapore 038988
Fax: (65) 6211-2116

AND

Please submit your soft copies via email to:

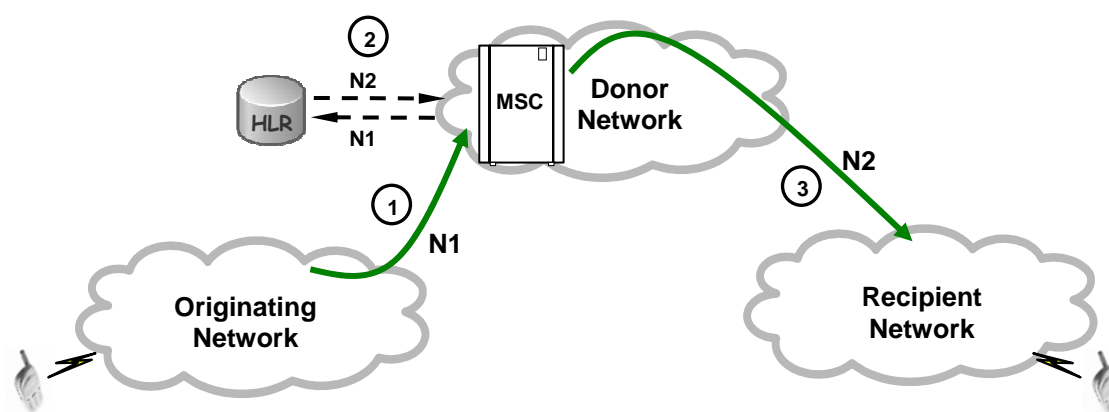
Lim_Hsueh_Wei@ida.gov.sg

31. IDA reserves the right to make public all written submissions made in response to this Consultation Paper and to disclose the identity of the respondent. Any part of the submission, which is considered by respondents to be commercially confidential, should be clearly marked and placed as an annex. IDA will take this into account when disclosing the information.

MNP AND FNP IMPLEMENTATION IN SINGAPORE

MNP solution

- The MNP solution is based on a simple Call Forwarding (“CF”) solution agreed between the mobile operators. With this solution, the Donor Network sets the ported number (“N1”) to be forwarded to the number (“N2”) assigned by the Recipient Network to the ported subscriber. When a subscriber with number N1 ports from the Donor Network to the Recipient Network, a voice call to the ported number N1 will be forwarded by the Donor Network to the ported subscriber in the Recipient Network using the number N2 (see Figure 1 on illustration of CF solution). CF incurs inefficient use of network resources (i.e. call circuits) and number resources (i.e. two numbers N1 and N2).



HLR: Home Location Register, the knowledge centre of the network that contains pertinent user information, including routing address, account status and preferences. The Mobile Switching Centre (MSC) / SMS Centre (SMSC) interact with the HLR for the necessary information to establish how the call/messages should be processed or routed accordingly.

Figure 1: Illustration of CF solution

- The CF solution was enhanced in 2003 to forward SMS messages to ported subscribers. Previously, ported subscribers were unable to receive SMS messages sent to their N1 number. When an SMS message is sent to a ported subscriber, the following operations in the Donor Network will be performed:
 - The SMS Centre (“SMSC”)¹⁴ checks whether the subscriber has ported his/her number;
 - If it is a ported subscriber, the network will translate the N1 number to the matching N2 number; and

¹⁴ SMS Centre, the entity that stores and forwards SMS messages, and allows messages to be exchanged between mobile phones and other networks.

- (iii) The SMS message is sent to the Recipient Network using the N2 via its inter-operator SMS Gateway¹⁵. The Recipient Network then delivers the SMS message to the ported subscriber through its SMSC.
3. Note that for SMS to non-ported subscribers in the Recipient Network, the SMSC will route the SMS message directly to its inter-operator SMS Gateway.

FNP solution

4. The FNP allows fixed line customers to retain their telephone numbers when they switch from one fixed line service provider to another fixed line service provider. The FNP solution uses Query-on-Release (“QoR”), an IN-based solution agreed on between SingTel and StarHub. When a call is made to a ported fixed line number (“N1”), the Donor Network will send a specific signalling message to the Originating Network to indicate that the dialled number has been ported out. The Originating Network will then query its NP database for the new routing number (“N2”) and route the call to the Recipient Network (see Figure 3 on illustration of QoR solution).

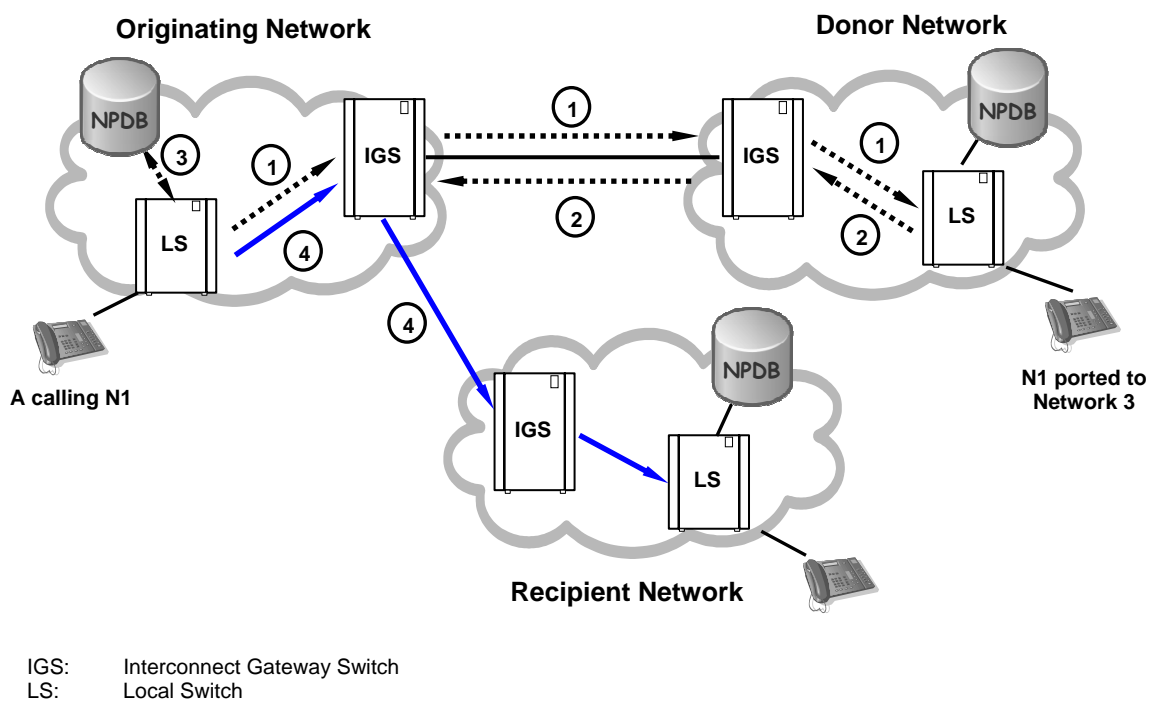


Figure 2: Illustration of QoR Solution

¹⁵ SMS gateway, the entrance and exit into a communication network

**NUMBER PORTABILITY ADMINISTRATION AND
CALL ROUTING METHODS**

1. Number portability requires the operators to address the following areas:
 - (i) **Number portability administration:** the administrative processes for managing and porting numbers between operators;
 - (ii) **Call routing:** the appropriate technical solutions for routing calls to ported customers correctly between the different networks; and
 - (iii) **Economic arrangements:** Costs and other commercial arrangements associated in implementing number portability.
2. This section provides further information on number portability administration and call routing methods.

Number portability administration

3. A well-designed administrative process is important for implementing number portability successfully. These processes involve (i) Ordering; (ii) Provisioning; and (iii) Notification. Ordering involves requesting the porting of a telephone number from another operator, the time and date for the port, and the validation of customer's request and credit standing. Provisioning involves processing the request, provisioning an operator's business and operations support systems, and activating porting in the network. Notification involves communicating porting information to all operators so that the networks are synchronised.
4. Bilateral/peer-to-peer and centralised database model are the two administrative approaches that operators can adopt in managing number porting.
5. In the bilateral/peer-to-peer model, operators communicate directly with each other. Individual commercial bilateral agreements are contracted between operators, who must then know and manage the terms and conditions of each agreement. In some cases, a standardised approach to managing and enabling porting is possible. However, bilateral/peer-to-peer approach may become complex and inefficient with increasing number of operators.
6. In the centralised database model, multiple operators interface with a centralised system. The number of communication links between the operators is minimised, thereby helping to increase efficiency and cost effectiveness (See Figure 1 below). The centralised model also helps in standardising and simplifying the ordering, provisioning and notification

processes. The centralised database model also helps to minimise the reliance on another operator to enable number porting, which can be subject to competitive abuse.

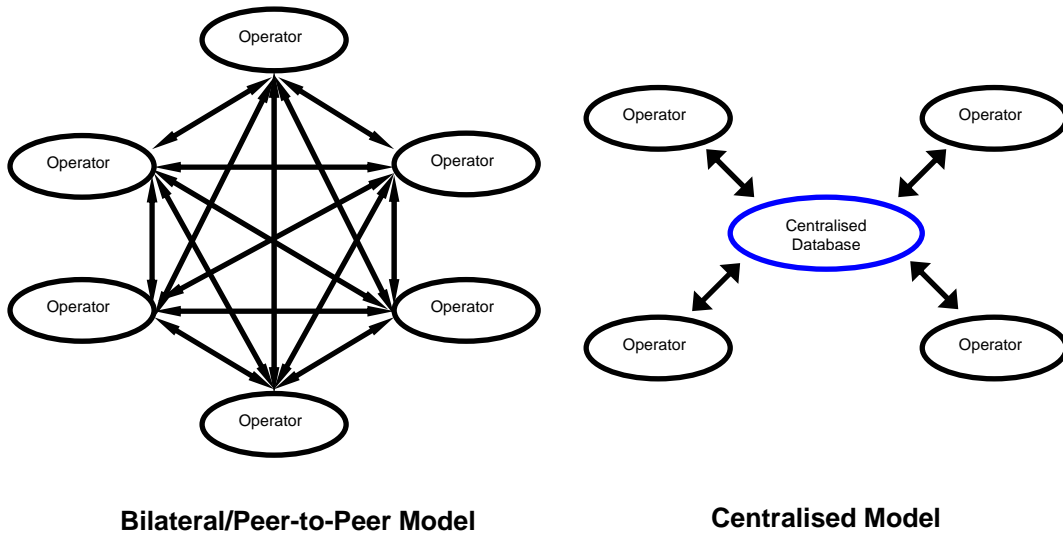


Figure 1: Illustration of bilateral/peer-to-peer and centralised models

7. Some of the merits of using a centralised database model are set out below:
- (i) Offers a long-term, efficient and cost-effective solution for the entire industry with large number of operators. Ability to support FNP, MNP and inter-modal porting;
 - (ii) Provides a single and standardised mechanism supporting ordering, provisioning and notification processes in managing number portability, and service quality assurance (such as timely, accurate and efficient processing of number portings);
 - (iii) Provides a fair and neutral management in implementing number portability and minimises reliance on another operator in terms of administrative processes to enable number porting, which can be subject to competitive abuse. This promotes competition; and
 - (iv) Centralised system can be expandable to accommodate other potential services, such as number administration, directory services, ENUM, inter-operator billing settlement etc.

Call routing solutions

8. There are broadly two methods for routing of calls: (i) where the Donor Network is involved in the routing of a ported call from the Originating Network

to the Recipient Network. This is known as Indirect/Onward Routing¹⁶; and (ii) where the Originating Network directly routing a ported call to the Recipient Network, without the need to involve the Donor Network. This is known as Direct Routing/All Call Query (“ACQ”). These methods are explained below.

(I) Indirect/Onward Routing

9. In Indirect/Onward Routing (also known as Call Forwarding), operators will route calls to the Donor Network who in turn forwards the calls to the Recipient Network. In this case, the Donor Network is involved in the routing of ported calls (see Figure 2 on Indirect/Onward Routing).

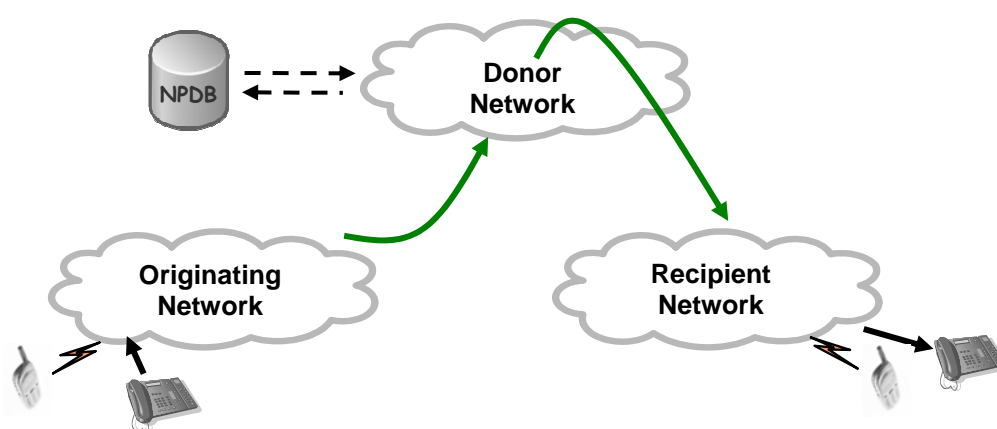


Figure 2: Indirect/Onward Routing or Call Forwarding

10. Some of the key advantages and disadvantages of Indirect/Onward Routing are set out in Table 1.

Table 1: Key Advantages & Disadvantages of Indirect/Onward Routing

No	Advantages	Disadvantages
1	The number portability database of the Donor Network Operator can be small since it contains only the telephone numbers of the Donor Network	Since a call to a ported number does not go directly from Originating Network Operator to Recipient Network Operator, the routing of a ported call is not

¹⁶ It should be noted that there are several approaches to implement Indirect/Onward Routing. This includes: (i) the Donor Network identifies the Recipient Network and routes the call onward to the Recipient Network (known as Onward Routing); (ii) the Donor Network checks if the called number is ported and if so, releases the call to the Originating Network together with the information identifying the correct Recipient Network (known as Call Drop Back); and (iii) the Donor Network identifies that the called number is ported and returns a signalling message to the Originating Network indicating that the number is ported. The Originating Network then queries a database to obtain information identifying the Recipient Network (known as Query on Release). For simplicity, we have only mentioned Indirect Routing/Onward Routing in this paper. The Call Drop Back and Query on Release approaches may be viewed as an intermediate or hybrid solutions between the Onward Routing and ACQ methods.

No	Advantages	Disadvantages
	Operator's customers which have been ported. It does not have to contain all ported numbers.	optimised nor efficient.
2	The signalling impact is minimal. For non-ported numbers, there is no increase in the call set-up time.	
3		Call forwarding or "tromboning" ¹⁷ occurs, which involves additional transit / interconnection charges.
4		If the Donor Network Operator goes out of business, the porting of calls would fail, as portability based on indirect routing is dependent on the Donor Network Operator forwarding such ported calls.
5		The Originating Network Operator is dependent on the Donor Network Operator for the call handling and Donor Network Operators typically do not provide this service for free. Further, the Originating Network Operator has no control over the quality of service provided by the Donor Network Operator.

(II) Direct Routing/All Call Query ("ACQ")

11. With Direct Routing/ACQ, operators will route calls directly to the ported numbers in the Recipient Network. This requires the Originating Network Operator to determine what will be the correct network to route the ported calls to (see Figure 3 on Direct Routing/ACQ).

¹⁷ Tromboning can occur when a call is made to a ported customer that resides in the Originating Network. In this case, there will be a loop in call routing through the Donor Network and back to the Originating Network. Tromboning doubles the signalling resources used and therefore adds to the conveyance costs.

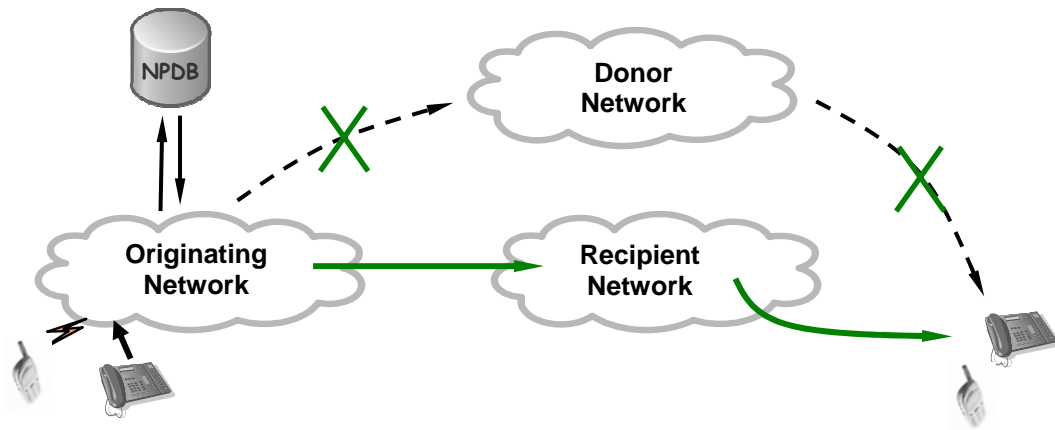


Figure 3: Direct Routing/ACQ

12. Some of the key advantages and disadvantages of Direct Routing/ACQ are set out in Table 2.

Table 2: Key Advantages & Disadvantages of Direct Routing/ACQ

No	Advantages	Disadvantages
1	Eliminates reliance on the Donor Network Operator, thereby providing the ability to maintain portability in the event that Donor Network operators fail and exit the market.	Since all calls are queried, call set-up time for both ported and non ported numbers will increase. This is due to increased signalling and processing time for each call. However, the increase in call set-up time is not known to be significant.
2	Minimises network congestion, which could arise on the Donors' networks as ported calls are routed through them.	The required network database needed to support Direct Routing/ACQ versus Indirect/Onward Routing needs to be larger and more complex. This network database for each operator needs to hold all ported numbers instead of just those ported numbers of the operator.
3	More optimised and efficient call routing. No tromboning.	

Common Approach to Number Portability Implementation

13. In recent years, many countries¹⁸ have opted for the centralised database model as it has been viewed as a more robust and optimum solution for number portability implementation for consumers and industry. This approach provides a single and standardised mechanism supporting ordering,

¹⁸ E.g., US, Sweden, Finland, Denmark, Norway and Taiwan.

provisioning and notification processes among operators. It also provides a fair and neutral management in implementing number portability.

14. To support the Direct Routing/ACQ method, routing data must be available to every operator and updated after every port takes place between any operators. Since there are typically multiple operators in the market, it becomes critical to synchronise and make available the data to all operators. The centralised database model helps achieve this objective, where porting information is kept in a centralised number portability database. Any update to the database is then broadcast simultaneously to all operators. Alternatively, either the entire database or subsets of the database can be downloaded into the local network databases of the operators (see Figure 4 below).
15. On balance, the advantages of the Direct Routing/ACQ method generally outweigh the disadvantages, with many countries implementing the centralised database model with Direct Routing/ACQ instead of Indirect/Onward Routing method. Direct Routing/ACQ method has been a preferred method as it provides a long term optimised call routing and eliminates the reliance on the Donor Network operator.

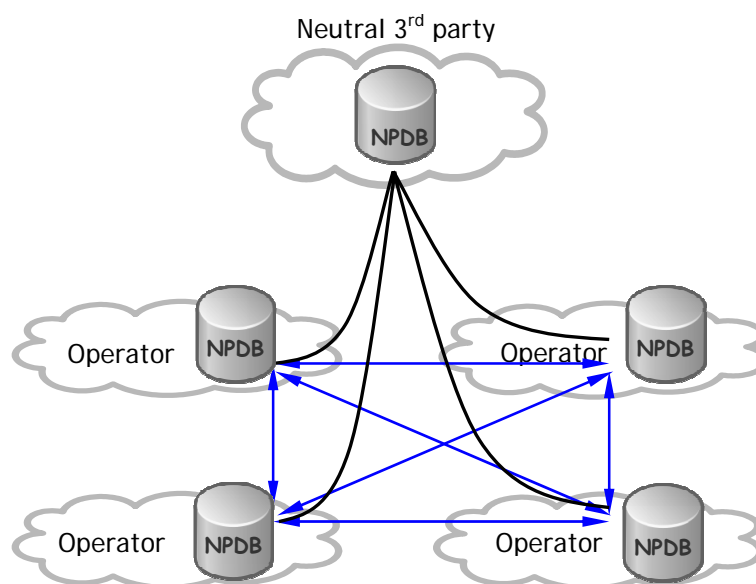


Figure 4: Centralised Number Portability Database to synchronise Number Portability Local Databases

NUMBER PORTABILITY REQUIREMENTS

- 1 The implementation of NP must fulfil the following requirements:
- (a) No unreasonable degradation¹⁹ in service quality, reliability and convenience to end-users as a result of switching from one service provider to another. It must also be seamless and transparent to end-users. There must be no unnecessary impediments and delays that discourage end-users from porting to a different service provider;
 - (b) Cost effective, efficient and robust solution in the long-run. The NP solution must cater to foreseeable future market and industry developments. Provisioning for future services and capabilities would include number porting across multi-operator and platforms (e.g. fixed-mobile or inter-modal porting, porting between fixed operators, IP Telephony service providers, WBA operators). The objective is that existing and foreseeable future needs can be reasonably supported. Existing services that must be supported include video telephony and voice call services (DEL, DDI, DID, 1800, 1900, postpaid and prepaid for both 2G and 3G); SMS (postpaid and prepaid for both 2G and 3G); and MMS (postpaid and prepaid for both 2G and 3G);
 - (c) Easily scaleable and capable of meeting future porting demands;
 - (d) Ensure efficient use of numbering resources. This is to ensure sufficient number resources to cater for future industry needs;
 - (e) A long-term robust, cost effective and efficient solution, facilitates ease of entry of new players (including application/content providers) and non-discriminatory treatment between players;
 - (f) Reliance on the donor network operator should not be required to route calls to ported subscribers. This should ensure optimal routing of calls to ported subscribers and minimise anti-competitive behaviour by the donor network operator. It must not disadvantage the recipient network operator to whom the subscriber has ported to nor impair the recipient network operator's ability to compete effectively against donor network operator. IDA strongly believes that an NP solution that is dependent on the donor network operator reduces the recipient network operator's ability to control the operational ease and costs of such call routing and is a sub-optimal solution; and

¹⁹ It is noted that the cutover from donor network to recipient network may result in disruption to ported customers but this could be mitigated through appropriate measures (e.g. implement the cutover at off peak periods).

- (g) No unnecessary or adverse impact to service provisioning of other service providers in the implementation of new NP solution, e.g. 3rd party content and application providers²⁰.

²⁰ If Singapore moves away from the existing Call Forwarding NP solution, service providers like mobile content and application providers that currently use N2 numbers for authentication/routing may be affected. IDA believes that the impact would be greatly mitigated if the centralised database solution for NP is adopted and such providers are granted access to this database for customer billing and authentication purposes.