Infocommunications Development Authority Of Singapore (IDA)

Report on IDA's Determination of Fixed and Mobile Inter-operator Number Portability Charges

31 March 2000

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This report sets out IDA's determination on inter-operator fixed and mobile number portability (NP) charges. The said charges were formulated in the context of principles drawn from the Costing Principles For Number Portability (Annex 1), IDA's Interconnection Charging Principles and economic principles advocated by the United States (US), Canada, Australia, Hong Kong and the United Kingdom (UK). The quantum of the NP inter-operator charges are based on a review of the calculations supporting the charging proposals submitted by Singapore Telecommunications Limited (SingTel) and StarHub Pte Ltd (StarHub) for Fixed Number Portability (FNP), and SingTel Mobile Pte Ltd (SingTel Mobile), StarHub and MobileOne (Asia) Pte Ltd (MobileOne) for Mobile Number Portability (MNP). The calculations were analysed and compared to charging practices for similar NP services in the jurisdictions noted earlier.

Technical Approach

The FNP technical approach is an Intelligent Network (IN) solution based on the Query on Release method. This method requires the Donor Network to provide an indication to the originating network that the number called is a ported number. The originating network will then query its database to determine where the call should be routed. Relevant information on ported numbers is exchanged between operators for the purpose of updating their individual databases.

The technical approach for MNP is a simple call forwarding solution where a second number (N2) is used to reroute the number (N1) to be ported.

Charging Principles

The charging principles for NP are ultimately intended to enhance consumer interests by promoting a competitive telecommunications industry. It is important to recognise the types of benefits that would accrue to all industry participants, namely porting customers, other subscribers, and telecommunications operators, and then assess the reasonableness of charges proposed by operators. The principles are designed to favour the introduction of competition without in any way favouring any one carrier or class of carriers. The benefits that accrue to NP fall into three categories:

- Type 1 benefits which accrue to porting customers directly;
- Type 2 benefits which accrue to all customers through enhanced competition made possible by NP; and
- Type 3 benefits which accrue to all subscribers in the form of fewer misdialled calls and fewer calls to directory inquiry.

The charging principles, advocated by IDA, are intended to form the basis for determining inter-operator charges. The principles ensure that operators recover a reasonable share of the costs they incur to provide NP services while still meeting the following objectives:

- ***Effective competition***. Inter-operator charges should diminish incumbent operators' competitive advantages of market awareness, reduce customer inertia in changing operators and enable new operators to provide NP services on a viable basis.

- ***Cost minimisation.*** NP charges should reflect the lowest charge possible while still providing the charging operator the opportunity to recover a reasonable portion of its costs.
- ***Cost causality.*** Charges should be set to ensure efficient consumption and production of NP services. When charges are based on cost they will send the appropriate signals to consumers on how much they should consume.
- ***Relevant cost***. Only those costs that are *incremental* to providing NP should be recovered through inter-operator charges.
- ***Distribution of Benefits***. Benefits resulting from NP accrue to all subscribers of telecommunication services and not just customers who have ported their numbers. Therefore, subscribers who have ported their numbers (and their respective operators) should not be required to bear the entire cost of NP.

The charging principles also require that NP charges be symmetrical, reciprocal and practical.

The charges for Fixed Number Portability (FNP) and Mobile Number Portability (MNP) in Singapore were determined in the context of the following guidelines:

- ***Operators should bear their own system set-up costs.***

  System set-up costs are to be borne by each operator unless an operator incurs costs in support of number portability implementation from which it does not benefit. This view is consistent with establishing charges that promote effective competition, ensuring that charges are based on cost and encouraging cost minimisation. System set-up costs are incurred at the outset of NP implementation as a result of the licence condition requiring NP capabilities. Porting numbers from the Donor Network Operator (DNO) to the Recipient Network Operator (RNO) do not cause these costs. Furthermore, inter-operator charges for system set-up costs could be used anti-competitively to raise rivals' costs and reduce the incumbent's incentive to be cost-efficient.

- ***Charges for NP administration, i.e. NP application, port-back, termination, withdrawal and day-time activation, should be determined using a narrow definition of incremental costs.***

  A narrow definition for incremental costs is used to take into consideration the external benefits resulting from a subscriber's decision to port their number. As such, DNOs will not be allowed to recover certain costs that are common to providing NP administrative services and other services (such as turning off the old service and turning on the new service). Low inter-operator charges also reduce the ability of a DNO to raise a RNO's costs in an anti-competitive manner.

- ***Fixed telecommunications operators should bear their own conveyance costs with respect to NP.***

  There may be a minimal difference in the signalling costs associated with calls to ported numbers compared to signalling costs associated with calls to non-ported numbers. Accordingly, over the longer term, IDA will be considering phasing out conveyance charges.

- ***Mobile telecommunications operators may recover database interrogation functions and associated conveyance costs as a result of the interim, Operator Call Forwarding (OCF), solution that is currently in place.***

  To motivate operators to implement more efficient conveyance practices IDA will be considering phasing out conveyance and monthly recurring charges after 1 April 2001.

Determined Charges

The charges determined for FNP are as follows:

Table 1: Determined Charges for FNP

One-time charge per ported number*	
• Application	**$9.50**
• Port-back	**$9.50**
• Termination	**$9.50**
• Withdrawal	**$4.50**
Subsequent Portability	
• Application**	**$9.50**
• Database updates***	**$4.50**
Conveyance charge per database dip*	**$0.0040**

* Irrespective of time-of-day of processing and activation.
** Payment by new RNO to the new DNO.
*** Payment by the new RNO to all operators who must update their databases.
**** Payment by the new RNO to the original DNO.

The charges determined for MNP are as follows:

Table 2: Determined Charges for MNP

Administration	**$10.50**
Administration – Subsequent Porting*	**$10.50**
Monthly recurring	**$5.50**
Access charges:	
• *Peak*	**$0.014**
• *Off-peak*	**$0.007**

* Payment by the new RNO to the original DNO.

There is no application charge for port-back activity in the case of MNP due to the current call forwarding solution that is in place. The original DNO (and now the new RNO) would be the only operator incurring any costs; that is only the original DNO would need to reset its call forward setting on it switches.

For both fixed and mobile number portability charges, a comparison of the determined rates to published international rates indicates that the determinations are in line with international benchmarks.

Finally, the charges are intended to:

- Reflect the Long Run Average Incremental Costs (LRAIC) standard using a narrow definition of incremental costs. Costs that are indirect fixed, and are incurred to provide NP services and other telecommunications services, have been excluded.

- Stimulate operators into adopting efficient application administration practices and conveyance practices since charges have been made to account for potential economies of scale that can be realised from more efficient operations and network routing practices.
- Allow operators to recover the incremental costs associated with NP along with a financing charge of 10% on capital resources that were consumed in the provision of NP.
- Be symmetrical and reciprocal.

Going Forward

The determined NP charges shall apply on an interim basis, until such time that all operators have sufficient evidence to validate the NP charges they can propose in the future, as follows:

- An interim period of one year for Fixed Number Portability charges; and
- An interim period of six months for Mobile Number Portability charges.

After the interim period, operators will be required to demonstrate that their NP charges are based on costs that would be avoided if NP were not to be provided in the long term – particularly those relating to conveyance of calls to ported numbers. Future reviews may be triggered by the occurrence of one or more of the following events in the market:

- Entry of new fixed and mobile operators;
- Increased complexity in inter-operator calls;
- Changes in NP platforms / conveyance methods; and/or
- Insufficient porting activity.

To put all operators on a level playing field, IDA will continue to maintain its position of requiring that NP charges be reciprocal and symmetrical – to do otherwise would create a competitive imbalance among operators in the early years of competition.

IDA will also be considering the elimination of access and monthly recurring charges pertaining to MNP after 1 April 2001. While IDA will consult with operators to address the issue, operators will be required to demonstrate the extent to which signalling and transport facilities are consumed with calls to ported numbers and whether the total cost associated is material in the context of the operators' operating and capital costs.

Finally, IDA will be considering the streamlining of the various types of NP administrative charges to one single NP charge (i.e. bundling port-back, termination, withdrawal and day-time activation charges into application charges). This would simplify inter-operator transactions with regard to NP, as well as longer-term operator/customer relationships.

Structure of this Report

- ***Section 1: Benefits of Number Portability***, summarises the types of benefits that can be realised with NP and need to be considered in the determination of NP charges for Singapore.

- ***Section 2: Charging Principles***, discusses the charging principles advocated by IDA and those principles in practice in other jurisdictions.
- ***Section 3: Fixed Number Portability and Section 4: Mobile Number Portability***, sets out IDA's determinations for FNP and MNP. These were determined following an audit of the operators' submissions by an independent consulting firm appointed by IDA to undertake the task.
- ***Section 5: Going Forward***, details the future direction in the review and calculation of NP charges

NP is defined as "the ability for subscribers to retain their current numbers, including 1800 (toll-free) and 1900 (premium) services numbers, when they change operators or geographical location."

A fundamental goal of public policy, in Singapore, is to enable effective competition between incumbent operators and new entrants. NP reduces customer inertia with regard to changing operators and significantly reduces the competitive advantage incumbent operators would have if they were not required to support NP. Accordingly, implementation of NP is instrumental toward achieving effective competition as the industry undergoes progressive liberalisation and new operators enter the market.

The charging principles for NP are ultimately intended to enhance consumer interests by promoting a competitive telecommunications industry. In the determination of charges for the industry, it is important to recognise the types of benefits that would accrue to all industry participants, namely: porting customers; other telecommunications subscribers; and telecommunications operators. The benefits that are expected to result from the implementation of NP fall into three categories:

- Type 1 benefits which accrue to porting customers directly;
- Type 2 benefits which accrue to all subscribers through enhanced competition made possible by NP; and
- Type 3 benefits which accrue to all subscribers such as fewer calls and fewer calls to directory inquiries.

Type 1 benefits, also referred to as the private costs of porting, accrue to *porting* customers only. They comprise:

- Savings from not having to change stationery and other items, such as advertisements that include a business subscriber's telephone number;
- Reduced telecommunications expenses from switching to lower cost operators; and
- Convenience, such as using the same number and operator for incoming and outgoing calls.

With NP, new operators are more likely to provide a range of services to their customers and focus on meeting their needs for both incoming and outgoing traffic. If numbers cannot be ported, new entrants will tend to focus on provision and marketing of services that require outgoing lines or other such services as Centrex, virtual private network services, payphone services, etc. To avoid the inconvenience and transaction costs associated with establishing new directory numbers, multi-line business customers, in particular, will continue to buy their inbound services from the incumbent operator(s). Residential customers, too, might subscribe to more than one operator's service, using one operator primarily for outbound calls and another for inbound calls.[1] A lack of NP in a liberalised telecommunications market would likely result in vigorous competition in some markets segments and weak competition

[1] Some residential customers use British Telecommunications plc for incoming calls and another operator for outgoing calls. Monopolies and Mergers Commissions Report, p 2.38. Mercury Communications Ltd claimed that it could have earned 194 million pounds more over three years if it could have carried its large business customers' incoming calls in addition to their outgoing calls. MMC Report, p 2.108.

in others.

Type 2 benefits accrue to all customers through the enhanced competition made possible by NP. The benefits of competition will likely include lower prices for commodity services such as basic voice local and long distance calls. *Non-porting* customers benefit from the resultant enhanced competition, as it may no longer be necessary to change operators in order to obtain lower prices. Many customers who are attracted to new operators' promotional offers may find their existing operators more willing to meet or beat competing offers. Incumbent operators will be further motivated to increase the efficiency of their networks and lower their cost of service to retain their existing customers. More importantly, competition enhanced through NP is likely to result in a greater variety of products and services as operators seek to differentiate themselves in the marketplace. Operators are also more likely to discover what customers are willing to pay for, and likely to seek to more actively meet their customers' needs. While prices and consumer expenditures on new services may rise, the value received by consumers could possibly rise even more.

Type 3 benefits are benefits that confer to other subscribers when a subscriber ports his number. These external benefits will likely be greater for subscribers who call many other subscribers and include the following:

- Continued validity of non-porting subscribers' public and private directories and memorised numbers;
- Reduced problems with faxes sent to/received by the wrong fax machines since they do not identify whether the responding fax machine belongs to the intended recipient;[2]
- Reduced telephone operator assistance; and
- Reduced wrong number/billing disputes.

Customers who switch operators and do not port their numbers can, at some cost, undertake activities that reduce the transaction costs of all other subscribers such as updating their private directories. However, it is more probable that customers who switch operators, and do not port their numbers, might minimise their private costs (corresponding to Type 1 benefits); but in doing so may also cause significant external costs (corresponding to Type 3 benefits). Inter-operator NP charges can be instrumental in encouraging customers to reduce such external costs if the charges for porting their lines are sufficiently low to encourage porting rather than prohibit it.

In addition to the three types of benefits described above, NP (when implemented on an IN platform) can also lead to a more efficient use of numbering resources. As well, the broad public benefits of a stable numbering system, the efficient use of numbering resources and the value of a stable directory infrastructure may be significant. These benefits are largely external in nature, as they accrue primarily to all subscribers, not just those who make the porting decision.

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[2] This benefit is likely to be higher for businesses that send and receive a large number of confidential documents by fax.

An important policy objective for Singapore's info-comms industry is the establishment of a globally competitive sector with many players offering innovative, high quality and cost effective services. Among its responsibilities as a regulator, IDA encourages participants to continue to apply leading technologies and business practices while maintaining efficient operations and providing a quality of service equalling, if not surpassing, that of other world class operators.

As countries move from monopoly to competitive markets, regulatory policy must stimulate efficient entry into markets, efficient production of end services, competitive pricing to end-users, and curb anti-competitive behaviour among telecommunications carriers. The terms under which carriers transact for interconnection-related services determines the extent to which competition will be effective in reducing consumer prices, improving quality and diversity in services and attracting efficient entrants. The charging principles prescribed by IDA favour the introduction of competition without in any way favouring any one carrier or class of carriers. A review of the regulatory principles and frameworks surrounding NP in select jurisdictions was completed to understand the differences in NP charging practices between Singapore and these jurisdictions.

This section first reviews five important issues that need to be considered when formulating charging principles for NP inter-operator services. Then, charging principles, which apply to each classification of costs, is described. The section concludes with the broad guidelines and process used to determine and recommend the charges for FNP and MNP in Singapore.

Cost Recovery of Number Portability Charges

A market with ***effective competition*** can be characterised by the following factors:

- Independent rivalry between market participants;
- No significant barriers to entry;
- No particular participant having a competitive advantage; and
- Firms freely entering the sector in response to profitable opportunities in the market.

Inter-operator charges should diminish incumbent operators' competitive advantages of market awareness, reduce customer inertia in changing operators and enable new operators to provide NP services on a viable basis. To reduce customer inertia, NP charges for changing operators should be kept to a minimum. A Donor Network Operator (DNO) could potentially set its inter-operator NP charge at an excessive level and significantly raise the RNO's costs. This could then reduce the RNO's ability to effectively compete for subscribers – particularly where RNOs may choose not to pass on such NP charges to their subscribers. *The elimination or reduction of inter-operator NP charges can be seen to promote effective competition.*[3]

Charging principles should encourage carriers to ***minimise their costs*** by ensuring that all operators receive the appropriate incentives to adopt efficient technology and business practices. To the extent that less efficient operators are not permitted to pass on all their costs

[3] The Australian Communications Authority does not permit operators to recover any costs relating to NP from competing carriers.

to other operators, through inter-operator NP charges, they will have the necessary incentives to minimise their costs over the long term. *Inter-operator NP charges should reflect the lowest charge possible. Forward Looking Economic Costs (FLEC) is the basis upon which operators are required to determine their charges. NP charges based on costs that reflect the most cost-effective technology currently available, and which can accommodate projected growth over a specified time horizon, will prompt the right cost minimisation behaviour among operators.*

The compensation principle of ***cost causality*** requires that charges be set to ensure efficient consumption and production of services. A consumer (or business) that is not charged for the costs that it causes will use too much of a service, while a consumer (or business) that is charged for costs it did not cause may seek an alternative arrangement that may be less effective or efficient. When charges are causally related to costs, they will send the appropriate signals to consumers on how much should be consumed. In the case of porting, a subscriber's decision to port his telephone number when changing operators is *economically efficient* if both:

- The price of porting is less than the transactions costs associated with a number change to the porting subscriber plus the transaction costs of all parties who wish to call him; and
- The price of porting is less than the value of lost incoming calls to the porting subscriber plus the value of those calls to all subscribers who try to call him.

Inter-operator charges should provide DNOs with opportunity to recover, within reason, the NP costs that are caused by the RNO subscriber's decision to port its number.

The ***relevant cost*** principle requires that only those costs that are *incremental* to providing NP should be recovered through inter-operator charges. Costs that are incurred in relation to providing both NP and other services should be distinguished from those that are incurred solely for the provision of NP. If an operator can recover costs that are common to other services through its inter-operator NP charges, it would not necessarily have the incentives to reduce or minimise these common costs.

The relevant costs for inter-operator charges are the Long Run Average Incremental Costs of (LRAIC) of providing the service. LRAIC consists of all variable costs and those fixed costs that are directly attributable to the incremental change in NP services, as well as a share of indirect costs discernibly caused by the provision of NP. Indirect costs that are fixed, or invariant with the provision of NP, are not included in the incremental cost measure. LRAIC includes capital costs such as depreciation of relevant assets, cost of capital employed, and all incremental operating expenses. Capital costs are included in LRAIC because, in the long run, the costs of replacing fixed assets for the provision of services are variable. Cost of capital is also relevant because carriers should be allowed to earn a reasonable return on capital employed to NP.

Distribution of benefits is an important consideration in that charges should reflect that porting *and* non-porting subscribers benefit from NP. Industry-wide benefits result from intensive competition, such as product differentiation, improved quality of service, reduced consumer prices, etc., therefore it can be argued that porting customers (and their respective operators) should not be required to bear the entire cost of NP.

Charging principles designed to promote achievement of the Government's policy objectives also require that charges be symmetrical, reciprocal and practical. Reciprocity is a

necessary requirement of a fair and equitable interconnection environment that does not favour any carrier or group of carriers. Symmetrical charging is consistent with the requirement that charges should be simple and cost effective to administer. Ideally, FLEC based charges should yield symmetrical results since the most efficient technology should be used in delivering NP.

Types of NP Costs

The structure of costs for NP varies with the technological implementation and with the specific institutional arrangements selected by the industry. From an economic point of view, these costs fall into a limited number of categories, each of which can be separately analysed. There are three categories of costs: system set-up costs, administrative costs, and recurrent charges.

System Set-up Costs

System set-up costs result from the decision to implement NP and are incurred at the outset of implementation, i.e. they are one-time costs. Porting the number of any particular customer does not cause these costs. These costs vary with the technology used to implement NP, however, the relevant costs fall into two major categories:

- The costs of establishing and maintaining the databases that contain information on ported numbers; and
- The costs of software upgrades necessary to modify switches so that they can route calls to ported numbers.

It is useful to note that OFTEL also includes the establishment of systems used to support billing and administration of NP as system set-up costs.[4]

System set-up costs would be incurred in conditioning an operator's network for NP and would not be avoided even if *no* subscribers subsequently ported their numbers. Accordingly, *the principle of cost causality would imply that these costs should not be recovered through charges to a porting customer.*

OFTEL, the Office of the Telecommunications Authority of Hong Kong (OFTA), and the Australian Communications Authority (ACA) prescribe that system set-up costs should be borne by the operator incurring those costs. The ACA goes further to state that if a DNO is permitted to charge for such a service, it could deter efficient entry into the market. In the US and Canada, NP is provided by centralised and/or regional organisations to the industry as a whole. The industry participants share the system set-up costs that are incurred by these organisations. Therefore, the charging practices in the US and Canada have little bearing on NP arrangements in Singapore.

Although the magnitude of system set-up cost may not be exactly the same across operators, the principle of cost minimisation is best served by a rule requiring each operator to bear its own costs. If inter-operator charges for system set-up costs were permitted, each operator would have an incentive to raise its charges to other operators and this would raise their rivals' costs thus making it harder for them to compete. By requiring each operator to bear its

4 OFTEL, Number Portability in the Mobile Telephone Market, July 1997, page 19.

own costs, IDA forecloses opportunities for a telephone operator to raise its rivals' (and society's) costs, and give the operators incentives to minimise their costs.

IDA has stated that system set-up costs are to be borne by each operator unless "an operator incurs costs in support of number portability implementation from which it does not benefit." IDA's initial view that each operator should bear its own system set-up costs is broadly consistent with the principles of cost causality, effective competition and cost minimisation. It is reciprocal and symmetrical, and practicable.

Administrative Set-up Costs

Administrative costs are caused directly by a particular subscriber's request to have his number ported. IDA defines administrative costs as those costs that are incurred by the DNO or any third party operator to process a subscriber's application to port their number to the RNO. To effect number portability all other operators must adjust their databases so that their switches will know that calls to this subscriber should be routed to the subscriber's new operator's network. In certain NP network architectures switches must be reconfigured to redirect calls to the new location of the ported customer, or alternatively, local databases or a SCP must be updated when a subscriber ports. Comparatively, in a typical full Intelligent Network (IN) implementation, each SCP must be updated every time a customer changes operators and ports his number. Therefore, both incumbent and new operators are likely to incur the same types of costs in updating their number databases when customers choose to port their numbers.

Incumbent operators often argue for cost-based prices for administrative set-up costs because they are concerned that artificially low prices may promote too much porting. For example in the UK, in the inquiry by the Monopolies and Mergers Commission (MMC) into Telephone Number Portability, British Telecom claimed that the "absence of any charges would lead to excessive porting and a waste of resources, primarily those of BT."[5] In Hong Kong, Hong Kong Telephone Company Limited (HKTC) argued that "customers for whom the value of porting [is] lower than the real cost of porting will still port, with below cost-recovery pricing meaning that more customers will port than is economically efficient, and there will be a misallocation of resources within telecommunications companies towards porting and away from other services."[6] This view focuses on the wrong problem: it is not excessive porting that should be guarded against, but insufficient porting.

Cost-based charges (where inter-operator charges are based on the per line set-up cost) of NP could lead to an *inefficiently low* level of porting. Public policy can address this market failure by pricing NP below the level that would be cost-justified because of the intangible external benefits that are likely to accrue to all subscribers of telecommunications services (e.g. Type 3 benefits). OFTEL concluded, "that it would be wrong in economic terms not to recognise these external benefits and to load all costs onto porting customers."[7] In Hong Kong and the UK, administrative costs are recovered from the RNO by the DNO through inter-operator "per line set-up" charges. In Australia, DNOs are not permitted to recover their administrative costs from RNOs.

5 Mergers & Monopolies Commissions Report, Para 1.11.

6 Hong Kong Telephone Limited Submission on NP Discussion Paper, 15 April, 1997, at p 49.

7 OFTEL, Inquiry by the Monopolies and Mergers Commission into Telephone Number Portability: Explanatory Statement from the Director General of Telecommunications, p 18.

Economic efficiency arguments indicate that it may be advisable to keep the price for the administrative services *below* their incremental cost. Because it is difficult to quantify external benefits, IDA defines incremental costs narrowly to keep charges at a minimum. Furthermore, the porting decision will coincide with the decision to switch operators, and certain costs will be common such as those relating to turning off the old service, turning on the new service, and updating the NP database, for example. It could be decided that none of these types of common costs should be allocated to per line set up charges and that short- or medium- term incremental costs be used instead of long-term costs.

To some extent, IDA has provided RNOs with the flexibility to choose between charging their newly ported subscribers a fee for porting their numbers or treating porting costs as overhead costs to be recovered from marking up other services over their incremental cost, or costs to be averaged into their rates to ported and non-ported subscribers alike. However, because IDA has directed RNOs to reimburse the DNO for the database update and administrative costs that it incurs, the quantum of the inter-operator administrative charge should be determined by applying a narrow definition of incremental cost. A low inter-operator charge reflects the external benefits expected from NP.

IDA has also considered that there may be a possibility of subsequent portability and hence, had reviewed the appropriate charges applicable under this situation.

Subsequent Portability – Fixed Networks

In a multi-operator environment, to effect subsequent portability, some work will need to be carried out by the new Recipient Network Operator (RNO), the original Donor Network Operator (DNO) the original RNO, and other network operators that maintain databases to support Fixed Number Portability (FNP).

In Hong Kong, RNOs are required to compensate all operators who must update their databases to support a porting request, irrespective of whether the number is being ported for the first time or subsequently. In the case of Singapore, where the FNP technical approach is an Intelligent Network (IN) solution based on the Query on Release method, the extent of work required to accommodate subsequent number porting will vary among operators. The new DNO (i.e. former RNO) will incur the same types of costs as those associated with processing a typical first-time porting application. However, all other operators will simply need to update their databases. These updates could be performed during ongoing database maintenance; of which the magnitude of, and incremental cost associated with, this work is likely to be considerably lower compared to the cost of a first-time porting application.

Therefore, a two-tiered inter-operator charge for administering subsequent portability will be applicable:

- The new RNO shall compensate the new DNO (former RNO) on a per application, per number basis ; and
- The new RNO shall also compensate all other operators who must update their number databases on a per application, per operator basis. However, since the costs incremental associated with this function are expected to be very small, IDA will be considering reducing the quantum of this charge to zero over time.

Subsequent Portability – Mobile Networks

In the case of Mobile Number Portability (MNP), given that a call forwarding solution has been implemented in Singapore, a request for subsequent portability from the new RNO will require the original DNO to adjust the unconditional call forwarding setting on its switches to reflect a new destination network (namely the network of the new RNO). Only the original DNO would incur costs to effect the subsequent portability request. In this case, the original RNO would not incur any costs to update its databases. Therefore, the one-time set-up costs will be paid by the new RNO to the original DNO.

Conveyance Costs

Conveyance costs are the *additional* costs involved in routing a call to a subscriber with a ported number, compared to the costs involved in routing a call to a subscriber with a non-ported number. For example, with Remote Call Forwarding (RCF), additional switching and signalling resources are used during call set-up to a ported number, and additional transmission capacity (voice circuit-miles) are used during the call itself. With full IN implementation, every call consumes more signalling resources during call set-up, but there is no incremental use of transmission capacity during the call itself.

The volume of additional conveyance resulting from NP depends on the architecture and technology chosen to implement NP. Fixed and mobile networks have different requirements for call routing under NP, and accordingly, NP in the context of each type of network is discussed separately.

NP in Fixed Networks

In IN network implementations, SCPs are used to route calls to their destinations. It is assumed that StarHub's IN implementation of NP on its network will not cause the operator to incur any incremental costs in conveying calls to ported numbers. That is, calls to both ported and non-ported numbers will use the same call set-up routine and make use of the same signalling and voice circuit resources.

Upon review of SingTel's call routing for calls to ported numbers, calls originating on its network to numbers that have been ported to a different operator's network are first routed to the local switch that previously served the called party. This (previous) destination switch notifies the originating switch that the number has been ported at which time the originating switch then consults the SCP for the new destination switch. Consequently, in the case of SingTel's network, the call may use more signalling capacity than a standard call between SingTel and an interconnected mobile or fixed operator.

However, two types of calls to ported numbers do not consume additional signalling capacity relative to similar types of calls to unported numbers:

- First, consider a call to a customer who has ported his number from say StarHub to SingTel. Suppose a call to this customer originates on the SingTel switch currently serving him. By consulting its local database, the switch can most likely complete this call without reference to the SCP, thus consuming no more resources than a standard call to a non-ported number on the switch.

- Second, consider a call from a SingTel subscriber to a Directory Number (DN)[8] originally assigned to StarHub. Such a call will be completed with the assistance of the SCP, regardless of whether that number was ported or not.

The additional signalling capacity required to support NP will depend on the number of inter-switch calls to ported numbers within SingTel and the number of calls to subscribers of the new entrants. However, a customer's porting decision may have a minimal incremental impact on SingTel's signalling costs. Consider a SingTel customer who decides to switch providers and become the customer of a new entrant. If this customer ports his number, calls originating on SingTel's network will need to consult the local database of the switch the ported number originally resided on for proper routing of the call. If the customer does not port his number, his new provider will assign him a new number and calls from a SingTel subscriber to this subscriber will necessarily consult the SCP. It follows that either the SCP or a local database will be consulted for calls to every customer that leaves SingTel's network, whether or not that customer ports his number. It is unlikely that signalling on calls to ported numbers is more resource intensive than calls to DNs assigned to a new entrant. The cost causality principle would then require that no distinction be made in between calls to ported and unported numbers. Put differently, NP in the case of fixed telecommunications networks does not justify a specific charge for conveyance.

In the case of FNP, the principle of effective competition leads to the same conclusion, namely that each operator bears its own costs of conveyance. An inter-operator charge for conveyance leaves open the possibility for an operator to raise its rivals' costs by either setting its charges above cost (if it experiences a net outflow of customer porting their numbers) or setting charges below cost (if it experiences a net inflow of customer porting their numbers). In addition, by requiring each operator to bear its own costs, operators will have every incentive to keep their conveyance costs down. *Accordingly, over the longer term, IDA will be reconsidering its original position of allowing conveyance charges, to directing that each operator bears its own conveyance costs.* Prior to effecting such a transition in principles, IDA may require operators to support a study on NP conveyance costs. The study would need to determine the incremental conveyance costs associated with alternative call routing scenarios for calls to ported and non-ported numbers.

NP in Mobile Networks

In the case of MNP in Singapore, both SingTel Mobile and MobileOne currently use Operator Call Forwarding (OCF) technology to effect number portability. However, OCF is an interim technology solution and that a more efficient NP approach is expected to be implemented by April 2001.

Calls to ported numbers are forwarded to a central database where the ported destination is determined. Subscribers who have ported their number to another operator cause the costs of performing this additional conveyance and interrogation. The additional costs incurred here include signalling resources to the database and the database "dip" itself. In this situation, if the originating carriers must determine the destination for calls to a ported number, cost causality suggests that they should recover the costs of the additional conveyance and

[8] The Directory Numbers (DN) are assigned in blocks to each telecommunications carrier. The DN provides an immediate indicator of the destination network of a call particularly if the DN belongs to another network operator and therefore calls to another operator's DN would be directly routed to the Interconnection Gateway.

database interrogation.

Currently there are two types of conveyance charges in the case of MNP, i.e. 1) *access charge*, which is to reimburse the DNO for the cost of routing a call to a ported number under OCF; 2) *monthly recurrent charge*, which is to recover the cost of operating, maintaining and updating the NP database. The latter, in essence, implicitly assumes a certain number of database interrogations per ported customer, and spreads the cost of operating, maintaining and updating the database across the total number of ported customers. On the other hand, a per-dip charge can otherwise be calculated if sufficient information about database interrogation is provided.

There may be merit in permitting operators to recover the costs associated with database interrogation functions that are required to support MNP. To motivate operators to implement more efficient conveyance practices, IDA will be considering phasing out conveyance charges by 1 April 2001, at which time a more comprehensive review of the access and monthly recurring charges associated with NP will be undertaken.

Subsequent Portability

From the original DNO's perspective, in the case of both FNP and MNP, the calls will be routed to the new RNO no differently from the way they were previously routed to the original RNO: all calls will be routed the same way over its network. Therefore, the conveyance charges for FNP and monthly recurring charges for MNP shall apply. Charges will be paid by the new RNO to the original DNO.

Determined Charges

The table below shows the determined charges for FNP.

Table 3: Determined Charges for FNP

One-time charge per ported number*	
• Application	**$9.50**
• Port-back	**$9.50**
• Termination	**$9.50**
• Withdrawal	**$4.50**
Subsequent Portability	
• Application**	**$9.50**
• Database updates***	**$4.50**
Conveyance charge per database dip****	**$0.0040**

* Irrespective of time-of-day of processing and activation.
** Payment by new RNO to the new DNO.
*** Payment by the new RNO to all operators who must update their databases.
**** Payment by the new RNO to the original DNO.

The rationale supporting the determinations is as follows:

- The charges reflect the LRAIC standard using narrow definition of incremental costs. Costs that are indirect fixed, and are incurred to provide NP services and other telecommunications services, are excluded.
- The charges determined should stimulate operators into adopting efficient application administration practices and conveyance practices, since charges have been made to account for potential economies of scale that could be realised for more efficient operations and to account for reduced consumption of network resources if more efficient routing practices were adopted.
- The charges set will allow operators to recover the incremental costs associated with NP along with a financing charge on capital resources that were consumed in the provision of NP.
- Charges are symmetrical as required by IDA.

Comparison with Other Jurisdictions

A comparison of the determined charges to charges in other jurisdictions suggests that they are comparable to international benchmarks.

Table 4: Comparison of FNP Charges to charges in the UK and Hong Kong

Charges in local currency					
Singapore ($S)		**United Kingdom (£)**[9]		**Hong Kong ($HK)***	
One-time charges		**Per-line set-up Charges**		**Per line set-up charges**	
Application	$9.50	*Digital Exchange*		Proposed by HKTC	$HK 200
Port-back	$9.50	Fax no Real Time Router	£5.52		
Termination	$9.50	EDI no Real Time Router	£4.32		
Withdrawal	$4.50	Fax and Real Time Router	£4.79		
Daytime Activation.	$9.50	EDI and Real Time Router	£3.59		
		Block transfer costs – at least 10,000 numbers			
		Fixed Charge	£2,038.72		
		Zone Charge	£45.27		
		Processor charges			
		System X exchange	£47.37		
		AXE10 exchange	£49.59		
		BT Ale	£66.64		
Recurrent charges per call		**Additional conveyance charge per minute**		**Conveyance charges**	
Conveyance	$0.0040	Average	£0.00100	"General conveyance"	None
		Daytime	£0.00129		
		Evening	£0.00076		
		Weekend	£0.00059		
Charges translated to Singapore dollars.					
Singapore ($S)		**United Kingdom (£)**		**Hong Kong ($HK)**	
Exchange rate: $1 S = $1 S		*Exchange rate: £1 = $ 2.73S*		*Exchange rate: $1 HK = $ 0.22 S*	
One-time charges		**Per-line set-up Charges**		**Per line set-up charges**	
Application	$9.50	*Digital Exchange*		Proposed by HKTC	$S 44.00
Port-back	$9.50	Fax no Real Time Router	$15.07		
Termination	$9.50	EDI no Real Time Router	$11.79		
Withdrawal	$4.50	Fax and Real Time Router	$13.08		
Daytime Activation	$9.50	EDI and Real Time Router	$9.80		
		Block transfer costs – at least 10,000 numbers			
		Fixed Charge	$5,565.71		
		Zone Charge	$123.59		
		Processor charges			
		System X exchange	$129.32		
		AXE10 exchange	$135.38		
		BT Ale	$181.93		
Recurrent charges per call		**Additional conveyance charge per minute**		**Conveyance charges**	
Conveyance	$0.0040	Average	$0.00273	"General conveyance"	None
		Daytime	$0.00352		
		Evening	$0.00207		
		Weekend	$0.00161		

* Charges are still in the process of being determined in Hong Kong.
Note 1 Charges in the US and Canada are not comparable due to different inter-operator network arrangements.

[9] OFTEL, "Number Portability Costs and Charges", Determination and Explanatory Document, January 1997

In comparing the quantum of the charges across jurisdictions, it is difficult to draw any reasonable conclusion, except that, in terms of Singapore's currency, the charges determined in Singapore fall between NP charges in the UK and in Hong Kong.

- It is important to note, however, that the charges determined by OFTEL are based on a Fully Allocated Cost (FAC) standard, thereby explaining why UK's charges are higher than those determined for Singapore.
- The UK has established per line set-up charges for block portability, which suggests that there are economies of scale in processing applications in batches. In comparing the per line set-up charges for a single digital line, using the Fax no Real Time Router, the administrative charge of $15.07 per line is significantly higher than the per line set-up charge for a single line which is set up within block arrangement. (i.e. Total block portability cost of $6,135 divided by 10,000 lines equals $0.61 per line). Therefore, it is probable that there are potential for economies of scale in the administrative processing of applications.
- The structure of FNP charges proposed in Hong Kong appear to be simple to administer since one charge is levied for successful NP applications. It is presumed that the cost of other NP activities (e.g. termination and withdrawals) are treated as either overhead costs which are shared with other services or that these costs are rolled into the cost of administering successful porting applications.
- The recurrent conveyance charge determined for Singapore is comparable to the additional conveyance charge imposed in the UK, assuming an average call duration of 3 minutes.
- Hong Kong does not permit operators to charge for standard conveyance services.

Other Considerations

The determined charges shall apply for an interim period of one year, after which all operators should have sufficient evidence to validate the charges they can propose in the future. In the future, operators will be required to demonstrate that their proposed charges are based on costs that would be avoided if NP were not to be provided in the long term – particularly those relating to conveyance of calls to ported numbers.

To put all operators on a level playing field, IDA will be maintaining its position of requiring that NP charges be reciprocal and symmetrical – to do otherwise would create a competitive imbalance among operators in the early years of competition.

Finally, IDA will also be considering the streamlining of the various types of NP application charges to one single charge (i.e. bundling port-back, termination, withdrawal and day-time activation charges into NP application charges). This would simplify inter-operator transactions with regard to NP as well as the longer-term operator/customer relationships.

Determined Charges

The table below sets out the charges determined for MNP.

Table 5: Determined Charges for MNP

Administration	**$10.50**
Administration – Subsequent Porting*	**$10.50**
Monthly recurring	**$5.50**
Access charges:	
• *Peak*	**$0.014**
• *Off-peak*	**$0.007**

* Payment by the new RNO to the original DNO.

There is no application charge for port-back activity in the case of MNP due to the current call forwarding solution that is in place. The original DNO (and now the new RNO) will be the only operator incurring any costs; that is only the original DNO will need to reset its call forward setting on it switches.

The rationale supporting the determinations is as follows:

- The charges reflect the LRAIC standard using narrow definition of incremental costs. As well the FLEC perspective has been assumed. This is consistent with the charging principles directed to operators;
- Charges are set to allow operators to recover the incremental costs associated with NP along with a financing charge on capital resources that were consumed in the provision of NP; and
- Charges are symmetrical as required by IDA.

Comparison with Other Jurisdictions

A comparison of the determined charges to charges in other jurisdictions suggests that they are comparable to international benchmarks.

Table 3: Comparison of MNP Charges to charges in the UK and Hong Kong

Charges in local currency					
Singapore ($S)		**United Kingdom (£)[10]**		**Hong Kong ($HK)***	
Administration	$10.50	**Administration**	£0*	**Administration**	$26.00
Monthly recurring charge	$5.50	**Monthly Recurring Charge**	None	**Monthly Recurring Charge**	None
Access Charge **Peak** **Off-peak**	 $0.014 $0.007	**Donor Conveyance Charge** (per minute)	£0.0160	**Database Interrogation Charge**	$0.0119

[10] OFTEL, "Number Portability Costs and Charges", Determination and Explanatory Document, January 1997

Charges translated to Singapore dollars.					
Singapore ($S)		**United Kingdom (£)**		**Hong Kong ($HK)**	
Exchange rate: $1 S = $1 S		*Exchange rate: £1 = $ 2.73S*		*Exchange rate: $1 HK = $ 0.22 S*	
Administration	$10.50	**Administration**	$0*	**Administration****	$5.72
Monthly recurring charge	$5.50	**Monthly Recurring Charge**	None	**Monthly Recurring Charge**	None
Access Charge **Peak** **Off-peak**	 $0.014 $0.007	**Donor Conveyance Charge** (per minute)	**$**0.0437	**Database Interrogation Charge**	$0.0026

* The network operators have a zero fee for per-line set-up costs, but the service providers charge exporting customers up to a £30 fee.
** This charge is paid to all other operators by the RNO.

The charges determined for Singapore fall within the range of charges that are practised in the UK and Hong Kong.

- It is important to note, however, the charges determined by OFTEL are based on a Fully Allocated Cost (FAC) standard, thereby explaining why the UK's charges are higher than those determined for Singapore. As well, monthly recurring charges are not levied in the UK and Hong Kong because conveyance charges in these countries could be much higher
- There is no administration charge in the UK, however service providers can charge subscribers up to a £30 (or S$82) for porting their numbers.

Other Considerations

The level of detail and analysis supporting MNP charges was substantially lower than that provided for FNP charges. Accordingly, the extent to which a detailed analysis could be performed was limited to the scope and depth of the information provided in the submissions.

Most importantly, IDA will be considering eliminating access and monthly recurring charges after 1 April 2001. To do so, however, would require some consultation from operators to demonstrate the extent to which signalling and transport facilities are consumed with calls to ported numbers and whether the total cost associated is material in the context of the operators' operating and capital costs.

The charges determined shall apply on an interim basis, until all operators have sufficient evidence to validate the charges they can propose in the future, as follows:

- ***Fixed Number Portability:*** An interim period for one year. By the end of the period, StarHub will have established a year's data in NP statistics, processing costs, application times, etc, as well as a year's worth of financial activity to support and validate its information.

  Also within one year, new fixed operators will have entered the market and this will influence the way FNP is technically supported in the market. The nature and type of FNP interactions between operators will change, which in turn will significantly influence the NP charges.

  There may also be a need to consider the impact of inter-operator calls between fixed and mobile operators. For example a need to understand how fixed operators accommodate Mobile Number Portability (MNP); that is, it may be important to understand the extent to which fixed operators will need to accommodate mobile customers who are porting their numbers and vice versa.

- ***Mobile Number Portability:*** An interim period for six months. The quality of data provided by the three mobile operators impacted the level of detail of the analysis performed currently on the operators' submissions. In the case of MNP, several assumptions and generalisations were made to normalise the data across all three operators.

  As it is more likely the case that come 1 April 2000, StarHub (i.e. RNO) will cause SingTel Mobile and MobileOne (i.e. DNOs) to incur costs when customers port their numbers to the former. These types of inter-operator relationships need to be better understood and the quality of data needs to be improved to make a better assessment of the charges. For instance, in Hong Kong, the RNO's reimburse the DNOs who incur charges to update their number database. To increase the quality of the information provided for subsequent reviews, IDA will be considering the undertaking of a special study, outlining the terms of reference for the study and the types of calculations that the operators are required to submit, to determine MNP charges.

In the future, operators will be required to demonstrate that their charges are based on costs that would be avoided if NP were not to be provided in the long term – particularly those relating to conveyance of calls to ported numbers. It is anticipated that further, future reviews will be required, triggered by one or more of the following events occurring:

- ***Entry of new fixed and mobile operators***. An increase in the number of fixed and mobile operators will influence how NP applications need to be processed and will increase the number of operators who would be affected by customer porting their numbers and this could, likely, influence the way NP applications are processed and the way calls to ported numbers are transported between networks. Furthermore, newer entrants will employ the latest technologies to support NP, and thus charges that are based on cost information supplied by these new entrants will encourage all operators to adopt more efficient technologies and business processes.
- ***Increased complexity in inter-operator calls***. An increase in the number of the types of calls to ported numbers (e.g. calls from fixed to mobile networks, calls from mobile to

fixed networks, calls between fixed networks, calls between mobile networks). This increased complexity will influence the way NP applications are processed, databases are updated and the way calls to ported customers are transported (conveyed) through the networks.

- ***Changes in NP platforms / conveyance methods***. Introduction of new network applications and technologies will affect the way NP applications are processed, databases are updated and the way calls to ported customers are transported (conveyed) through the networks. The change in technology could significantly reduce costs of conveyance, for instance.
- ***Insufficient porting***. International trends suggest that anywhere from 1.5% to 4% of the incumbent's subscriber base could port their numbers. IDA will require operators to provide number portability statistics on an ongoing basis and if Singapore has a low volume of porting subscribers (relative to other countries such as the United Kingdom or Hong Kong), an investigation into porting activity and the level of NP charges will be undertaken.

To put all operators on a level playing field, IDA will continue to maintain its position of requiring that NP charges be reciprocal and symmetrical – to do otherwise would create a competitive imbalance among operators in the early years of competition.

Most importantly, IDA will be considering eliminating access and monthly recurring charges pertaining to MNP after 1 April 2001. IDA will consult operators, whereby operators will be required to demonstrate the extent to which signalling and transport facilities are consumed with calls to ported numbers and whether the total cost associated is material in the context of the operators' operating and capital costs.

Finally, IDA will be considering the streamlining of the various types of NP administrative charges to one single NP charge (i.e. bundling port-back, termination, withdrawal and day-time activation charges into application charges). This would simplify inter-operator transactions with regard to NP, as well as longer-term operator/customer relationships.

Enquiries

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Annex 1: Costing Principles for Number Portability

1 COSTING / CHARGING PRINCIPLES

1.1 Charges for number portability shall be established based on Long Run Average Incremental Cost (LRAIC) allocated between parties based on cost causation, cost minimisation and reflective of the external benefits accruing to end-users and industry.

2. INTER-OPERATOR NUMBER PORTABILITY CHARGES

2.1 The following guidelines shall be adopted by operators when determining the inter-operator charges for number portability:

(a) the costs of setting up the number portability system or capability within each operator's network shall be borne by each operator. This would include costs of any switch software modification and operational support system upgrades to cater for number portability. The operator shall not pass on these costs to the other operators requesting number portability. However, if an operator incurs costs in support of number portability implementation from which it does not benefit (e.g. a fixed network operator implementing a different system solely to support mobile or paging number portability), then it should be able to recover these costs in full from the operators who do benefit.

(b) the administrative costs of porting a number should be recovered from the importing operator. Administrative cost would refer to the costs incurred by the exporting operator or any third party operator to process the application for number portability by a customer and bring it into effect. The importing operator may choose t pass these charges to the customer or absorb the charges.

(c) the costs of any additional network capacity to support calls to ported numbers should be borne in part by the operator which incurs them and recovered in part from the importing operator. This should preferably be levied as a one-off charge at the time of porting.

2.2 Where the operators fail to come to an agreement on the charges, they may approach IDA for determination. IDA will determine the charges based on benchmarks computed based on LRAIC principles. IDA's decision shall be final.