

Appendix 1

Interconnection/Access In A Fully Liberalized And Convergent Environment

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**REPUBLIC OF SINGAPORE
INFOCOMM DEVELOPMENT AUTHORITY
OF SINGAPORE**

Infocomm Development Authority of Singapore

TABLE OF CONTENTS

1. INTRODUCTION	3
2. APPROACH TO INTERCONNECTION	4
3. SCOPE OF INTERCONNECTION PRINCIPLES	6
4. OBLIGATIONS OF LICENSEES	8
5. CHARGING STANDARDS	9
6. RESPONSIBILITY FOR CHARGES	11
7. STRUCTURE OF CHARGES	12

1. INTRODUCTION

- 1.1. With the move toward the full liberalization of the telecommunications industry, the Infocomm Development Authority of Singapore (IDA) encourages the entry of new players and the expansion of existing players into an increasingly dynamic market. In fostering the new info-communications market place, the IDA would like to collaborate with players to ensure the development of a vibrant market place and in particular, to rollout broadband infrastructure and to increase the availability of broadband services.
- 1.2. The interconnection policy approach and regulatory framework as set out in this paper will form Appendix I of the Code of Practice for Competition in the Provision of Telecommunication Services (“Code”). This document outlines the approach that the IDA intends to implement with respect to the regulation of interconnection, including broadband interconnection.
- 1.3. In setting the interconnection and access policy direction and regulatory regime, the IDA is guided by the following policy goals:
 - 1.3.1. Develop the ICT sector as a major sector of growth by positioning Singapore as a vital node (includes technology platforms, knowledge capital, and transparent pro-business pro-consumer regulations) in the regional and global information networks of the future;
 - 1.3.2. Prepare Singapore for the information society of the future by ensuring all sectors of consumers enjoy the benefits of ICT, thereby reducing the risk of a “digital divide” in Singapore society;
 - 1.3.3. Encourage companies in all other economic sectors to leverage on ICT as a competitive tool.
- 1.4. To support these goals for Singapore, the IDA’s policy objectives with respect to interconnection and access are as follows:
 - 1.4.1. Actively encourage infrastructure investment, in particular, in new and ubiquitous broadband infrastructure; and international connectivity and capacity;
 - 1.4.2. Actively promote the development and use of innovative services, including interactive multi-media broadband services; and
 - 1.4.3. Irrespective of the network to which a customer is connected, ensure seamless, any-to-any, system and service connectivity.

After considering the respective comments from industry participants, the IDA believes that the interconnection and access framework outlined below meet these policy objectives.

2. APPROACH TO INTERCONNECTION

- 2.1. The policy objectives require meaningful competition in both intra-network infrastructure, i.e. similar types of networks or technologies, and inter-network infrastructure i.e. alternative types of networks or technologies. Intra-network competition has been achieved to some extent through the entry of new mobile and fixed network licensees. The IDA is considering ways and means to stimulate inter-network competition, especially where restrictions on the use of necessary facilities form barriers to broadband access.
- 2.2. To cope with the ongoing changes in the market and the latest technological developments, especially in the broadband environment, the IDA expects to regularly review the Code and will forebear from regulating interconnection if it believes that customers and licensees will be better served without such regulation. Alternatively, the IDA will continue to refine and improve the interconnection and access policies where necessary.
- 2.3. The IDA will act wherever necessary to ensure that deployment of broadband to all customers proceeds at a reasonable and timely pace. The IDA will continue to monitor the deployment of broadband and the extent to which broadband facilities and services are available for all.
- 2.4. The IDA will mandate that access to Essential Support Facilities (ESF) and Unbundled Network Elements (UNE) are available to Facilities Based Operators to enhance their ability to enter the market. The IDA will also mandate that physical interconnection for the purpose of any-to-any connectivity as well as for gaining access to the support facilities and unbundled network elements is implemented. One area that appears to be a particular concern is access to international facilities. Facilities Based Licensees will have the right to acquire Indefeasible Rights to Use on international facilities including satellite and submarine cable systems. The IDA believes that in the short-term, policy interests will be best served if licensees can efficiently share transmission capacity and necessary network components, including those required for broadband services. In addition to easing the entry of new licensees, this will also promote any-to-any system and service connectivity and access for consumers.
- 2.5. The IDA supports, in principle, the notion of relying on market forces, where all licensees are able to agree on interconnection terms in a commercially negotiated manner. However, the market is currently underdeveloped and not yet fully competitive. As a result, the IDA will work with dominant licensees to specify the pricing and availability of a core group of interconnection related services. These prices will be valid

Infocomm Development Authority of Singapore

for a period of three years, after which the IDA will reassess the competitiveness of the market and whether it can support interconnection charges based on commercially negotiated terms, with ceilings and floors as guidelines, where necessary. The IDA believes that prescribed interconnection charges will ensure a level playing field for all new entrants, while the time limit of three years will provide additional incentive for new entrants to invest in infrastructure.

- 2.6. The interconnection rights and obligations of licensees with different levels of market power, and between infrastructure and service providers will be revised in the new Code. The IDA understands the argument against removing reciprocal access and the subsequent ability of new licensees to “cherry-pick” an incumbent’s customers. The IDA will ensure that incumbents are fairly compensated for providing access, including a fair return for the commercial risk undertaken by deploying new and advanced technology. Thereafter, any competitive advantage created by new entrants is seen as a result of service innovations and efficiency in retail, regardless of reciprocity in interconnection regulation.
- 2.7. The IDA does not support asymmetric interconnection charges. Each licensee will incur equivalent charges for interconnection related services. These charges will be a result of the service provided not of the technology platform used.
- 2.8. The IDA will not compensate licensees for the perceived risks taken in providing broadband services by permitting an additional premium to be included in the cost of capital. The experience in broadband deployment in other jurisdictions does not support the notion that such an investment carries a higher risk. Publicly available data illustrate that many companies in virtually all segments of the communications industry have made tens of billions of dollars of investment in broadband facilities. Deployment of broadband, both backbone and last mile, is occurring on a major scale, for both business and residential markets. Investment on this scale indicates strongly that, at the level of technological development and manufacturing, advanced telecommunications capability is available at reasonable cost. Companies and the capital markets are obviously betting that broadband will be successful in both business and residential markets and many companies are rushing to seize part of that success. Inclusion of a risk premium in the cost of capital is unjustified as it would increase interconnection costs and serve as an impediment to development of competition.
- 2.9. The IDA wishes to give licensees maximum flexibility in their network and technology decisions and will continue to adopt a technology neutral approach towards interconnection, the platforms adopted, and the configurations deployed. The revisions for interconnection, including broadband interconnection, are focused on meeting the policy objectives with respect to the five key dimensions of the interconnection framework:
 - 2.9.1. *Scope of Interconnection Services*, specifying the classes of licensees and their associated rights and obligations with respect to interconnection related services (IRSs);

- 2.9.2. *Obligation to Provide Interconnection Services*, specifying the principles which govern the actions of licensees in providing IRSs and the conditions under which these arise;
- 2.9.3. *Responsibility for Charges*, prescribing which licensee should pay or receive payment for IRSs;
- 2.9.4. *Cost Standards*, setting out the rules to determine which cost items should be included in the determination of interconnection charges and the costing methodology for ascertaining the level of these charges; and
- 2.9.5. *Structure of Charges* describing the principles governing how charges should be configured to properly reflect the underlying cost behavior.

3. SCOPE OF INTERCONNECTION PRINCIPLES

- 3.1 Currently, the IDA has set four major classes of IRS for traditional telephony-based context, i.e. physical interconnect (PI); origination, transit, and termination (O/T/T); unbundled network elements (UNEs); and essential support facilities (ESFs). These four major classes of IRS will remain under consideration for interconnection charging purposes. All types of info-communications services, voice, video, text, and multi-media; and all types of traffic, one-way, two-way, point-to-point and point to multi-point will be considered to be within the jurisdiction of the proposed COP.
- 3.2. In general:
 - 3.2.1. PI is the linking of two networks to enable the exchange of traffic and/or to provide access to ESFs and UNEs.
 - 3.2.2. Origination, Transit, and Termination (O/T/T) services involve the switching, routing, and transmission of telecommunications traffic between network licensees. O/T/T services allow traffic originated on one network to terminate or transit through another network. The dominant licensee is responsible for providing origination, transit and call termination services to any licensed requesting licensee (either an FBO or an SBO). For all O/T/T services the dominant licensee must also provide signaling interconnection.
 - 3.2.3. UNEs are physical network facilities and the associated services they support that may be de-coupled from the dominant licensee's network and connected to the requesting licensee's network.

- 3.2.4. Essential Support Facilities (ESFs) are those passive support structures, for which no practical or viable alternatives exist, that enable the deployment of telecommunications infrastructure.
- 3.3. The IDA is considering the following changes to the four IRSs to be relevant in the broadband context.

Table 1: Changes to the IRS Considering the Broadband Context

PI, UNE, ESF	<ol style="list-style-type: none"> 1. Expanding the list of POIs, POAs, UNEs, and ESF to accommodate all types of inter and intra network interconnection. 2. In contrast to the traditional telephony-based narrowband context, broadband interconnection permits many licensees to share the available capacity at POIs.
O/T/T	<ol style="list-style-type: none"> 3. One-way, point-to-multipoint, and transit considerations will need to be included in the treatment of O/T/T services.

- 3.4. Physical interconnection may take place at a number of points in the network. For traffic exchange it can occur at the following points of interconnection (POI):
- Interconnect gateway switches;
 - Signaling transfer points;
 - Local switches – line side and trunk side.

Facilities based licensees will be able to take advantage of physical interconnection (by virtue of the co-location tariffs) while service based operators will only have access to virtual interconnection.

- 3.5. Physical interconnection may also take place to provide access to unbundled network elements, unbundled network services and essential support facilities. For access to unbundled network elements it can occur at the following points of access (POA):
- Distribution frames (Exchange MDF, Building MDF, Roadside MDF);
 - Fiber distribution frames;
 - Digital Cross connect frames or Add / Drop Multiplexers.

For access to essential support facilities and unbundled network elements it can occur at the following points of access (POA):

- Lead in ducts / manholes;
- Exchange cable vaults;
- Exchange buildings (tandem, local, international and interconnection);
- Building equipment rooms;
- Roof spaces.

- 3.6. The following O/T/T services will be mandated: PSTN Voice, ISDN, ATM, X.25, and Frame Relay.
- 3.7. Essential Support Facilities will include:
- co-location facilities in the dominant licensee's telephone exchanges buildings (tandem, local, interconnection and international), telecommunications equipment rooms located in commercial buildings (where it is the property of the dominant licensee), telecommunications equipment rooms located in residential buildings (where it is the property of the dominant licensee), satellite earth stations, submarine cable landing stations / frontier stations, and radio tower sites;
 - manholes, cable chambers, trenches, ducts, and conduits;
 - space within cable risers located in commercial and residential buildings;
 - masts, towers, and poles;
- 3.8. Unbundled Network Elements will include:
- Copper loops and sub-loops
 - Distribution Frame access
 - Dark Fibre
 - Directory listings
 - Emergency services
 - White Page listings
- 3.9. Loop spectrum availability will not be mandated at this point in time. Licensees may choose to provide loop spectrum on a commercially negotiated basis, however, it will not be a mandated requirement.
- 3.10. The IDA has not received sufficient input from industry to make any decisions with respect to the unbundling and sharing of the cable television network infrastructure and support facilities. The IDA will investigate further and will address this issue in the final version of the Competition Code.

4. RIGHTS AND OBLIGATIONS OF LICENSEES

- 4.1 The IDA intends to take the following policy approach for the Code:

“Licensees will allow fair, non-discriminatory, and non-exclusive, direct or indirect access to their systems, to provide interconnection related services and will establish compensation arrangements for the origination, transport and/or termination of all services carried across each other's systems. The actual points of interconnection will be determined by negotiations between the requesting and providing licensees. However, based on the capacity requirements of the interconnecting licensees, the providing

Infocomm Development Authority of Singapore

licensee must ensure that the numbers of points of interconnection are sufficient to guarantee a quality that is consistent with that achieved by the providing licensee’s own services. Further, licensees are obliged to disclose information on technical standards, changes to networks that affect interconnecting licensees, and must consider actively the requirements of interconnecting licensees when constructing or acquiring new facilities.”

4.2. The rights of the Services and Facilities based licensees are outlined in the table below:

Rights	Interconnection for O/T/T	Access to ESFs and UNEs
Facilities Based Operator (FBO)	Virtual or Physical Interconnection	Right to acquire all eligible ESFs and UNEs
Services Based Operator (SBO)	Virtual Internconnection	No Rights.

5. CHARGING STANDARDS

5.1 Cost Bases

5.1.1 The IDA intends to take the following policy approach for the Code:

Charges shall be based on the forward looking economic cost (“FLEC”) standard, i.e., what it would cost the licensee to expand its system and operations sufficiently to carry the other licensee’s interconnecting traffic, using current technology and best practices. However, for the deployment of new infrastructure and broadband services, where it is impractical to use the FLEC cost basis, the current/replacement cost basis will be used. However, the calculation of charges will not recognize a premium in the cost of capital to address the risk taken by licensees in the deployment of any new broadband infrastructure and broadband services.

5.1.2 Three alternative perspectives may be used to determine the costs for an IRS:

5.1.2.1 Historical/Embedded costs are the costs that the incumbent licensee incurred in the past and that are recorded in the incumbent licensee’s books of accounts. They reflect historical purchase prices, regulatory depreciation rates, system configurations, and operating procedures.

5.1.2.2 Current/Replacement cost (CRC) is the present-day cost of replacing an asset with another asset that provides the same service potential. The “replacement asset” needs not be the same asset, but rather an asset that hypothetically is the best (least-cost) option given current technology.

5.1.2.3 Forward Looking Economic (FLEC) costs are the prospective costs a firm would incur in producing a service using best-in-use technology and

product practices. When calculating forward-looking economic costs, costs are valued at current prices.

- 5.1.3 The IDA is in favor of maintaining the FLEC standard (which is the basis adopted for the traditional telephony-based context) for the following reasons:
 - 5.1.3.1 In a competitive environment, market prices would be driven toward FLEC, even if these were lower than the firm's embedded costs.
 - 5.1.3.2 FLEC creates the right investment incentives for facilities based entry by competitors and creates incentives to move towards competition whilst preserving current investments and not predetermining the outcome.
 - 5.1.3.3 Charges based on FLEC will lead to lower prices for consumers.
 - 5.1.3.4 FLEC based charging minimizes the dominant licensee's ability to engage in anti-competitive cross-subsidization.
- 5.1.4 The IDA understands that in a broadband context, FLEC poses certain challenges. There are practical issues associated with the application of FLEC, as the licensees would be required to design the "best-in-use" network architecture. This could be difficult and time-consuming to determine in the evolving broadband context where standards and technologies for intra-network interconnection may be embryonic. The "best-in-use" technology also evolves rapidly, requiring updates to the interpretation of FLEC on a regular basis by the IDA and licensees. Given the issues in implementing FLEC, the IDA will allow the use of CRC where appropriate.

5.2 Cost Standards

- 5.2.1 The IDA intends to take the following policy approach for the Code:
The long run average incremental cost ("LRAIC"), a common measure of FLEC, shall be used in the computation of interconnection charges. LRAIC consists of all variable costs and those fixed costs that are directly attributable to the incremental change in the IRS, as well as the share of indirect costs that are discernibly caused by the provision of those services.
- 5.2.2 Charges for interconnection should be based on relevant costs. That is, costs incurred as a result of interconnection and the use of IRSs, as well as any costs that could be avoided if such services were not provided. The Code therefore advocates the use of Long Run Average Incremental Costs (LRAIC) for all types of interconnection services. In a broadband environment, the appropriateness of the LRAIC standard holds, and the IDA therefore will still intend to use LRAIC.

6. RESPONSIBILITY FOR CHARGES

6.1. Physical Interconnection (PI), Unbundled Network Elements (UNEs), and Essential Support Facilities (ESFs)

6.1.1 The IDA intends to take the following policy approach for the Code in the area of cost responsibilities for Physical Interconnection (PI), Unbundled Network Elements (UNEs), and Essential Support Facilities (ESFs):

UNE and ESF costs incurred in establishing and maintaining POAs or using facilities will be paid by the requesting licensees based on relative use (equally for non-traffic sensitive facilities, and an appropriate function of the number of connections, actual usage and capacity requested for traffic sensitive facilities). The initial cost of establishing a POA is paid by the dominant licensee. This cost will be included in the ESF or UNE charges paid by the requesting licensees. The POA costs will be allocated based on the expected number of users and the duration of use.

6.1.2 Calculating charges based on usage ensures that the charges reflect the actual costs incurred by an individual licensee. In the broadband context, the IDA is considering the additional use of capacity based allocations in the calculation of charges. Basing the calculation of charges on capacity used is in line with the cost causality principle in the broadband context. A requesting licensee, who uses greater capacity to offer and benefit from the revenues of broadband services, must be responsible for the costs incurred in establishing or maintaining the POIs to support its capacity usage.

6.1.3 Capacity requirements are typically defined up front in the establishment and maintenance of the POI, and can materially affect the cost of the interconnection when different types of networks are involved. Due to the greater uncertainties in inter-network interconnections, it becomes difficult to ensure from a policy perspective that capacity requirements specified by interconnecting parties are motivated by efficient consumption of interconnection resources given best available information.

6.1.4 The IDA is, therefore, considering a scheme which limits the amount of capacity that can be requested to only twelve months anticipated requirement. Additional capacity cannot be requested until the initial capacity is utilised. Capacity unused after twelve months must be returned to the dominant licensee.

6.2 Originating/Terminating (O/T) Services

6.2.1 The IDA intends to take the following policy approach for the Code:

Originating charges result from the costs of conveying the traffic generated by the originating carrier's access customer to the terminating carrier's system, enabling its customer to use a service offered by the terminating carrier's system or provided by a value added service provider connected to the terminating carrier's system. Terminating charges result from the costs of conveying the traffic generated by the originating carrier's access customer to the terminating carrier's system, enabling the customer or value added service provider connected to the originating carrier to establish one-way or interactive communication. Each carrier is responsible for their own costs in setting up a point of interconnection and pays for their use of the other carriers network.

6.2.2 The purpose of the originating charge is to compensate the originating carrier when the terminating licensee, or the service based operator connected to the terminating licensee, bills the customer directly. The originating charge then compensates the originating carrier for the incremental cost of access.

6.2.3. Origination and Termination charges will be applied on a symmetrical basis. These charges will be based on the type of traffic exchange regardless of the underlying technology and network infrastructure.

6.2.4. Origination and termination charges applicable to calls between the fixed and wireless networks will be changed from the current arrangement to be consistent with those charges applied between fixed network licensees. A fixed to mobile party call will now incur a termination charge payable to the mobile network licensee equivalent to one half of the retail per call charge. Similarly a mobile to fixed party call also incur a termination charge payable to the fixed network licensee equivalent to one half the retail per call rate.

7. STRUCTURE OF CHARGES

7.1 Symmetry of Charges

7.1.1 The IDA intends to take the following policy approach for the Code:

The structure of charges must mirror the cost behavior of IRS provision, where material. This means that costs, which fundamentally behave differently, must remain segregated in the charging structure and must be charged differently.

7.1.2 Technological development and convergence enables the provision of equivalent services on different technology platforms, but the cost of providing similar

Infocomm Development Authority of Singapore

services may be different due to the differences in the cost of the technology employed. Symmetrical interconnection charges will be applied even though there may be differences in the underlying cost structures unless this approach proves to undermine the policy objective of encouraging infrastructure investment. This approach does not preclude licensees from reaching other mutually acceptable agreements.