International Telecommunication Union

QUESTION 6-1/1

Interconnection

ITU-D STUDY GROUP 1 3rd STUDY PERIOD (2002-2006)

Report on interconnection

International Telecommunication Union

THE STUDY GROUPS OF ITU-D

The ITU-D Study Groups were set up in accordance with Resolutions 2 of the World Telecommunication Development Conference (WTDC) held in Buenos Aires, Argentina, in 1994). For the period 2002-2006, Study Group 1 is entrusted with the study of seven Questions in the field of telecommunication development strategies and policies. Study Group 2 is entrusted with the study of eleven Questions in the field of development and management of telecommunication services and networks. For this period, in order to respond as quickly as possible to the concerns of developing countries, instead of being approved during the WTDC, the output of each Question is published as and when it is ready.

For further information

Please contact:

Ms Alessandra PILERI
Telecommunication Development Bureau (BDT)
ITU
Place des Nations
CH-1211 GENEVA 20
Switzerland
Telephone: +41 22 730 6698
Fax: +41 22 730 5484
E-mail: alessandra.pileri@itu.int

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Foreword

The definition of the Question 6-1/1 on Interconnection contains inter alia, the outputs expected from the study. It can be found on the ITU-D WEB Site under Question 6-1/1:

http://www.itu.int/ITU-D/study_groups/SGP_2002-2006/SG1/StudyQuestions/SG1Quest.html.

Based on the inputs from the Study Group, two Administrative Circulars CA/13 and CA/16 were circulated to various member countries. The responses provided a great number inputs and references for the Study Question. The Study Group had two meetings in Geneva and based on the inputs received from Study Group meeting participants and other responses received, the Report of the Study Group has been drafted and is being presented to ITU-D Study Group 1 for its consideration and approval. Parts of the Report are derived from ITU's published documents also.

The Report is having three main Sections.

Section I deals with Legislative and Regulatory Framework needed to implement interconnection agreements, unbundling and collocation. Content of Interconnection agreements and Reference Interconnect Offers are also covered. A number of Annexes connected with Section I find a place in the Report.

Section II deals with Economic Issues of Interconnection. An overview of the key interconnection economic issues, including cost study approaches is done. Bottom up Approach, Top Down Approach and Outside-In Approach is discussed in detail. Description of COSITU and Regional Cost Models and other liaison inputs from ITU-T Study Group 3 also find a place in this Section with details and references being given in various Annexes.

Section III deals with Technical issues related to Interconnection. These include Interconnection Architecture and Routing of Traffic, Location of Points of Interconnection (POIs), Interconnection Gateway Switches, Technical Interface Specifications, Signaling Architecture, Interconnect Billing System for Multi-Operator Scenario, Quality of Interconnection, Traffic Measurements and planning of Interconnections, Carrier Selection across Inter-connecting networks, Number Portability across Inter-connecting networks, Need for Changes in Fundamental Technical Plans, Technical/Network up-grading to facilitate interconnection.

Based on the inputs available, it was observed that various interconnection issues have been addressed by various telecommunication administrations, service providers and regulators in a different manner and generic guidelines and recommendations cannot be made applicable in a uniform manner for all countries in the world. As a result an attempt has been made to present a Report that could be treated as an Handbook covering a set of Interconnection practices covering details from a number of countries. Developing countries opening their telecommunication sectors for open competition would have all references as may normally be required for framing their interconnection rules, guidelines, practices for best possible interconnection applicable for multi-service multi-operator environment.

Most of the expected outputs have been covered through the three Sections of the Report supported by more than 20 Annexes and hundreds of Web Site references for more detail.

SECTION I

Legislative and Regulatory Framework and Interconnection Agreements and Reference Interconnection Offers (RIOs)

1 Legislative and Regulatory Framework needed to implement Interconnection Agreements, unbundling and collocation.

Each country has to frame the terms of the Interconnect Agreements depending on the level of competition, size of the networks, dominance of the incumbent operator etc. However, as a general practice, the issues on interconnect agreements have been discussed below. Some of the interconnection agreement models followed by few countries like India, Belgium, Finland, OFTEL have been provided in Annexes. It is not possible to suggest any one model to suit the requirements of all countries. Each country has to examine all the existing models and develop their own country specific model to suit their national needs.

1.1 The global practices suggest that the structure and level of Interconnection charges often determine whether competitors will be financially viable. Efficient technical arrangements for Interconnection are considered as one of the most important pre-requisite for sustainable competition. These arrangements should specify gateway functions to be performed at Network-Network Interfaces such as those relating to Signalling, generation of Call Data Records (CDRs) by Transit Switches for Interconnection Billing as well as Points of handing over traffic by one operator to another, in conformance with Fundamental Technical Plans.

1.2 The latest ITU publication on Interconnection indicates that more than 101 countries have established Interconnection Regulatory Framework in some form or the other relying upon a host of measures such as legislation, license provisions, executive orders, directives, guidelines and determinations.

1.3 In addition to National Regulatory Frameworks, a number of Regional groups have begun developing common approaches to Interconnection. European Union (EU) has Interconnection directive to be incorporated into the national laws of its 15 member states. Asia Pacific Economic Cooperation (APEC), Asia Pacific Telecom (APT), Inter-American Telecommunication Commission (CITEL) and Telecommunications Regulators Association of Southern Africa (TRASA) are also working towards global harmonisation approach for Interconnection. Many Regulators in the recent months have issued General Framework of Interconnection, to facilitate detailed negotiations between Operators.

1.4 Many countries have favoured a policy of industry negotiation on Interconnection Agreements and are allowing operators to seek Regulatory intervention for dispute resolution if negotiations fail. However, there appears to be a growing consensus that advance regulatory guidelines – or even specific Interconnection rules – may be necessary to establish the proper environment to facilitate Interconnection.

1.5 It is becoming clear that the lack of advance Regulatory Guidelines may have some serious drawbacks. Without Guidelines, Interconnection negotiations are frequently protracted, delaying the introduction of competition. This leads to regulatory uncertainty and discourages investment. Interconnection arrangements that are negotiated in such an environment often reflect the unequal bargaining power of the incumbent operator and may not be optimal for developing an efficient competitive market place.

1.6 The issue, of whether to establish binding Rules or Regulatory Guidelines, is often described in terms of ex-ante versus ex-post regulation. An ex-ante framework involves setting in advance, clear and possibly detailed, sector-specific rules for all market players to follow. An ex-post model, by contrast, gives market players substantial freedom and flexibility to act in the market, punishing any transgressions of telecommunication or general competition law only after they occur.

1.7 Many countries have adopted ex-post model but actually practice ex-ante, sector-specific regulation. That is to say that policy-makers generally agree that in truly competitive market, Interconnection Agreements should be left to market forces and commercial negotiation. But in viewing their own markets, very few policy-makers have concluded that Interconnection markets are sufficiently competitive to warrant pure ex-post regulation.

2 Contents of Interconnection Agreements.

2.1 An orderly Interconnection regime is extremely important for the healthy growth of the telecommunications sector. There are many complex aspects and settlement of these issues is an ongoing activity. The following key items should be elaborated in full details in an Interconnection Agreement to be signed between Access Providers and Long Distance Operators:

a) Scope and definition of services;

b) Interconnection and POI requirements and principles;

c) Provision of all relevant technical information;

d) Interconnection provisioning procedures;

e) Network and transmission capacity requirements

f) Technical service level commitments;

g) Technical specifications and standards;

h) Transmission and performance standards;

i) Fault reporting and resolution procedures;

j) Network management, maintenance and measurement procedures;

k) Network integrity, safety, protection and related matters;

l) Call routing, handling and operations procedures;

m) Access to Interconnection gateway facilities and sharing of infrastructure;

n) Charging mechanisms, billing and settlement procedures;

o) Transmission of calling line identification (CLI) information;

p) Operator assisted services, directory information and assistance;

q) Commercial terms and conditions;

r) Provision for contribution to the cost of local access;

s) Fundamental Technical Plans;

t) Confidentiality of information;

u) Liability and indemnities;

v) Provision for an Interconnection Agreement liaison and co-ordination Committee, and

w) Review periods and terms for review;

x) Quality of Service.

2.2 Contents of a typical interconnection agreement from ITU's publication "Trends in Telecommunication Reform 2000-2001: Interconnection Regulation" is available in Annex I.

3 Reference Interconnection Offers:

Making the Dominant Operator responsible for offering Interconnection on Cost based Principles to new entrants.

3.1 Some countries seeking to introduce competition, require "Dominant" Carriers i.e., the former monopoly operators of the Public Switched Telephone Network who are also the dominant NLDO, to Interconnect with the other Carriers such as Access Providers (BSOs / CMSOs), based on a regulator approved Reference Interconnection Offer (RIO). One such example is Singapore, where the Regulator i.e., the Info-Communications Development Authority (IDA) has mandated that the Dominant Carrier i.e. SingTel to prepare a RIO, based on which, the new entrants can seek Interconnection.

3.2 The Singapore RIO is in two Parts. The first outlines the procedures necessary to accept the RIO and enter into a RIO Agreement with SingTel; the second includes the minimum terms and conditions on which SingTel will enter into such an Agreement with Telecommunications Licensees. A Requesting Licensee, that has notified SingTel that it wishes to negotiate an Individualised Agreement, may obtain Services on the prices, terms and conditions specified in this RIO on an interim basis pending the adoption of the Individualised Agreement, either as a result of voluntary agreement or the dispute resolution procedure.

3.3 Basically, the Dominant Operator is required to publish the cost of unbundled network elements and services, based on which the new entrants can avail his Network Carriage services, such as Origination, Transit and Termination. Similar approach has been adopted in the UK, where the Regulator (OFTEL) has mandated the Dominant Carrier i.e. British Telecom (BT), to publish Accounting Statements showing the cost of unbundled network elements involved in call conveyance from the Point of Entry to the Point of Exit on the BT network, to determine the charges of using the BT Network i.e., per mile-minutes (MM) of use of various elements. The format used by BT to show the unbundled network elements involved in call conveyance, as well for Interconnection of links finds a place in Annexes.

3.4 Outline on Reference Interconnect Offer (Indian Model) is available in Annex II.

4 Annexes

Various Annexes related to this Section are indicated below with brief summaries available in the referred Annexes and more details based on references provided.

- **Annex I:** Contents of a typical interconnection agreement (Based on Document RGQ6-1/1/023-E, from Trends in Telecommunication Reform 2000-2001: Interconnection Regulation).
- **Annex II:** Outline on Reference Interconnect Offer (Indian Model)
- **Annex III:** Outline on Planning and Operations of an Interconnection (Belgium Model)
- **Annex VIII:** Interconnect Billing in British Telecom
- **Annex X:** Methodology for recovery of costs incurred by Service Providers in setting up Carrier Pre-selection Best International Practice
- **Annex XI:** Polling and Subscriber Education.
- **Annex XVII:** Reference Tables on Web Site Addresses covering RIOs, Interconnection Agreements, Regulations, Rulings and other specific issues as raised in Administrative Circular CA/16
- **Annex XVIII:** Setting Up Interconnection Regimes: Reference for Regulators (FCC Document)

The above inputs would provide sufficient details on Interconnection Issues for any developing country that would like to finalise their Reference Interconnect Offers, and other Legislative and regulatory framework issues as may be needed to implement interconnection agreements, unbundling and collocation.

SECTION II

Economic Issues in Interconnection

5 Overview of the key interconnection economic issues, including cost study approaches

(Source: ITU Trends in Telecommunication Reform 2000-2001: Interconnection Regulation, Chapter 4. The full Trends publication may be purchased from the ITU Electronic Bookstore at http://www.itu.int/publications/docs/trends2000.html)

5.1 As in politics and marriage, most disputes and discussions about interconnection ultimately come down to economics. Incumbents want to protect their market shares, while new competitors need to establish a profitable market presence. The outcomes of policy decisions on interconnection often go a long way toward determining how successful different operators will be in achieving those goals.

5.2 The objective of regulators, however, is to establish an interconnection regime that is as economically neutral as possible. That way, the success or failure of competing operators will depend on their management and business strategies, rather than on a tilted playing field.

5.3 Many countries and multilateral organizations are now adopting rules and principles that require interconnection charges to be "cost-oriented" or "cost-based." There are good reasons for such requirements. Without a cost-based standard for setting interconnection charges, a dominant operator has an incentive to set prices as high as possible. That deters market entry, results in excess costs being passed on to consumers, and may lead to anti-competitive cross-subsidization by the dominant carrier.

5.4 In order to establish a cost-based rate structure, however, regulators must understand the economics of interconnection. They must be familiar with the costs involved in interconnecting multiple telecommunication networks. And they must realize that the economic landscape of a monopoly market changes fundamentally when it is opened up to competitors. In the real world, it is difficult to identify and measure all of the shifts in demand and cost causation involved in instigating competition--let alone to forecast them in advance. Nevertheless, it is the regulator's responsibility to grasp both the economic theory and practical realities of interconnection.

5.5 The economic issues involved in interconnection largely come down to questions of cost: cost definition, cost measurement, cost allocation, and cost recovery. This Section explores in detail the trends and debates over these questions now occurring around the world.

6 What are the costs of interconnection?

There is no single, simple way to measure interconnection costs. While it may be easy to define a general principle that charges for services should be "cost-oriented" or "cost-based," the real implications of that principle are much more complex. At the outset, it is useful to understand the different categories of telecommunication network costs that can be identified. The following is a brief taxonomy of such costs. It should be kept in mind that these are not mutually exclusive categories. Rather, they may be seen as different ways of looking at many of the same costs.

6.1 Categories of Costs

6.1.1 Fixed and Variable Costs

In principle, all telecommunication costs can be classified as either *fixed* or *variable*. Fixed costs remain constant over time, regardless of how much the network is used. There are two main types of fixed costs: one-time investment costs, also known as *capital expenditures,* and recurring *operating expenses*.

Capital expenditures are generally large purchases of plant and equipment that have a planned useful life of at least four to five years. Such equipment typically includes all major network switching and transmission facilities. Standard accounting practice calls for converting capital expenditures to recurring expenses as either annual depreciation or amortization charges.

Operating expenses are the costs that the operator incurs on a regular basis—monthly or annually, for example. These expenses generally are constant; they do not vary in amount according to the level of network usage. Operating expenses can be divided into two major categories: fixed operating expenses (including materials and services), and labour expenses such as salaries and employee benefits.

Variable costs, meanwhile, are directly related to the level of network usage. In telecommunication networks, variable and fixed costs are often dubbed "traffic-sensitive" and "non-traffic-sensitive" costs, respectively.

6.1.2 Dedicated, Shared, and Common Costs

The goal of most cost analyses is to identify the costs associated with a specific telecommunication service, such as interconnection. But the reality is that many underlying facilities can be used for a variety of services. In fact, shared use of facilities improves efficiency.

Certain fixed costs and most variable costs can be viewed, however, as being *dedicated* to a particular service or group of services. Service-specific fixed costs occur when investments and spending are needed only to support a particular service. Costs that vary solely in proportion to the use of a single service can be viewed as dedicated variable costs.

Shared costs, meanwhile, generally include circuits, switches, equipment, and personnel involved in providing more than one type of service at a time. These shared costs can be *allocated* among the various services according to several different methods.

While shared costs are associated with multiple services, by contrast, *common* costs are not associated with the provision of *any* particular service. Rather, they are administrative costs incurred in supporting the network as a whole. These can include personnel costs for corporate management, as well as customer service, marketing, and "overhead" costs for supplies, equipment, and outside services.

6.2 Costs Engendered by Interconnection

Ideally, it would be good to know the cost structure of a monopoly carrier's network *before* trying to determine the costs that stem from providing interconnection to one or more competitors. But in reality, most network operators' accounting systems make no clear distinction between the equipment and expenses that relate to interconnection and those involved in serving end users.

This is more appropriate than it may seem, because there are no physical differences, in many respects, between these two types of services. The main distinctions lie in the volumes and the concentrations of capacity and traffic at particular locations. Still, despite the similarities of interconnection and retail services, it is possible in principle to identify the costs associated with network interconnection. These costs can include direct fixed interconnection costs, and indirect variable interconnection costs.

6.2.1 Direct, Fixed Interconnection Costs

Interconnection typically requires the deployment of new, dedicated facilities to connect the two networks. Depending upon the nature and location of the interconnection, these can range from minor network additions to significant investments in new network segments.

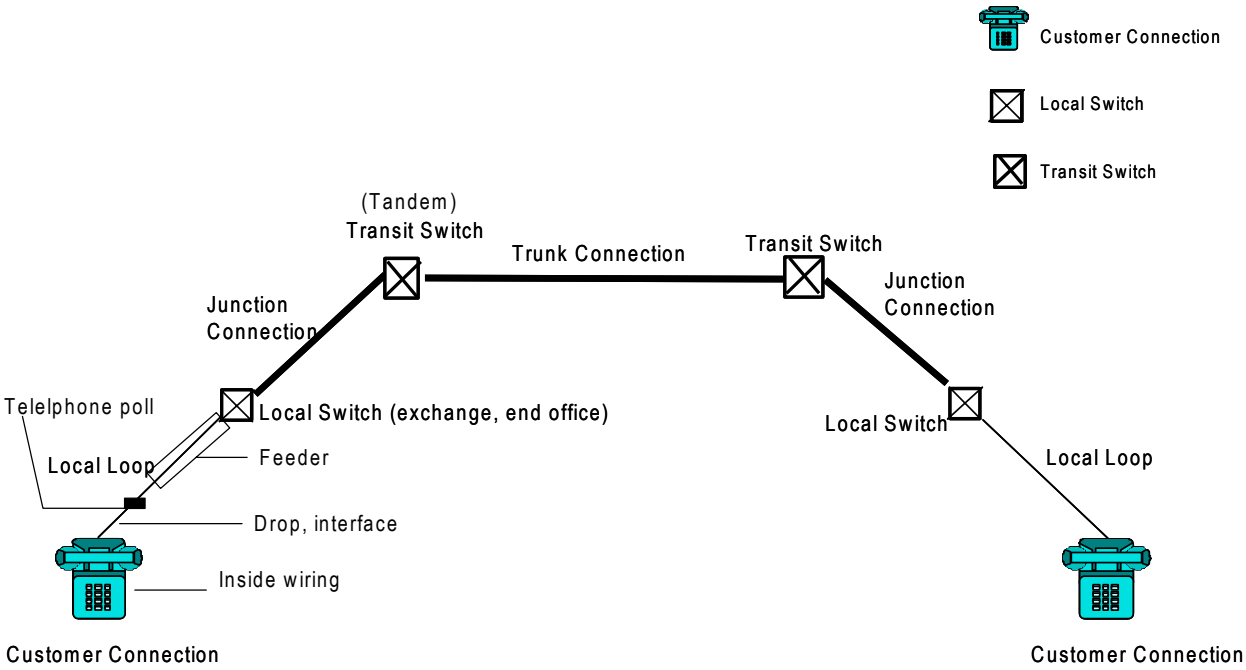
The interconnection of two fully developed, facilities-based, switched voice networks may involve merely establishing high-capacity, two-way circuits between tandem switching centres, with all of the related termination and processing costs that may entail. But interconnection can occur at a variety of levels across networks, with different facility requirements at each level (for example, tandem, end-office, trunk-side or line-side connections (See Figure 1)[1]. Where collocation occurs, the incumbent may allocate a proportion of costs for floor space and all related support functions.

Local network unbundling can complicate the picture further. Costs can be attributed to providing individual loops or even to portions of loops, such as distribution and drop cables.[2] Costs may also be attributed to network interfaces and inside wiring—even the customer's telephone handsets in some countries. In many places, however, unbundling entails only the costs associated with an allocation of radio spectrum or capacity on a high-speed access trunk.

[1] Line-side denotes the customer side of a switch, usually to end office switch.

[2] The drop is the part of the local loop that connects to the customer premises, typically running from the nearest telephone pole or underground distribution point. The distribution cable connects the drop cable to feeder or sub-feeder links, which run to the switching office.

Figure 1 Generic PSTN Network Structure



Source: Taken from Maev Sullivan's presentation "The Basics of Interconnection" made at the ITU Workshop on Telecommunication Reform (3-5 May 1999)

6.2.2 Indirect, Variable Interconnection Costs

Interconnection also imposes variable costs in proportion to the amount of traffic that passes between the networks. Each network already will be engineered to carry the optimal traffic load of its own customers. When new traffic comes onto the network from an interconnecting carrier, that optimal capacity must be adjusted to accommodate the additional traffic. To add capacity, the operator may have to invest in additional trunks or central office processing capacity, either immediately or at some point in the future.

Even if there is no net increase in traffic—if competition merely shifts customers to the new entrant's network—the source of traffic demands on the system will change. The distribution of costs for some proportion of network capacity will shift from one carrier to another. There is always some traffic-related capacity cost impact due to interconnection.

Traffic-sensitive costs also include operational and administrative costs stemming from the measurement and billing of traffic exchanged through interconnection. These costs, not surprisingly, may vary in proportion to the volume of traffic that is exchanged.

6.3 Costs for Different Types of Interconnection

So far, this discussion has focused primarily on interconnection between switched voice carriers competing in the same market. But most of these cost principles apply to other forms of interconnection, with some variations:

- **Interconnection of local and long distance/international networks.** There are still fixed and variable costs when the local carrier originates and terminates traffic and the long distance carrier provides only inter-city transport. However, the overwhelming share of

these costs is borne by the local access carrier. Consequently, charges tend to "flow" to the local operator. In effect, the long distance carrier "needs" the local network to exist, while the local network can, in principle, stand by itself.

- **Interconnection of fixed and mobile networks.** The costs involved in interconnecting mobile networks with fixed networks are not substantially different than those for interconnection between two competing fixed networks. Points of interconnection are likely to be limited, however, to a few discrete locations on the mobile network, where traffic is exchanged in bulk. This differs from the widespread interconnection of fixed networks at multiple central offices. The fixed costs of fixed-to-mobile interconnection will stem from the facilities installed to link the two networks, while variable costs will be a function of the traffic that passes between them. In principle, these costs flow in both directions, but they may be unequal on a per-minute basis.
- **Interconnection of data (and IP-based) networks.** The interconnection of fixed data networks is generally less complicated than switched network interconnection. The main costs involved are for dedicated links between the networks. These costs can be identified in a relatively straightforward manner. That is not the case, however, for interconnection of packet-switched networks such as IP (Internet protocol) networks. Trunking capacity and switching costs for such networks may be similar to those of switched voice networks, but the dispersed and non-linear nature of the data packet transmission leads to real differences in incurred costs. Also, the Internet itself involves unique cost-causation issues, as both owners of website content and those who access those sites can be said to "cause" traffic over the Internet.

7 How Can Interconnection Costs Be Measured?

In order to apply cost theories to the practical task of designing interconnection rules and policies, there must be a way to measure the costs of actual network connections. Not surprisingly, there are a variety of different opinions, perspectives and methods for doing that, arising from differences in data availability, accounting methods, policy objectives, and evolving economic principles.

The discussion that follows covers three essential aspects of cost analysis. First, it is necessary to establish the appropriate theoretical cost framework. Second, carriers must follow useful accounting practices to provide the data needed for cost studies. And finally, regulators and carriers must use a reliable cost study methodology—or a combination of methodologies—to generate reasonable calculations of actual interconnection costs.

7.1 Theoretical Frameworks

The choice of a theoretical framework can have as much to do with practical and policy considerations as with economic principles. It is important to note that there is no "correct" or true measure of telephone network costs. Rather, different perspectives on costs are useful for different purposes. In short, cost analysis always has a normative purpose of some kind.

7.1.1 Historical, Fully Distributed Costs (FDC)

This approach is also known as the "Fully Allocated Cost" or "FAC" model. It actually embodies two separate concepts, which are usually combined for analytical purposes. *Historical*, or *embedded* costs are those that the operator has already incurred, at a given point in time, for equipment, facilities, or personnel. These costs usually will be recorded in the company's current

books, at least in some form, for its own accounting purposes. The best way, then, to identify historical costs is to use verifiable accounting data from actual purchases.[3]

The purpose of a Fully Distributed Cost analysis is to assign shared and common costs to individual services or service elements. The question is how those costs should properly be assigned. Again, there is no single "correct" answer. Some studies allocate costs according to the relative capacity utilized for each service. Others look at minutes of use. In some cases, the proportionate revenues generated by different services are used as an allocation factor.

An historical FDC approach, then, examines the already-incurred costs of existing services and allocates a portion of shared and common costs to each service under study. This is a fairly practical approach that relies upon generally available data and explicit assumptions. The drawback is that interconnection charges based upon historical, fully distributed costs tend to reinforce inefficiencies in the incumbent carrier's network operations and management overheads. Also, a historical view will tend to leave out the impact of newly deployed technologies that reduce costs going forward.

In practical terms, historical FDC studies may be the most realistic type of analysis many regulators can perform, given the limitations of available data and their own resources. Some regulatory agencies, such as **the Tanzanian Communications Commission**, have implemented FDC studies to set interim rates until a Long Run Incremental Cost methodology can be developed and implemented.[4] Similarly, the **Korean Ministry of Information and Communication** revised its interconnection policy in 1997, moving away from an FDC methodology.[5] This shift away from initial reliance on FDC studies has been the pattern in several other countries as well.[6]

7.1.2 Forward-Looking, Incremental Costs

This costing category also encompasses two separate approaches that are typically combined. *Forward-looking* cost analyses attempt to identify costs that will be incurred during some real or theoretical future period. This avoids the pitfall of including excessive embedded costs in rates imposed on end users or competitors.

Incremental cost, meanwhile, is the extra cost, added to an existing base of costs, required to provide a defined additional increment of a given service. Focusing on the incremental cost of establishing interconnection is often seen as the most economically efficient means of determining the impact of a competitor's interconnection on the incumbent operator's costs of service.

Almost by definition, incremental cost analysis is forward-looking. But in reality, any such analysis must use existing data on the costs of facilities and services as a starting point. The key, then, is to modify actual recorded costs to account for changing trends in underlying cost factors. In telecommunications, this implies a downward trend in average unit costs because of decreasing absolute technology costs and increasing utilization of equipment and plant capacities.

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[3] Some adjustments may need to be made to account for known changes in the costs of items since the date of the expenditures.

[4] Tanzania Communications Commission, Interconnection Policy.

[5] Republic of Korea, Ministry of Information and Communication, "Interconnection Policies in Korea" #1997.9. See http://www.oecd.org/dsti/sti/it/cm/news/ko.pdf.

[6] For example Denmark, Sweden, the United Kingdom; see *Commission of the European Communities Recommendation C(97)-3148 on Interconnection Pricing*, Table 1. See http://www.ispo.cec.be/infosoc/telecompolicy/en/r3148-en.htm

Incremental cost analyses do not account for common or overhead costs and they also tend to leave out fully distributed costs, such as for spare capacity. As a result, incremental cost studies of any carrier's services will result in a sum that is substantially less than the actual total costs the carrier really incurred.

Nevertheless, incremental cost methodologies are becoming the *de facto* standard for interconnection pricing around the world. That may be because of the widespread belief that any fully competitive market will drive prices down toward marginal (incremental) costs. Because regulators seek to emulate the workings of a competitive market as much as possible, they view incremental cost models as tools to establish interconnection rates on a firm, pro-competitive foundation. In other words, setting interconnection rates at incremental cost is viewed as the closest possible imitation of what market forces would achieve in a truly competitive local access service market.

Naturally, however, the issue is more complicated than that. Incremental costs can be defined and measured in a variety of ways, and views on what may be the most appropriate conceptual measures of incremental costs are evolving.

One undeniable point is that the standard must involve some version of *long run* incremental cost (LRIC). In economic terms, the *short run* incremental cost of telephone service usage [the extra cost imposed on a carrier by a single additional telephone call or minute of use] is virtually zero. In the long run, however, the presumption is that all network facilities and operations are optimally configured to account for the precise volume of anticipated traffic. Viewed over the long term, then, an incremental telephone call yields an incremental extra investment and extra operating cost.

Different theorists and regulatory agencies have attempted to come up with the best construction of LRIC that should apply to telecommunication services, including interconnection. The **US Federal Communications Commission (FCC)** and several other regulatory bodies have developed models that include *Total Service Long Run Incremental Cost (TSLRIC*), and *Total Element Long Run Incremental Cost (TELRIC)*. These models seek to capture the costs of replicating or creating all of the network elements and functions needed to provide a given service (or service element) over the long run. The **Australian Competition and Consumer Commission** also has adopted this approach.

The **European Commission**, meanwhile, has settled on a *Forward-Looking Long Run Average Incremental Cost (FL-LRAIC)* model, which is very similar to TSLRIC or TELRIC. The use of the term "average," however, specifically anticipates dividing the total traffic costs for both the incumbent and the interconnecting firm by the total demand, rather than assigning unique costs to each operator.

Numerous developing countries have adopted or proposed one LRIC standard or another for interconnection pricing. The **Colombian Comisión de Regulación de Telecomunicaciones (CRT)**, for example, has issued extensive guidelines for its Regimen Unificado de Interconexion (RUDI), which includes a TELRIC model for determining carriers' costs.[7] The **South African Telecommunications Regulatory Authority (SATRA)** also adopted interconnection guidelines that include requirements to base charges on forward-looking LRIC.[8] SATRA added provisions,

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[7] CRT, Políticas Generales y Estrategias para Establecer un Regimen Unificado de Interconexión (RUDI), July 2000. See http://www.crt.gov.co/NoticiasYEventos/RUDI/RUDI_Ag15.pdf

[8] SATRA has been superseded by ICASA.

however, preventing interconnection charges from exceeding relevant retail prices or fully allocated costs.[9]

7.2 Major Categories of Costs

In practice, purist distinctions among forward-looking cost models may be of minor importance for most regulators when compared to their more urgent problem: the quality of data and analytical tools needed to conduct an ideal LRIC study are seldom available. Cost studies are only meaningful if they are based on useful accounting data provided by carriers. Of course, all telephone companies maintain financial records, but the kind of bookkeeping required to support regulatory cost studies is usually very different from standard business accounting practices.

Accounting records should be able to track the relationship between cost inputs and service outputs. That involves examining at least three major categories of costs:

- Capital investment (plant whose acquisition cost is depreciated or amortized over a number of years);
- Operating expenses (outlays for goods and services that are paid from the current budget); and
- Personnel costs (salaries, wages and benefits of regular employees).

7.2.1 Capital expenditures

In some ways, capital investments are the most difficult to track in relation to services, because of their size, duration, and often-shared use. But accounting systems should be able to readily distinguish between different types of plant (central office, trunk, or loop plant, for example). They can also be designed to record the various service-related purposes of specific plant deployments. A project to expand the local access network at a given location, for example, can be coded to account for the amount of cable and switching plant installed, as well as the effective number of access lines and transmission capacity that will result from the project.

Shared expenses, such as inter-office trunks, can be labelled as such in the accounting system, allowing costs to be allocated across all of the shared services during subsequent cost studies. In any system, the more detailed the information, the better. Accounting records should identify exact amounts spent on equipment, software, installation, maintenance, and support for each type of plant. Ideally, the records should be automated for easy access and use.

7.2.2 Operating expenses

Non-capital expenses often fall into shared and common cost categories. They include such items as building expenses, rents, furniture, vehicles, and supplies. Small equipment purchases related to capital plant investments – for example, central office line cards for interconnecting loops – should be classified together with capital expenditures. To the extent that these expenses can be directly associated with one or more end user services, they should be identified that way for cost studies.

7.2.3 Personnel Costs

Some labour costs can be associated with specific services, at least to some extent. For example, personnel costs for long distance operator services can be readily identified as long distance voice service costs. On the other hand, some personnel cost – such as those for company management

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[9] South Africa Department of Communications, General Notice 1259, 15 March 2000, Interconnection Guidelines in Terms of Section 96(6) of the Telecommunications Act of 1996, Sec. 11. See http://www.satra.org.za/.

and administrative staffs – are purely overhead and are not connected with any specific service. Most employees' job responsibilities, however, relate to a particular group of services or operations.

Many countries already have put in place detailed carrier accounting systems. For example, the FCC has overseen US carriers' compliance with its Uniform System of Accounts (USOA). Carriers provide information through the FCC's Automated Reporting Management Information System (ARMIS),[10] which has been in place for decades. This system has been adopted, in some form, by a number of other countries, such as most of the Pacific Island nations. Less developed countries with new regulatory systems need not move immediately to such a complex and sophisticated accounting regime, however. More rudimentary accounting systems may suffice—with cooperation between carriers and regulators—to support initial attempts to set cost-oriented interconnection and service prices.

Figure 2: Activity-Based Costing

One system that many operators have introduced to track employee costs in relation to output services is called Activity-Based Costing (ABC). This system helps managers by requiring employees to track their own time and keep records of their work in defined categories of activity. The system can be tailored to associate each activity with the services that it supports. The result is a relatively straightforward calculation of labour costs for maintenance, support, customer service, and other activities involved in the provision of each service the carrier provides.

8 Cost Study Approaches

Cost studies should be as thorough as possible, given the available data. Regulators should also try to examine costs from more than one point of view, to reinforce the accuracy of the results. Three general approaches to cost studies can be pursued, either separately or in combination: *Top-Down*, *Bottom-Up*, and *Outside-In* (See Figure 3).

Each approach could, in principle, yield meaningful cost results by itself. But in reality, there are likely to be too many data gaps and methodological variances to rely on a single approach. Including all three methods in a single study can yield a range of results that will serve as a basis for meaningful conclusions on costs and interconnection rates.

8.1 The Bottom-Up Approach

This method is arguably the most "accurate" means of measuring unit costs, assuming sufficient data are available (See Figure 4). It is based on the idea that service costs can be identified from the facilities and other inputs needed to provide the services. The costs of the inputs are combined in proportion to their utilization in providing each service, then divided by the number of total units of service, resulting in per-unit facility costs. The Colombian RUDI model employs such a method, replacing a former Top-Down approach.[11]

This approach depends on the availability of complete, disaggregated data on input costs and the relative use of facilities in the provision of different services. This can be analyzed on a historical-cost basis or a forward-looking incremental cost basis, but any results expressed as pure, incremental facility-based unit costs must be reconciled with joint and common costs and administrative overheads.

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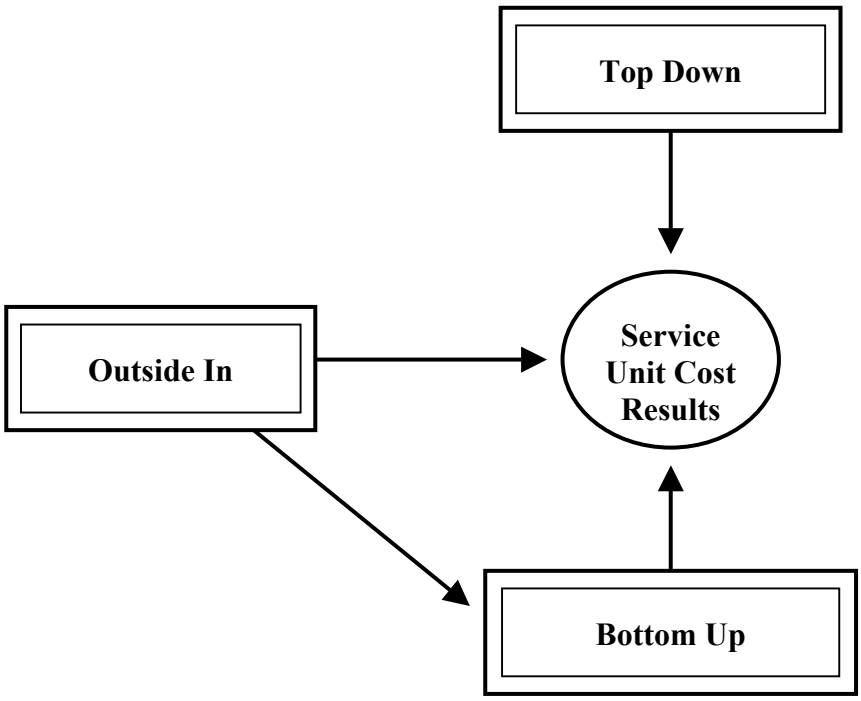
[10] See http://www.fcc.gov/ccb/armis/

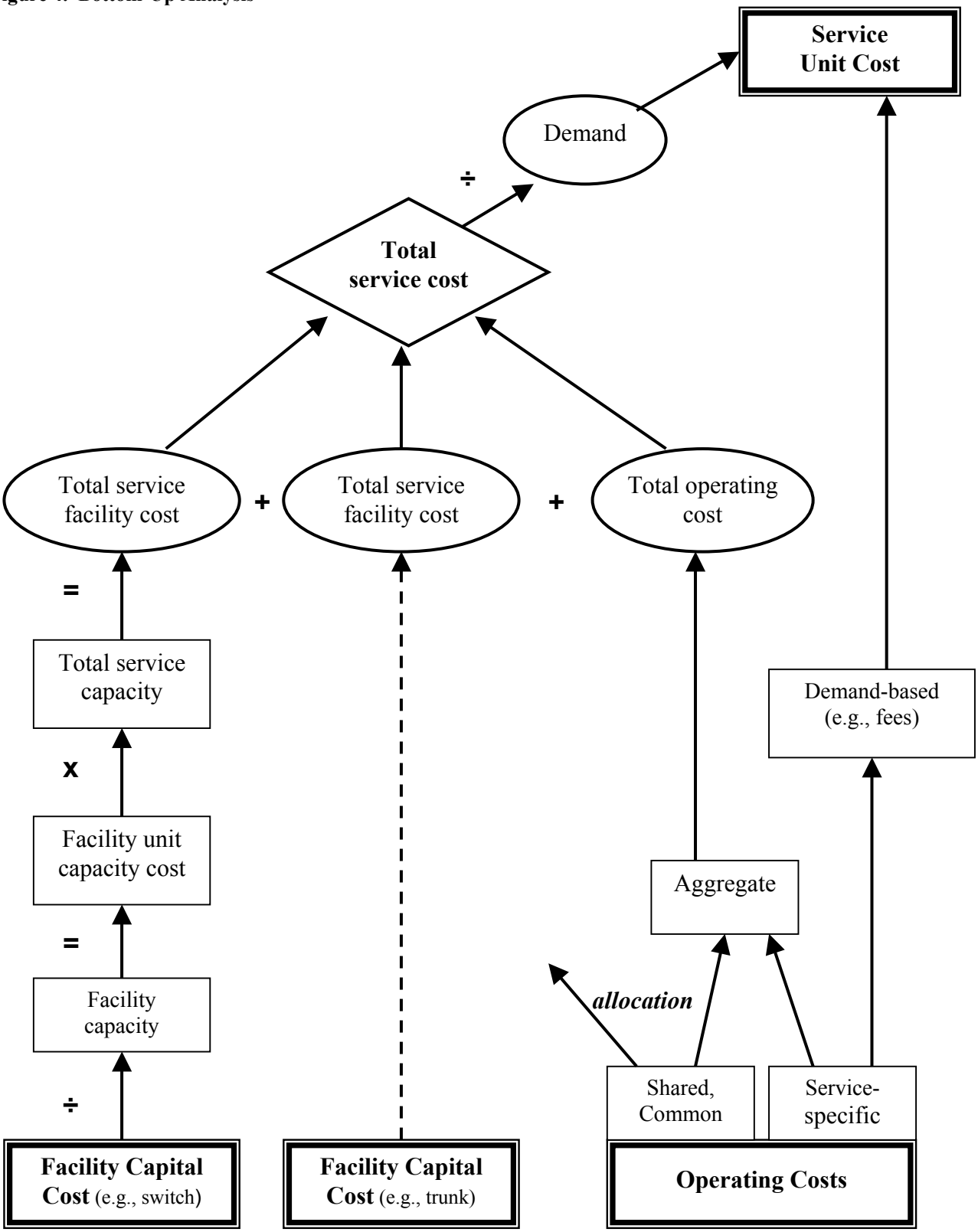
[11] CRT, Políticas Generales, Id..

Figure 3: Cost Study Methodologies



Source: D. Townsend.

Figure 4. Bottom-Up Analysis



Source: D. Townsend.

8.2 The Top-Down Approach

The top-down approach begins with aggregate, company-wide cost data such as total annual expenditures, capital investments and operating costs. Ideally, such costs will be tracked according to some general categories, such as whether they are capital or operating costs. The goal of a top-down study is to take these aggregate costs and allocate them among all services provided by the carrier. The advantage is that this method assures that all of the carrier's costs are accounted for. The difficulty, on the other hand, is determining an economically justifiable allocation formula.

The most appropriate use of top-down analysis is as a check and comparison against a comprehensive bottom-up, incremental cost analysis. Unfortunately, such a complete bottom-up analysis is rarely possible because of a lack of adequate data. Aggregate company costs, by contrast, are usually available. As a result, the top-down analysis often becomes an integral part of the cost study and is used to estimate capital and operating costs where exact facility input data are unavailable.

The **Australian Competition and Consumer Commission (ACCC)** uses a form of top-down analysis—dubbed a "full-cost approach"--as an option for settling interconnection disputes. The analysis is used to arrive at TSLRIC results, which depend upon extensive carrier record data.[12]

8.3 The Outside-In Approach

The third approach is to use "proxy" estimates from outside sources, establishing cost "benchmarks," or ranges of costs, for services or facilities. There are two steps. First, the regulators must define the appropriate cost elements and the scope of cost comparisons—whether they will be comparisons of specific facility costs, operating unit costs or service-wide costs. Second, the results have to be adjusted to account for differing conditions between the subject country and the benchmark country.

The **European Commission**'s *Recommendation on Interconnection* of October 1997 established a range of "best practice" prices for interconnection among carriers in EU member states. These were to be used as a basis for interconnection charges in the absence of detailed internal cost data and models.[13] The European Commission has periodically updated its *Recommendation on Interconnection* to reflect falling interconnection prices within Europe.[14]

The **Agence Nationale de Réglementation des Télécommunications (ANRT)** of **Morocco** ordered incumbent operator Maroc Telecom and new market entrant Medi Telecom to sign an interconnection agreement with interconnection rates based on international benchmarking, along with an analysis of the cost models used by the operators. ANRT informed the disputing parties in March 2000 that it would enforce its own contract if the parties failed to sign the proposed contract[15]

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[12] Australian Competition & Consumer Commission, Access Pricing Principles – Telecommunications, July 1997. See http://www.oecd.org/dsti/sti/it/cm/news/au2.pdf

[13] *Commission of the European Communities Recommendation C(97)-3148 on Interconnection Pricing*. See http://www.ispo.cec.be/infosoc/telecompolicy/en/r3148-en.htm

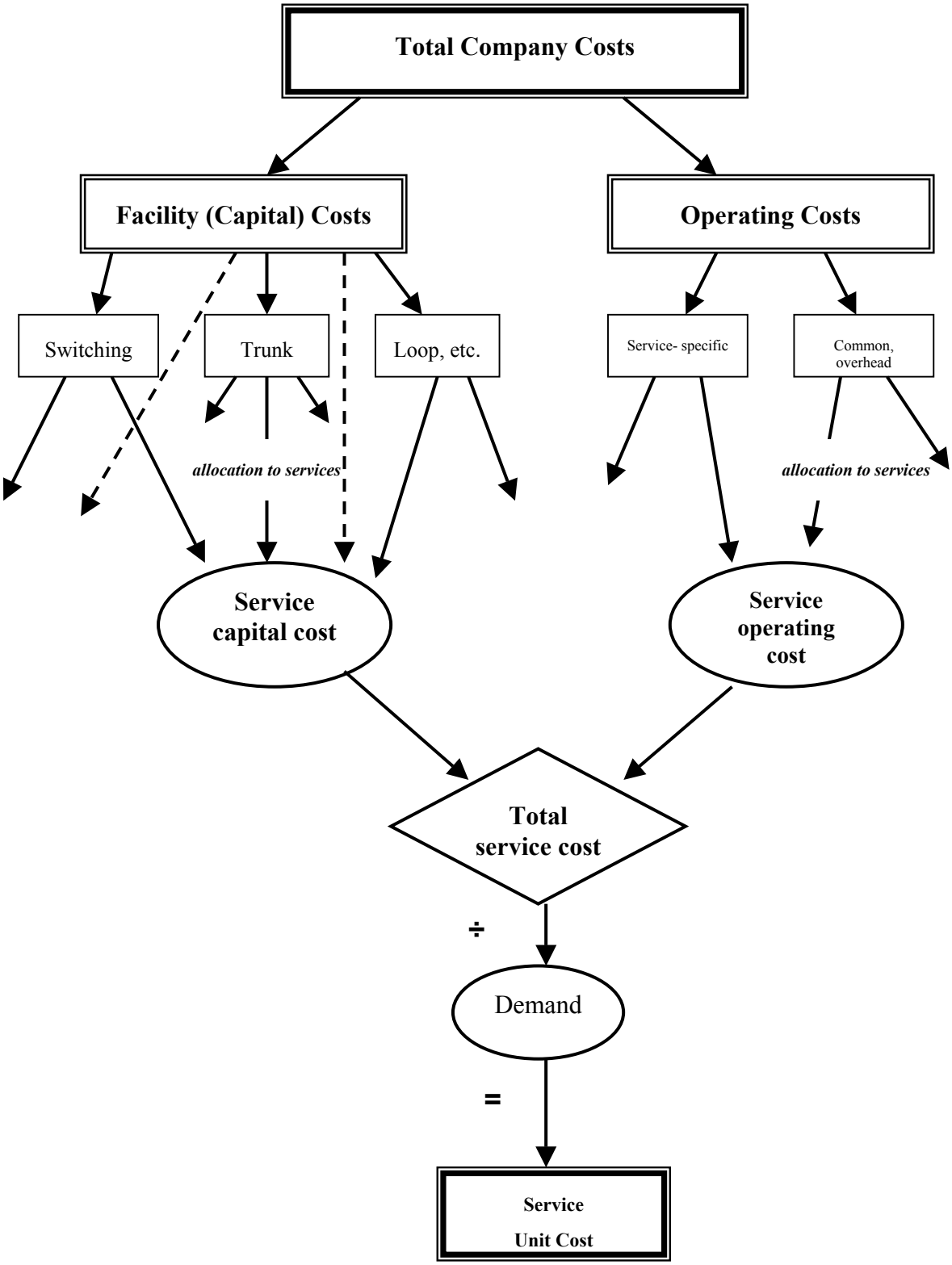
[14] The most recent interconnection prices, including "best practice" recommendations reported by the European Commission are included in Annex V. See also http://www.ispo.cec.be/infosoc/telecompolicy/en/rec20c0en.pdf

[15] Pyramid Alert, Africa/Middle East, 5 April 2000. See http://www.pyr.com

In principle, it would be desirable to develop a broad database of proxy costs from as many countries as possible. That could form a kind of econometric regression model or statistical correlation analysis of costs in almost any environment—if enough variable data were known. The challenge, of course, is to achieve an accurate measurement of costs in the proxy countries, using direct bottom-up and top-down approaches. Then it would be possible to compare reliable results from different countries and come to conclusions about the effect on interconnection costs of national variations in labor costs, topography, demography and other factors.

Figure 5 Top-Down Analysis

Source: D. Townsend.



8.4 How should costs be recovered?

Having defined and studied the costs of interconnection, the most important question remains, "Who should pay for these costs, and by what means?" Once again, the answer is not nearly as straightforward as the theory would like it to be.

8.4.1 Cost Recovery Principles

In drafting rules for interconnection charges, policy-makers and regulators may have several objectives and priorities. In many countries, legislative mandates or policy statements cite these goals haphazardly, without always acknowledging that in practice, many of the objectives conflict with one another. Nor do policy-makers give clear guidance on which goals should take priority when conflicts do arise.

8.4.1.1 Efficiency

The goal of economic efficiency is generally achieved by establishing charges that are as close to cost (ideally LRIC) as possible, and that are specifically based upon *cost causation*. That is, when certain costs stem from the activities of a given carrier or customer, they should be recovered through charges levied on that carrier or customer. Moreover, the relationship between costs and charges should be direct. Variable (traffic-sensitive) costs should be recovered through traffic-sensitive charges, and fixed (non-traffic-sensitive) costs should be recovered through fixed or "flat" charges.

One potential consequence of applying the efficiency principle is that different operators may logically impose different charges for similar services. Carriers' costs may differ, for example, because of economies of scale experienced by a larger company or due to a different overall mix of services. Under a pure efficiency policy, these differences should be reflected in interconnection charges. In some cases, the resulting rates may distinctly disadvantage some competitors. This may be particularly true if retail prices are also based upon such differentiated costs. Larger carriers could take advantage of their lower cost structures to undercut smaller competitors' prices.

Figure 6 The World Bank's Interconnection Pricing 'Tool Kit'

Drawing on more than 10 years of field experience in advising regulators on telecommunication issues, the World Bank is developing an interconnection pricing "tool kit." The main feature is a bottom-up cost model that will allow regulators to derive cost-based figures within a short time frame as little as two months. The model trades off some accuracy in return for simplicity, allowing regulators to adapt it to the realities of national or local network infrastructures, negotiation calendars, and most importantly, how much data is available.

The resulting output may not always be seen as the "right" interconnection rate but rather can be seen as a "floor" price that the regulator can impose. Though generic in spirit, the model is designed to be adapted on a case-by-case basis in each country. The tool kit also includes benchmarking tools and methodologies, as well as a guide for conducting interconnection negotiations.

Some pricing experts believe, however, that bottom-up costing models are not appropriate for developing countries because they fail to take into account the incumbent operator's access deficit. In addition, the average prices utilized in bottom-up cost models often do not reflect prices for network elements in developing countries.

For more information on the World Bank's "tool kit," contact Nicholas Chung at nchungsiongfah@worldbank.org or Ying Liang at yliang@worldbank.org.

8.4.1.2 Equity and Competitive Balance

In many markets, sustaining and nurturing competition is often a more immediate policy priority than achieving short-term economic efficiency. The *competitive balance* principle calls for interconnection charges to be generally set at the same levels for all similarly situated carriers. They may even be set at deliberately favourable levels for new market entrants.

The *equity* principle, meanwhile, may lead regulators to impose interconnection costs equally, or at least proportionally, on both interconnected carriers, even though, from a cost-causation point of view, one carrier may be generating more costs than the other. Equity can also be the motivating philosophy behind interconnection policies that base charges on discounts from relevant retail prices. The goal is often to ensure competitive fairness by granting new entrants a guaranteed margin between their interconnection costs and the prevailing market prices. But this practice can lead to real market distortions if the retail prices themselves are not based on costs.

Some policies are even more aggressive, explicitly mandating interconnection arrangements that essentially require incumbents to absorb many or all of the interconnection costs. Regulators often see such interconnection policies as a way to promote competition by easing conditions for new market entrants. This was arguably the philosophy behind the FCC's initial policy in the 1980s of establishing substantial access charge discounts for long distance carriers trying to compete with AT&T. US regulators have used the same approach in local markets, requiring incumbent local exchange carriers to bear the costs of implementing local number portability.

8.4.1.3 Laissez-Faire

Adherents to the laissez-faire doctrine believe that regulation can often be more of a hindrance than a help in introducing competition—or at least that regulation is unnecessary to achieve that end. **New Zealand**, for example, opened its telecommunication markets to competition without creating a sector-specific regulatory agency. However, this may change with a recent government recommendation to create a new **Electronic Communications Commissioner** in New Zealand.[16]

A total "hands-off" approach represents a kind of wishful thinking for most countries, where a single dominant operator has nearly total control of bottleneck facilities and considerable economic power to influence interconnection terms. However, policies encouraging negotiated interconnection agreements, with regulatory intervention only as a last resort, are quite common in established and newly liberalized markets alike.

8.4.2 Interconnection charges

In the end, all discussion and debate on interconnection policy and economic costs must lead to the setting of interconnection charges. Those interconnection fees should mirror both the network operators' costs and the regulatory policies that governments wish to pursue. But that does not always occur in practice. Regulators and operators may arrive at their best judgments of the proper costs to be recovered, then somehow, in implementation, set charges that result in very different levels of actual payments.

Regulators and operators have several options to choose from in setting interconnection charges. The descriptions that follow are somewhat general. In actual practice, there are countless variations on most of these options, and the rate structures and levels are often revised on a regular basis.

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[16] See Chapter 3, Section 3.1.1.

8.4.2.1 Cost-Based Charges

With cost studies and the principle of economic efficiency as a guide, interconnection charges can be set to recover costs in roughly the manner in which carriers incur them. Fixed costs can be recovered through proportionate fixed or flat charges. For example, a one-time cost for establishing a connection circuit can be recovered through a non-recurring charge for the appropriate amount. Variable costs, meanwhile, should be recovered through variable charges. That is, traffic-sensitive costs should translate into per-minute interconnection charges.

These appear, perhaps, to be straightforward concepts, but they have been practiced only intermittently in many markets. Regulators often choose to load a large amount of costs onto per-minute charges rather than parsing out the costs among different interconnection charges for different network components and services. Dominant operators may have a preference for usage-based charges, because such fees ensure increasing interconnection revenues whenever a competitor expands and brings in more traffic. But relying entirely on usage-based charges may not be the most economically appropriate arrangement.

It is difficult to establish underlying costs in any circumstance. The job becomes even more difficult when cost-based rates must be established for unbundled network access. Where the physical process of unbundling is problematic—or the necessary accounting data to determine costs are lacking--there is a risk that interconnecting competitors will be forced to overpay for unbundled access, effectively subsidizing the incumbent's operations.

The **European Commission's** series of "best practice" recommendations has offered carriers a detailed list of rates for interconnection, to use as guidelines. These benchmark rates include initial implementation charges, equipment rental charges, variable charges for ancillary and supplementary services, and traffic related charges.[17] The **United Kingdom's Office of Telecommunications (OFTEL)** has explored setting charges that would account for detailed variations in underlying costs. These charges could be split into two usage-based elements—one for call set-up and one for call duration. There also might be capacity-based charges. One goal of such an approach is to distinguish longer-duration calls, such as dial-up Internet access calls, from shorter calls, which have a different cost profile.[18]

8.4.2.2 Retail-Based Charges

One common, simple – yet ultimately questionable – practice involves basing interconnection charges directly on a carrier's retail collection rates. For example, a usage-based access or termination charge might be set based on a percentage of the dominant carrier's retail local call charges. Similarly, a fixed charge for an interconnecting circuit might be set relative to the carrier's fixed local access line or leased line prices. The assumption is that interconnecting carriers and the large customers of such retail offerings make an essentially equivalent use of the services and facilities.

This retail-based approach has a broad appeal. The regulator has the ability to ensure that there is a clear "margin" between retail prices and interconnection charges. For example, if interconnection prices are fixed at 60 per cent of retail prices, competitors theoretically will enjoy a 40 per cent margin to work with, allowing the competitors to cover their costs and still make a profit. This approach also appears to be pro-competitive by guaranteeing that competitors will have a sufficient margin to compete with their dominant rivals.

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[17] See Annex 4.

[18] OFTEL Consultative Document: Price Control Review, March 2000. See http://www.oftel.gov.uk/pricing/pcr0300.htm#Chapter%204

Often, the interconnection rate is determined by subtracting from the retail rate all of the dominant carrier's estimated average costs for such retail activities as marketing, customer-service and billing. This "avoided cost" formula is thought to generate an interconnection rate that approximates wholesale costs. The process may be reversed to derive retail rates. Starting with interconnection charges, regulators "impute" the cost of interconnection to the dominant carrier, then add retail costs, arriving at a retail price deemed to be competitively neutral.

The real drawback of retail-based pricing is that in most cases, it results in interconnection charges that are not based on the true underlying costs. It is difficult enough to identify accurate, cost-based interconnection rates. It is even more difficult to pinpoint the costs that go into calculating retail basic telephone rates, because those costs may include marketing, billing, and customer service. Thus, very few countries could realistically lay claim to having achieved cost-based end user pricing. Basing interconnection rates on distorted retail rates simply creates distorted interconnection charges. A more viable goal might be to determine cost-oriented interconnection charges independently, then use those as the basis for moving retail prices closer to costs.

8.4.2.3 Price Caps

Price cap mechanisms have become widely used for regulating all sorts of telecommunication rates. The core principle involves placing a ceiling or cap on charges for a group of services that are placed together in a conceptual "basket." This gives the operator flexibility to raise or lower rates for individual services, so long as the overall average rates remain below the basket's cap. Adjustments in the cap may be based on inflation, estimates of an operator's productivity growth, or specific, targeted rate-reduction goals. The caps usually are not based on detailed, service-specific cost analysis.

The popularity of price cap systems reflects the complexity and difficulty of determining the real costs underlying telecommunication services such as interconnection. Price caps are intended to keep prices reasonably in line with costs, without involving regulators in micro-managing carriers' operations and business decisions.

Price cap systems have been applied to interconnection charges in the United States, the United Kingdom, Peru and Bolivia, among other countries. It is probably more challenging to implement price caps for interconnection than any other service, because of the contentious market environment in which interconnection typically takes place.

The most difficult and important task in establishing a price cap regime is to set the initial caps as close to costs as possible. Any inaccuracy in the initial price caps will be maintained and even magnified over time. In the case of interconnection, setting initial price caps too high risks damaging potential competition or forcing competitors to subsidize incumbents for an extended period of time.

8.4.2.4 "Bill and Keep" or "Sender Keeps All"

This approach entails levying no charges on interconnecting carriers at all. Each carrier "bills" its own customers for outgoing traffic that it "sends" to the other network, and "keeps" all the revenue that results. The Bill-and-keep model assumes that if there were interconnection payments, they would roughly cancel each other out, resulting in no real net gain or loss for either carrier. Further, by forgoing payments, carriers avoid the administrative burden of billing one another for exchanged traffic.

This model plainly works best if the traffic flows from one network to another are roughly in balance. Otherwise, one carrier will be under-compensated for the costs of traffic that it receives from the other. To ensure that there is such a balance requires measuring and recording traffic and

costs on an ongoing basis. If traffic patterns shift significantly out of balance, carriers may shelve their bill-and-keep arrangements, at least temporarily, in favour of interconnection payments.

Bill-and-keep systems are typically used when competitive local carriers interconnect with one another or with an incumbent local carrier. Such a system was proposed, for instance, by competing carriers in Canada, instead of the interconnection charges proposed by the dominant carriers' Stentor alliance.[19] Mobile network operators also commonly employ the model. Moreover, the peering arrangements that traditionally have been used to interconnect Internet backbone networks of comparable size may be viewed as a form of bill-and-keep arrangement.

8.4.2.5 Revenue Sharing

In certain relationships between carriers serving complementary markets, revenue sharing is sometimes used in place of paying explicit interconnection charges. This is sometimes true, for example, where long distance operators interconnect with local access networks. The carriers' interconnection agreement may call for the long distance carrier to pay the local carrier a specified percentage of the revenue generated by each long distance call. The same may happen when fixed and mobile carriers interconnect, particularly when mobile service customers are charged for incoming and outgoing calls (called-party pays systems).

This approach can, theoretically, yield the same outcome as cost-oriented interconnection charges—if the revenue "shared" with the access provider roughly equals interconnection costs. But there are substantial risks that revenue-sharing payments will not be equal or even close to underlying interconnection costs. The interconnecting carrier's own retail rates may not be cost-based and may fluctuate according to market conditions. Simply requiring the payment of a percentage of revenues from these retail rates will result in the recovery of true interconnection costs only by chance.

8.5 Network Development and Universal Service

Often, a primary objective of telecommunication policies is to promote network build-outs and to support universal access to Information and Communications Technologies (ICTs). Indeed, in many countries, competition is not seen as an end in itself but rather the means to provide market incentives for rapid and efficient telecommunication infrastructure development.

Universal service and universal access policies are complex and constantly evolving. In the context of a discussion on interconnection economics, however, several observations must be made.

First, interconnection charges have long been a vehicle for subsidizing the operation of local access networks. This was true in the United States, to a large extent, when the access charge structure was developed in the early 1980s. And it has been true in nearly every other country where competition has been introduced. However, economists and policy experts have been arguing, for just as long, that interconnection payments should not be used to underwrite universal service goals. The **European Commission** has required in its interconnection directive, for example, that interconnection charges be "separated" from universal service contribution charges.

This issue is particularly relevant in markets where a dominant operator provides most or all local access services – the so-called "last mile" connections to the end user. In many such markets, these carriers now face competition for long distance, international, and mobile services. In some countries, such as the United States, Bolivia and Finland, the dominant local carrier is largely precluded from providing long distance services.

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[19] CRTC P.N. 95-36 Submission of Microcell Telecommunications, Inc., January 2, 1996, Appendix B, "The Impact of Alternative Local Interconnection Pricing on Stakeholder Groups in Canada".

In these markets, the local access network is seen as both costly to build and maintain and vitally necessary for consumers. Thus, for "social" purposes, end user prices for basic telephone subscription are often set below cost. This requires that local services be subsidized through revenues from other services. The most ready source of this subsidy is long distance service, which is often more highly profitable. So when competitors are allowed into the long distance market, it has been seen as fair and easy to require them to contribute to universal service through interconnection charges.

A variety of new theories and models have been introduced[20] in an effort to move away from this traditional subsidy approach toward setting cost-based interconnection charges. Policy-makers increasingly believe that cost-based interconnection pricing is more efficient. Thus, they believe telephony markets will operate more productively if subsidies are eliminated or at least converted into explicit and competitively neutral funding mechanisms. Moreover, local access markets are themselves now being opened to competition. It makes more sense in that context to establish a more broad-based universal service program rather than simply to subsidize a former monopoly.

It is worth noting, however, that requiring long distance carriers or competitive operators to contribute to local access network development is not entirely inconsistent with the principle of *cost causation*. In the present circumstances in most markets, if a call originates on one network and terminates on another, it "causes" costs for the terminating network.

For carriers (including new market entrants) that are seeking to build out their networks, the costs of incoming traffic may properly *include* a portion of the costs of new access lines they must install. This is an important point that often is overlooked in discussions of efficient, cost-based pricing policies. Each time a new access line is added to the network, it expands the range of destinations with which outside callers can communicate. When a call is placed to that new line, the caller and the network that originated that call are among the parties who can be said to have "caused" the installation of that line, in economic terms.

Put another way, it is in the interest of all subscribers in a telecommunication market to support the further expansion of the overall network. Customers can only see the optimal benefits of their subscriptions when all potential users are connected to the network. That, in essence, may be the best policy rationale for interconnection.

9 COSITU: ITU's model for the calculation of Telephone service costs, tariffs and Interconnection charges

9.1 Introduction

The whole question of tariffs is crucial to the development of telecommunications, since it is tariffs that will mercilessly make or break anyone setting out in this sector. Negotiating tariffs or rates is hence a delicate matter, whether it is for a new operator entering a liberalized market or a regulator wishing to set affordable tariffs for national calls without compromising competitiveness among operators.

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[20] See, for example, Townsend, David, "E-Commerce and Universal Service," in *info*Dev eXchange, Jul-Sept, 1999, at: http://www.infodev.org/news/exch899.pdf.

The question is also a much-debated one because the nature of the costs on which tariffs are supposed to be based can differ greatly:

- Are they historical?
- Are they current?
- Are we looking at economic costs?
- Are we looking at average costs?

To what extent do they reflect the genuine impact of a causal relationship with the volume of service provided?

Many other questions may be raised in this regard. Various cost concepts exist and are formulated in models (LRIC, LRAIC, FLEC, TELRIC, TSLRIC, CCA, FDC, etc.). Each concept presupposes the availability of a quantity of data without which the results obtained would be no more than vague estimates, however complex the models used.

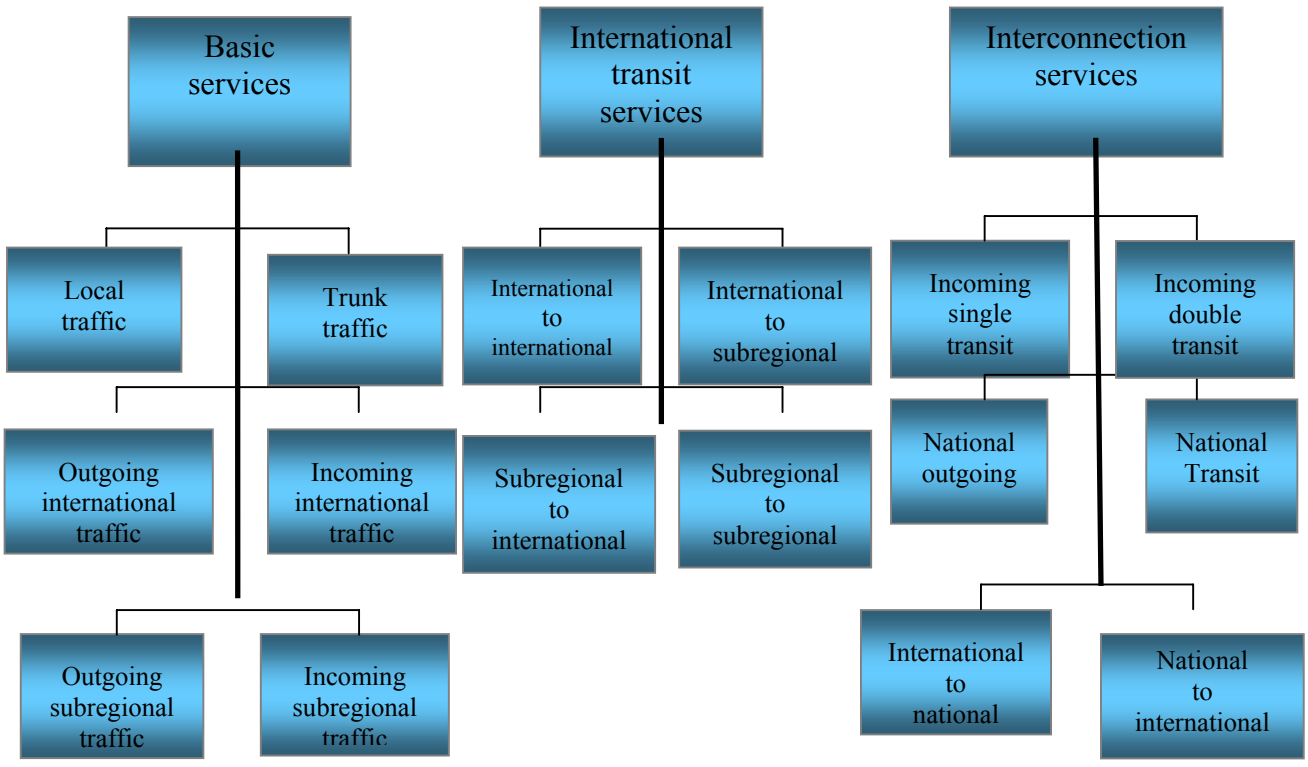
COSITU is a practical tool from ITU's Financing Strategies Unit to automate:

- the calculation of costs,
- taxes related to the exchange of international traffic (accounting, settlement and termination rates),
- interconnection rates between local operators, and
- tariffs for national and international telephone services taking into account the impact of Universal Service Obligations decided by public authorities.

This software can be applied to both fixed and mobile services.

10 Classification and Definition of services for which COSITU calculates costs

Following flow chart shows the classification of the services for which COSITU calculates the cost.



10.1 Definition of the Services:

10.1.1 Domestic Services:

- **Local/Urban**: Traffic carried solely within the network of the operator for which the calculations are made, between users located in the same local charging area.
- **Trunk/Interurban**: Traffic carried solely within the network of the operator for which the calculations are made, between users located in different local charging areas.
-

10.1.2 International Services

- **Incoming international**: A call from a user located outside the national boundaries to an end user connected to the network of the operator using the international gateway.
- **International outgoing:** A call from an end-user connected to the network of the operator using the international gateway to a correspondent located outside the national boundaries.
- **Outgoing sub regional**: A call from an end-user connected to the network of the operator using the international gateway to a correspondent located outside the national boundaries, in a country which can be accessed by terrestrial media that are also used for trunk calls.
- **Sub regional incoming**: A call from a user located outside the national boundaries, in a country which can be accessed by terrestrial media also used for trunk traffic, to an end-user connected to the network of the operator using the international gateway.
- **International to international**: A call between two non-sub regional international correspondents via the international gateway of the operator for which the calculations are made.
- **International to sub regional:** A call from a non-sub regional international correspondent to a sub regional correspondent via the international gateway of the operator for which the calculations are made.
- **Sub regional to international**: A call from a sub regional correspondent to a non-sub regional international correspondent via the international gateway of the operator for which the calculations are made.
- **Sub regional to sub regional**: A call between two sub regional correspondents via the international gateway of the operator for which the calculations are made.

10.1.3 National-International Services

- **International to national**: A call from an international correspondent to an operator without an international gateway located within the same political borders as the operator using the international gateway for which the calculations are made,
- **National to international**: A call from an operator without an international gateway located within the same political borders as the operator using the international gateway for which the calculations are made, to an international correspondent.
- **Outgoing national**: A call from an end-user of the network of the operator for which the calculations are made to another operator located within the same political borders as the first operator.
- **Incoming national, single transit:** A call coming from the network of another national operator to an end-user located in the charging area of the interconnection point and connected to the network of the operator for which the calculations are made.

- **Incoming national, double transit:** A call coming from the network of another national operator to an end-user located outside the charging area of the interconnection point and connected to the network of the operator for which the calculations are made.
- **National to national:** A transit call between two national operators via the network of the operator for which the calculations are made.

10.2 Theoretical aspect of COSITU

- COSITU accommodates both Bottom Up and Top Down approach of calculating the cost of network components, the initial stage for the bottom-up method being completed outside the model.
- Whatever the methods used to determine costs and traffic, the COSITU model can accommodate them.
- COSITU has, however, been optimized for use of real information from the accounts and technical data of real network operators with a view to equitable allocation of costs to the services that generate them, collectively or separately.
- COSITU is unaffected by technological choice, addressing directly the services sold – retail or wholesale.

10.2.1 Adjusted depreciation

- Linear depreciation is the rule most widely applied in the accounts of telecommunication operators.
- It is nevertheless possible to take account of the natural evolution of the price of equipment in the specific market and adjust the depreciation accordingly.
- Currency depreciation must also be taken into account:

$$\varepsilon = 1 - \sqrt[n]{\frac{C_0}{C_n}}$$

where

– C0 is the value of one SDR in the national currency in the year of acquisition;

– Cn is the value of one SDR in the national currency in year N;

- Statistically, the age of the equipment of an ordinary telecommunication network is D/2 (half the lifetime).
- ACC=AMO*((1+t)D/2 /(1-e)D/2 –1)

where:

ACC	=	adjustment to current costs
AMO	=	amortization allowance
t	=	annual average growth rate in the price of equipment
e	=	average annual rate of currency depreciation
D	=	depreciation period

10.2.2 Efficiency:

Efficiency is calculated by combining the installed capacity; utilized capacity; average annual growth rate in number of subscribers; replenishment period.

$$K' = \text{Max}(0 ; DK - Ku*[(1+t)N-1])$$

where

K ' is the idle capacity;

DK is the difference between the installed capacity and the utilized capacity;

Ku is the utilized capacity;

T is the annual average growth rate in the number of subscribers;

N is the necessary extension time.

10.2.3 Cost of Capital:

COSITU is able to calculate the Cost of Capital, assuming a preponderant risk of inflation for telecommunication companies in developing countries (sector risk ~ market risk -> BETA ~ 1), the essential components of the cost of capital as adjusted to local conditions. In case BETA is known, COSITU allows manual adjustment.

10.2.4 Routing Table:

The routing table is an essential instrument for cost-orientated charging. It allows allocation to every service, according to the intensity of demand it places on each one, part of the resources needed for its production. COSITU uses traffic volume (adjusted by the geographical correction coefficient) for network component cost allocation. On the basis of the routing table, COSITU allocates to services their share of each cost component. The resulting cost of a service is divided by the corresponding real traffic volume in order to obtain the unit cost of the service. At this stage, the COSITU server allows an online comparison with other telephone network operators.

In addition to calculating per minute service and network element costs, COSITU computes tariffs based on cost data, taking into consideration the following factors:

- Corporation tax;
- Contribution to a Universal Service Obligation (USO) fund;
- Effect of Universal Service Obligation (USO) policies on Access Deficit.

COSITU fosters consensus building among policy makers, national regulatory authorities and operators with respect to tariffs.

Both cost-based and cost orientated tariffs can be calculated.

COSITU offers market actors a practical means to settling disputes.

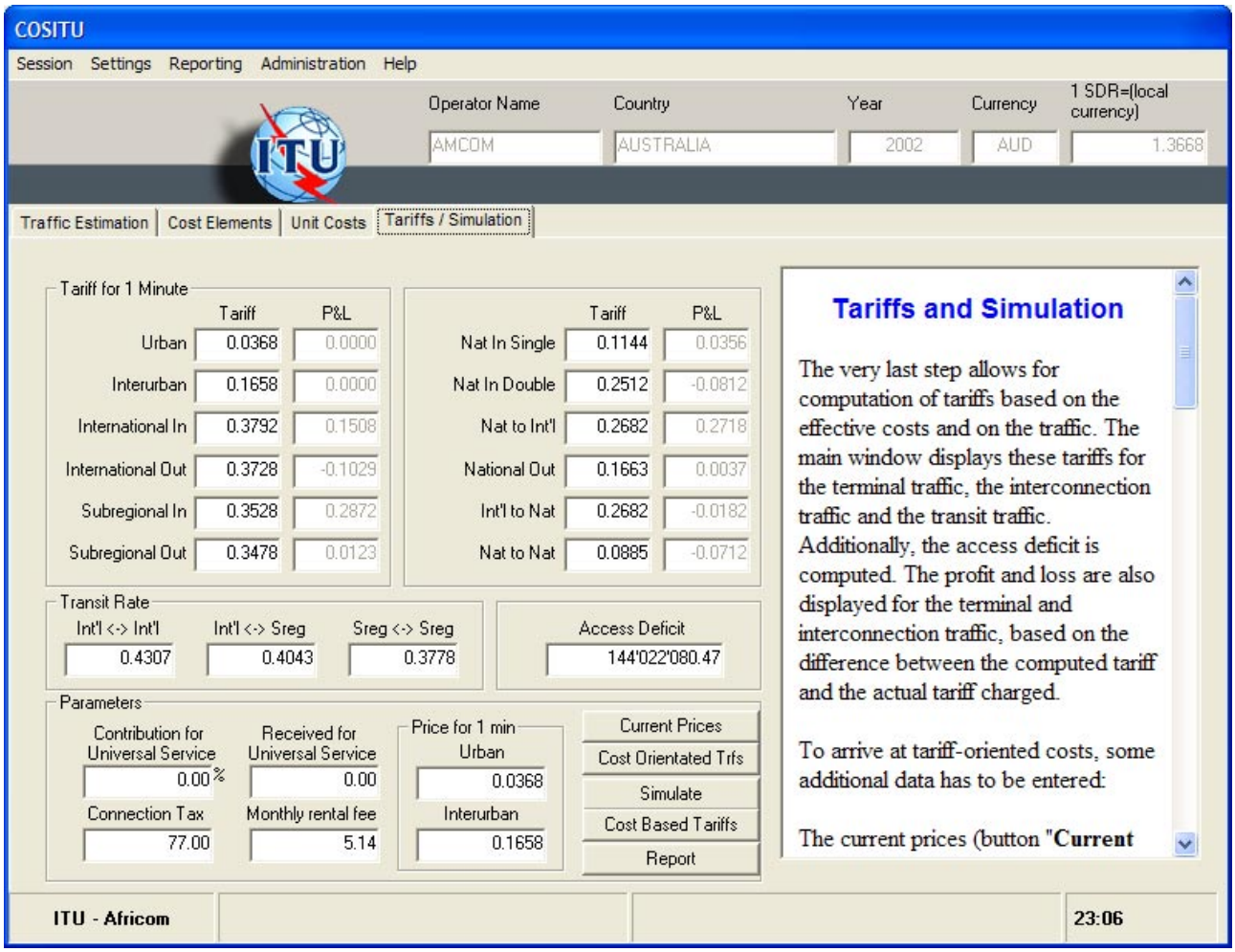


Figure 6: COSITU, a platform for consensus

11 Other Cost Models (Handbook on Costing Methodologies based on ITU-T Study Group 3)

Inputs on Liaison Statement from ITU-T Study Group 3 including listing of contents from Handbook on Costing Methodologies is covered in Annex XIV.

A number of other supporting details are covered in the following Annexes.

- **Annex XII**: Interconnection Usage charges (IUC) for use of Unbundled Network Elements (UNEs) involved in carriage of carious types of calls (Indian Model)
- **Annex XIII**: Interconnect Usage Charges Derived (Indian Model)
- **Annex XIV**: Inputs on Liaison including Handbook on Costing Methodologies
- **Annex XV**: Cost Model for Interconnect Charges as extracted from Document 1/RGQ6/009-E

Various Economic and Costing issues related to Interconnection as may be required by various countries especially countries opening up their markets for Open competition are adequately addressed based on above details along with referred Annexes and Web site references.

SECTION III

Technical Issues Related to Interconnection

12 Technical Issues Related to Interconnection

12.1 Technical Issues Related To Interconnection in Multi-Service Multi-Operator scenario are as below:

- Interconnection Architecture and Routing of Traffic
- Location of Points of Interconnection (POIs)
- Interconnection Gateway Switches
- Technical Interface Specifications
- Signalling Architecture
- Interconnect Billing System for Multi-Operator Scenario
- Quality of Interconnection
- Traffic Measurements and planning of Interconnections
- Carrier Selection across Inter-connecting networks
- Number Portability across Inter-connecting networks
- Need for Changes in Fundamental Technical Plans
- Technical/ Network up-grading to facilitate interconnection

12.2 International experience shows that the Incumbent operators generally have little incentive to make Interconnection easy for their new competitors, as it may be contrary to their immediate corporate interests to provide full, open and low cost Interconnection on a timely basis. When negotiations do occur, the incumbent operators usually retain most of the bargaining power. Regulators in such a scenario are expected to play a central role in ensuring that the National Interconnection Framework becomes more competitive.

12.3 Technical Issues related to Interconnection often lead to delay in Interconnection facilities and as a result though Open Competition may be in place theoretically in a number of countries or at least in many parts of the country.

12.4 Interconnection Architecture of the incumbent is generally based on the decisions taken over last few decades when switches with low capacities and low traffic handling capacity were available. As a result, there may be far too many switches that have either no Interconnection capabilities or if available are very restrictive. Similarly routing and traffic handover principles would be based of the existing architecture of the incumbent. As earlier there was no need for Inter-Carrier Billing, CDR based billing and CCS7 signalling support in the network may not be available. Technical support required for Carrier Selection and Number Portability may also be not available in the existing networks.

12.5 Normally in many countries the Network architecture gets defined as a mirror image of the incumbent by the licensors or regulators. However there may be a case to really verify as to how many points of interconnection are really required for efficient and cost effective open competition in any country. The location of Points of Interconnection is also an issue required to be considered. Then who should provide the Interconnection facilities also need to be decided.

12.6 In the background of changing technological scenario with availability of large capacity switches with one or two stage remote switching options along with wide range of transmission options, existing architecture and fundamental plans may not be adequate to meet the requirements of Multi-Service Multi-Operator scenario and possibly needs to be reexamined so that with same level of investments, much higher capacities could be added with lower interconnection costs and also lower tariffs to consumers.

12.7 No recommendations are being suggested in the Report. The issues would be differing from country to country and any generic technical approach may not be the solution.

12.8 Following Annexes and supporting References provide sufficient inputs as reference material for any developing country that would like to collect adequate technical inputs as required for taking correct technical decisions in support of best results of the Open competitive markets to all.

- **Annex I**: Contents of a typical interconnection agreement based on "ITU Trends in Telecommunication Reform 2000-2001: Interconnection Regulation"
- **Annex II**: Outline on Reference Interconnection Offer (Indian Model)
- **Annex III**: Outline on Planning and Operations of an Interconnection (Belgium Model)
- **Annex IV**: Outline on Regulations on Technical Issues (Finland Model)
- **Annex VI**: Possible solution for Interconnection in Multi-Operator Multi-Service Scenario through an "Interconnect Gateway Exchange" and "Interconnect billing" clearing house
- **Annex VII**: Functional Requirements of an interconnect billing system as an illustration
- **Annex IX**: Functional Specification of Carrier Selection
- **Annex X**: Methodology for recovery of costs incurred by Service Providers in setting up Carrier Pre-selection Best International Practice
- **Annex XVII** : Compilation covering Technical Issues as reported by all Member countries
- **Annex XVIII**: Reference Tables on Web Site Addresses covering RIOs, Interconnection Agreements, Regulations, Rulings and other specific issues as raised in Administrative Circular CA/16
- **Annex XIX**: Setting Up Interconnection Regimes: Reference for Regulators (FCC Document)

Annex I

Contents of a Typical Interconnection Agreement

Source : ITU Trends in Telecommunication Reform 2000-2001 : Interconnection Regulation, Annex 1. The full Trends publication may be purchased from the ITU Electronic Bookstore at http://www.itu.int/publications/docs/trends2000.html

Contents	Detail & Comments
Interpretation	
➢ Recitals	➢ 'Whereas' clauses add historical and legal context to assist understanding by future readers of agreements
➢ Definitions of key terms	➢ Terminology varies significantly among different countries and operators ➢ It is important to ensure compatibility of terminology with the local environment when adapting interconnection agreements from other countries ➢ Definitions in other documents may be referenced, e.g. definitions in law or regulations, regulatory guidelines, ITU definitions
Scope of Interconnection	
➢ Description of scope and purpose of interconnection	➢ Different types of interconnection agreements have different purposes; (e.g. between local networks, local to long distance/international, fixed to mobile, mobile to mobile, local ISP to ISP backbone.) ➢ The purpose of some interconnection agreements is to provide termination *services* or transit services; others involve provision of unbundled *facilities*, etc. ➢ Interconnection architecture

Contents	Detail & Comments
Points of Interconnection & Interconnection Facilities	
➢ Points of interconnection (POI) and related facility specifications	➢ POI locations (e.g. exchanges, meet points) usually listed in an appendix; may be modified from time to time; typically includes exchange types and street addresses ➢ Specific POI facility locations (e.g. digital distribution frame; manhole splice box) ➢ Description of network facilities to be interconnected (e.g. large-capacity fibre optic terminals with interconnecting single-mode optical fibres) ➢ Specify capacity and/or traffic volume requirements ➢ Indicate which party is to provide which facilities (include diagram of POIs and interconnected facilities) ➢ Technical specifications, for example: ➢ Calling Line Identification (CLI) specifications ➢ Other advanced digital feature specifications, e.g. call forwarding, caller name ID, etc. ➢ Basic and ISDN call control interface specifications ➢ Local number portability (LNP) query-response network specifications
➢ Signaling interconnection	➢ Specify type of signaling networks/standards (e.g. CCS7) ➢ Signaling POI locations to be specified (i.e. Signal Transfer Points or STPs) ➢ Point codes to be specified ➢ Technical interface specifications (e.g. signaling links to be dedicated E-1 or DS-1 transmission facilities; operating at 56 kbps) ➢ Diagram of signaling interconnection architecture

Contents	Detail & Comments
Network and Facility Changes	
➢ Planning & forecasts	➢ Requirement for mutual notification of network changes & capacity forecasts, for example: ➢ traffic forecasts for each POI ➢ local number and portability requirements ➢ area code saturation & changes to increased digit phone numbers ➢ default & redundant routing arrangements ➢ Periodic network planning reports may be specified
➢ Facility ordering procedures	➢ Specify rights and obligations of each party with respect to ordering and provisioning of interconnection facilities (including unbundled network elements – see below). ➢ Confidentiality requirements and procedures ➢ Ensure no anti-competitive use of order information (e.g. no contacts with end users; competitive service divisions of operator receiving orders). ➢ Specify points of contact (e.g. Interconnection Service Groups; E-mail addresses, etc.). ➢ Specify order format and procedures (e.g. standard order forms may be utilized in paper or electronic (EDI) format). ➢ Procedures to expedite specific orders. ➢ Co-ordination process for migration of customers between operators (e.g. coordination of cutovers to prevent or minimize service interruptions to end-users). ➢ Procedures for ordering operator to arrange for all equipment installations and changes at end-user premises. ➢ Order confirmation and order rejection procedures; timely notification, notification of additional charges, etc. ➢ Order completion notification and reporting requirements.

Contents	Detail & Comments
Traffic Measurement & Routing	
➢ Traffic measurement responsibilities and procedures	➢ Describe party responsible; measurement & reporting procedures (see billing procedures (below) ➢ Rules for routing of different types of traffic, if any; e.g. local traffic that is to be terminated reciprocally without charge may be carried on "bill-and-keep" trunks; traffic for which termination charges apply may be carried on other trunks (e.g. transit trunks, national traffic trunks, etc.)
Infrastructure Sharing & Collocation	
➢ Sharing of infrastructure, procedures and costs.	➢ Availability of poles, conduits, towers, rights of way, etc. ➢ Procedures, if any, for determining available capacity; procedures for allocating capacity among requesting operators (e.g. first come/first served). ➢ Prices and/or costing method. ➢ Provision and pricing of supplementary services (electrical power, security systems, maintenance & repairs, etc.) ➢ Sub-licenses on property of third parties (e.g. right of way owners, municipal and other public and private property owners, where infrastructure is located), insurance and indemnification for damages.
➢ Collocation	➢ Availability of actual or virtual collocation (e.g. for transmission facilities on exchange premises); list of addresses where collocation is available; procedures for determining available space; reservation of expansion space. ➢ Prices and/or costing method for collocated space ➢ Provision and pricing of supplementary services (e.g. electrical power and emergency backup power, lighting, heating and air conditioning, security and alarm systems, maintenance and janitorial services, etc.) ➢ Procedures for ensuring access to and security of collocated facilities (notification; supervised repair and provisioning work and/or separated premises, etc.) ➢ Negotiation of other lease and/or licence arrangements, including issues of sub-licences on property of third parties (e.g. building owners, right of way owners, municipal and other public property owners), insurance and indemnification for damages.

Contents	Detail & Comments
Billing	
➢ Scope of billing arrangements & responsibilities	➢ May include different arrangements, for example: ➢ Operators billing each other for interconnection services (e.g. termination) and facilities (e.g. unbundled loops and other network elements); ➢ Performance of billing functions by some operators for others (e.g. local operators billing end-users for long distance or international operators, ISPs, etc.)
➢ Billing procedures	➢ Interconnection billing media – discs, tapes, paper and/or electronic (EDI) transfers; format and software specifications ➢ Guidelines for production of interconnection billing outputs, including: ➢ Applicable industry standards or systems for metering and billing ➢ Billing data format & data elements ➢ Standardized codes and phrases ➢ Billing schedules ➢ Customer Service Record (CSR) provision, including: ➢ Details to be supplied by provisioning local operator (e.g. record of interconnection elements used, including circuit and other (e.g. DSLAM) equipment identification numbers). ➢ Media (e.g. tape, paper, etc.) and schedule for delivery. ➢ Other requirements to facilitate efficient verification and billing of end-user by non-provisioning operator. ➢ Retention periods for billing data
➢ Payment terms and conditions	➢ Billing fees and related charges ➢ Payment terms and conditions (including late payment penalties, service disruption credits, etc.).
➢ Billing disputes and reconciliation procedures	➢ Contact details for reconciliation & billing queries ➢ Responsibilities to provide any back-up records ➢ Notification of billing disputes ➢ Initial resolution procedures (e.g. escalation to more senior management) ➢ Final resolution (referral to arbitration, regulator or courts)

Contents	Detail & Comments
Quality of Service / Performance & Trouble Reports	
➢ Quality of Service	➢ Service performance standards may be specified in appendix, for example: ➢ Average time for provisioning interconnection circuits ➢ Percentage of interconnection cut-overs made on scheduled dates ➢ Comparative provisioning performance for competitors and self (or affiliates) ➢ Switching & transmission quality measures on interconnected circuits (e.g. probability of blockage at peak hours, transmission delay and loss)
➢ Testing & Maintenance	➢ Right to make reasonable tests, and to schedule service interruptions; procedures to minimize disruption
➢ Trouble Reports	➢ Procedure for trouble reports; notice periods; response time standards. ➢ Duty to investigate own network before reporting faults to interconnecting operator. ➢ Responsibility for costs incurred to second operator in investigating faults subsequently found to exist in first operator's network. Calculation of charges (labour, etc.) for investigating trouble reports.
➢ System protection and safety measures.	➢ Responsibilities of parties to take necessary precautions to prevent interference with or interruptions of other party's networks or customers

Contents	Detail & Comments
Interchange and Treatment of Information	
➢ Data Interchange Format	➢ Method and format of data interchange between carriers, including data interfaces, software, forms, etc.
➢ Data to be exchanged	➢ Specify all data types and systems for which data is to be interchanged, for example: ➢ New facilities and service orders, network changes and forecasts, billing etc. ➢ Number allocations & other data required for call routing and local number portability (where applicable, e.g. where LNP system is operated by incumbent operator rather than an independent party). ➢ Customer listings in directories and databases. ➢ Access to other network databases, for provision of advanced services
➢ Access to and use of customer information.	➢ Confidentiality procedures for customer information, including: ➢ Establishment of separate interconnection services group with secure data (password protection for electronic files; locks for data rooms and filing cabinets, etc.) ➢ Confidentiality forms to be completed by all relevant employees (penalties and bonding optional) ➢ Procedures to ensure protection of customer privacy
➢ Access to and use of operator information.	➢ Confidentiality procedures (see customer information procedures, above) ➢ Intellectual property rights.

Contents	Detail & Comments
Equal Access and Customer Transfer	
➢ Equal access procedures	➢ Procedures depend on equal access approach, e.g. carrier pre-selection; casual selection. Detailed procedures normally incumbent for carrier pre-selection, including: ➢ Customer authorization requirements (signature on prescribed form, clear choice requirements) ➢ Authentication & measures to prevent unauthorized customer transfers (slamming) ➢ Penalties for unauthorized customer transfers ➢ Methods of reporting customer transfers (contact points and data to be provided) ➢ Order confirmation procedure (format, medium, etc.) ➢ Schedule to implement transfers ➢ Procedures to implement transfers ➢ Dispute resolution process (e.g. escalation through senior management, arbitrator and regulator); information to be provided in dispute resolution process. ➢ Procedures for dealing with disputed customers (which operator may contact customer, information to be provided to and/or obtained from disputed customers)
Ancillary Services	
➢ Operator-assistance	➢ Types of operator assistance services to be provided, including directory assistance, translation services, fault report routing, etc. ➢ Call handling and operations procedures ➢ Fees and billing procedures
➢ Other Ancillary Services	➢ Subscriber listings in telephone directories ➢ Information & billing inserts ➢ Repair and maintenance services ➢ Other services provided by one or other operator to increase mutual operating efficiencies

Contents	Detail & Comments
Termination	
➢ Grounds for termination and restrictions	➢ Termination may only be permitted subject to certain restrictions (e.g. regulatory approval for termination of interconnection by incumbent operator) ➢ Grounds for termination by incumbent operator may include: ➢ Regulatory or court orders; ➢ Bankruptcy, insolvency, receivership, etc. ➢ Cessation of business; ➢ Fewer, if any, termination restrictions in competitive markets, and by non-dominant operators
➢ Termination procedures	➢ Advance notice requirements. ➢ Payment of non-recoverable interconnection costs incurred by disconnected operator. ➢ Computation and payment schedule for disconnection costs. ➢ Dealings with end-users, communication restrictions, etc. ➢ Disconnection cutover procedures.
Other Provisions	
➢ *Force majeure*	➢ List of conditions for which non-performance of interconnection agreement obligations will be excused
➢ Assignment	➢ Rights of assignment and restrictions on same (e.g. consent or regulatory approval requirements)
➢ Applicable laws	➢ Identifying jurisdiction whose laws will govern the agreement
➢ Regulatory Approvals	➢ Specify regulatory approvals required for effectiveness and/or renewal, amendment, termination, etc. of agreement.
➢ Breach of Agreement	➢ Remedies and penalties ➢ Liabilities, indemnification and limitation of liabilities
➢ Legal interpretation	➢ Standard provisions for legal interpretation and enforcement of agreement (e.g. entire agreement clause, effect of unenforceable terms, cumulative rights and remedies, etc.)

Contents	Detail & Comments
Other Provisions (*end*)	
➢ Dispute resolution	➢ Procedures for resolution of disputes under agreement that are not specifically dealt with elsewhere; for example: ➢ Good faith negotiations, time schedule for same, escalation through management levels; ➢ Referral to regulator, arbitrator or court (e.g. of different types of issues) ➢ Selection of and procedures for arbitration
➢ Term	➢ Duration of term ➢ Renewal rights and procedures.
➢ Amendment	➢ Review and re-negotiation procedures ➢ Impact of regulatory changes

Source: H. Intven. See also, http://www.infodev.org/projects/314regulationhandbook.

Annex II

Reference Interconnection Offer [RIO]: Indian Model

(Details on TRAI's Web Site www.trai.gov.in)

Sections covered in detail include

1) Scope and Definition of Services
   - Scope
   - Acceptance of RIO
   - Commitments
   - Amendments
   - Definitions

2) Points of Interconnection and Interconnection Principle
   - Points of interconnection
   - Traffic routing principle
   - Technical requirement set at PO
   - Collocations

3) Interconnection Provisioning Procedure
   - Initial deman
   - Formal deman
   - Provisioning. Testing and commissioning of deman
   - Augmentation of deman
   - Cancellation of deman
   - Guaranteed minimum usage perio
   - separate circuit groups based on charging principle
   - Damages due to the delay

4) Network and Transmission Requirements
   - Traffic Forecas
   - Network Engineering
     a) Diversity and alternate routing
     b) Grade of service and circuit provisioning
     c) Network changes intimations
     d) Provision of Calling Line Identification (CLI) details
     e) Carries Selection

5) Technical Service Commitments and Fault Repair
   - General commitments
   - Quality of service
   - Fault Reporting
   - Network restoration
   - Operating instructions
   - Planned maintenance works

6) Technical Specifications and Standards
- National Standards
- Signaling and Synchronization
- Interface Approval
- Transmission and Performance Standards
  - Transmission interface
  - Switching
  - Packet network
  - Speech performance
- PSTN / VOIP interoperability standards

7) Network Management, Maintenance and Measurements

8) Network Integrity, Safety and Protection

9) Operation, Special and Manual Services

10) Access to Interconnection Gateway Facilities

11) Charging Mechanism, Billing and Settlement
- Subscriber billing
- Inter-carrier billing
- Settlements
- Accounting
- Payments
- Errors and reconciliation
- Security deposit
- Fraud and default

12) Commercial Terms and Conditions
- Supply of services
- Third party rights
- Cost of interconnection
- Up-gradation
- Emergency services
- Applicable law
- Assign ability
- Waivers
- Partial invalidity
- Non discrimination

13) Interconnection User Charges
- Type of charges
- One-time charges
- Rental charges
- User chargers
- Set up charges

14) Fundamental Technical Plans

15) Confidentiality, Liability and Indemnities

16) Liaison and Coordination

17) Termination and Review of RIOs

18) Settlement of Disputes

19) Notices

Schedules

- Point of Interconnection Schedule
- Performance Standard Schedule
- Infrastructure Charging Schedule
- Miscellaneous Service Charging Schedule
- Interconnection Usage Charge Schedule for Unbundled Network Elements

Traffic hand-over Principles

– PSTN to PSTN (Outgoing Traffic)
  - Local
  - Regional
  - National
  - International

– PSTN to PSTN (Incoming Traffic)
  - Local
  - Regional
  - National
  - International

– PSTN to PLMN Traffic
  - Regional
  - National
  - International

– PLMN to PSTN Traffic
  - Regional
  - National
  - International

Annex III

Planning and Operations of an Interconnection (Belgium Model)

Source : www.bipt.be

Items covered are as below:

1) References
2) Acronyms
3) Scope
   - Technical Implementation Committee
   - Implementation Meeting
4) Responsibility
   - Incumbent
   - Competitor
5) Exchange of Information
   - Incumbent
   - Competitor
6) Transmission Facilities
   - For Incumbent's traffic
   - For Competitor's traffic
7) Choice Of Point Of Interconnection
8) Testing
   - Transmission Tests
   - Switching Tests
   - Clock tests
   - Network Upgrades
   - Compatibility Tests
   - Integration Test
9) Forecasting and Ordering
   - Start Up Period
   - Regular Regime
     - Rolling Forecasts
     - Ordering Intentions
     - Regular ordering of capacity
     - Order acceptance
     - Dimensioning of Switching Capacity
     - Dimensioning Of Transmission Capacity
     - Rush Order
10) Differences between successive forecasts and ordered capacity

11) Firm Order amendments before due date
    - Capacity decrease
    - Capacity increase
        - Switching
        - Transmission

12) Modification of an Existing Interconnection
    - Capacity removal
    - Capacity rearrangement
    - Capacity shift to new POI
        - Switching
        - Transmission

13) Lead Time for Provisioning

14) Routing Principles

15) Signaling

16) Performance Standard

17) Operations
    - Fault Handling
    - Routine Testing
    - Cooperation regarding fraud, security and law enforcement
    - Planned outages
    - Building Access
    - SDH management
    - Network synchronization

Annex IV

Regulations on Technical Issues [Finland Model]

Source : www.ficora.fi

- Finland is having a number of Regulations on following issues:
- Interconnectivity, Interoperability and Signaling
- Structure of Telecommunication Networks
- Synchronization of Digital Networks
- Performance of Telecommunication Networks
- Charging Principles in public telecommunication networks
- User access to public telephone networks/ ISDN and services
- Technical documentation of telecommunication networks and services
- Submission and publicity of interconnection agreements
- Telephone number portability
- Technical Implementation of identification services in telecommunication networks
- Management of public telecommunication networks

Annex V

Other Interconnection Options

i) Capacity Based Interconnection Vs Time Based Interconnection

ii) Build Operate and Transfer Concessions

i) Capacity Based Interconnection Vs Time Based Interconnection

A new concept/ model of capacity-based interconnection finds a mention in one of the contributions received by the Study Group. Its basic aim was to give new operators greater flexibility in providing a range of services using the telephone network while rendering them less dependent on their relations with the operator having significant market power and owning the access network, the overall intention being to promote a higher degree of competition. This is at variance with a time-based interconnection model, in which the charges for interconnection traffic were a function of time, the level of the interconnection (local or transit) and the services carried.

From the point of view of the contracting operator, the basic difference between the capacity-based and time-based interconnection models lies in the billing arrangements applied. In the time-based model, the established operator bills the new operator on the basis of the volume of traffic (number of minutes) exchanged between both networks, whereas in the capacity-based model the new operator contracts for a specific network capacity (measured in terms of the number of links), in accordance with predetermined objectives of availability and quality; the operator is billed a fixed amount reflecting the number of links contracted, independently of the volume of interconnection traffic actually carried. The amount charged also depends, as is standard in network interconnection, on the level at which the interconnection is established (basically, at the local switching network level or at the transit switching network level).

From the economic point of view, the implementation of a capacity-based interconnection model implies that the contracting operator has to switch from variable to fixed costs. The contracting operator is responsible for the dimensioning of the interconnection network needed to carry its traffic with the interconnected operator, usually the owner of the access network.

The model severs the existing link between the cost of interconnection services and the volume of traffic actually carried, with the effect that new operators using the model are encouraged to develop policies aimed at fostering demand with a view to more intensive use of the network, for example capturing traffic at off-peak times, with no repercussions on their costs. Proper application of this model can result in interconnection unit costs that are lower than those of the time-based interconnection model.

In conformity with the regulatory model in force in the European Union, the interconnection charges of an operator with significant market power are cost-orientated, it being therefore essential that the capacity-based model does not automatically result, *per se*, in a drop in the income obtained by the operator as remuneration for interconnection services. This principle, which can be referred to as "economic continuity", must be maintained, otherwise the income of the operator offering that model below cost will be unjustifiably eroded. This means that the application criteria for capacity-based interconnection should be such that any reduction in the costs of new operators is obtained not by the mere fact of adopting a new interconnection model but as a consequence of active business stratagems that change those operators' traffic profiles and lead to more intensive and efficient use of the network capacity they have contracted. New operators possibly can thereby benefit from the potential reduction in unit interconnection costs this model affords.

ii) Build Operate and Transfer Concession

Some of the countries in the pre-liberalisation era, have Build Transfer Operate (BTO) concessions in place. Under BTO, a company gets awarded a concession to build a telecommunication network or service, hands over the ownership to the national telecommunication or PTO and operates it for a certain period of time. Revenue Share arrangements are generally in place in such countries.

As the market segments are opened up and competition sets in and Interconnection Usage Charge Regime is prescribed by the Telecom Regulator or competent Authority as may be applicable, BTO concessions possibly would call for a review in accordance with the provisions contained in the contractual agreements entered under BTO.

Annex VI

Possible Solution For Interconnection In Multi-Operator And Multi-Service Scenario Through An "Interconnect Gateway Exchange" And "Interconnect Billing Clearing House"

Source: Extracts from 22nd APT Study Group Reports on Study Question 2.10 and 2.11. Full text of the Report is available on APT Web Site.

The opening of telecom scenario has brought a lot of value to the customers. The service quality is improving, prices are coming down and competitive operators are offering many new services. Behind the bright scene, a complexity is also developing, which if not tackled with long term perspective at the very beginning, could lead to a complex situation resulting in an increase in the cost of interconnecting network for multi-operator multi-service scenario. Incumbent's Network generally in all developing countries does not have adequate interconnection facilities for new entrants. As a result investments made by new entrants are required to wait for the availability of interconnect facilities. It leads to

- Higher cost of service
- Inefficient handling of call
- Sub-optimal utilisation of network
- Serious increase of CAPEX and OPEX making operation unavailable

Considering low affordability of general population in the developing countries, it should be the most important endeavour to-day to keep the CAPEX & OPEX of the network as low as possible, so that the communication facility may be provided at most affordable prices.

- Many of the developing countries have very high population but low tele-density
- There is a need to cover very large number of cities, towns and villages spread all over the country.
- There is a variety of terrain and spreading of network all over is not an easy task.
- Existing infrastructure is insignificant.
- Existing network is backdated and not planned to support dramatic future growth.
- Existing models and plans used to spread communication network are not tenable for mass-market model.
- Solution used elsewhere in the world may not the solution in developing countries.
- There is a need to find out the key problem area and then decide what possibly could be the best possible solution.
- There is generally lack of financial support for experimentation.

- Critical analysis of the issues could lead to a possible solution which would hold good for the long-term period also.
- There is a need to give up many traditional concepts and try out new, simple and elegant options that could provide a long-term cost effective sustainable interconnect network architecture.
- There is a need to find out a new solution, which might be the role model for developing countries.

Interconnecting the emerging Networks – a nightmare

Interconnection is one of the most serious problems that is emerging with the increase in number of operators in any country with open market conditions and Interconnection licensing requirements which possibly call for mandatory interconnections between each of Cellular, Basic and National Long Distance Operator in any particular licensed service area. With the increase of number of operators in different services, the number of interconnect links between operators will increase in multiples and will be very soon unmanageable. This could be clearly understood from the following example.

In one of the countries, the interconnection mandated between Access Providers and National Long Distance Operators as suggested by the Licensing /Regulatory Regime is at each Long Distance Charging Area and there are 322 Areas in the country under reference. Interconnection between Basic and Cellular Service Providers also take place at this level. NLDOs can also pick up the traffic at Local Area level. Basic Services Operators are expected to establish their POIs in each Local Area. Over the whole country there are 2647 Local Areas. International Long Distance Operators also can pick up traffic directly at Local Area level or through NLDOs. At present the country is already having 4 International Long Distance Operators, 4 National Long Distance Operators, 4 Cellular Operators in most of the Licensing Areas and two to four Basic Service Operators at Licensing Area level.

Example:

In a typical Long Distance Charging Area, the interconnection scenario will be dependent upon the number of multiple operators providing different type of services as per details below:

• Number of Basic Service Operators	4
• Number of Cellular Mobile Operators	4
• Number of National Long Distance Operators	4
• Number of International Long Distance Operators	4
Total	16

To connect these 16 operators with each other, we will need 16 x 15, i.e. 240 interconnect links, and where each operator will have to have 15 interconnects. If each operator has an interconnection with 2 E1s, 480 E1s will be required.

To handle so many interconnections will be too difficult to be provided and also be operationally difficult to manage. If we consider similar or more complicated situation in half or even one third Long Distance Local Areas, the gravity of the problem could well be understood.

To avoid this serious operational problem and to provide a manageable interconnect regime, an Interconnect Exchange at each LDCA level managed by an independent operator could be a possible solution.

Figure I and II illustrate the example.

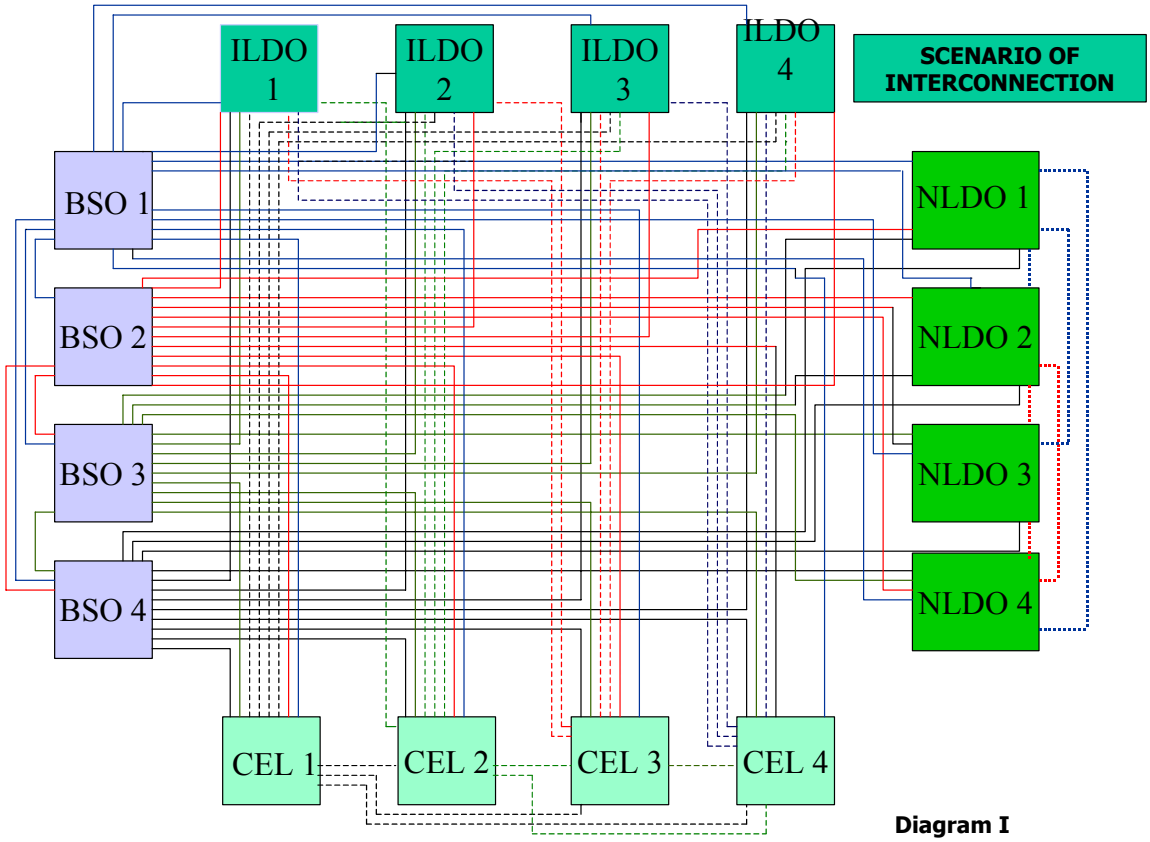


Diagram I

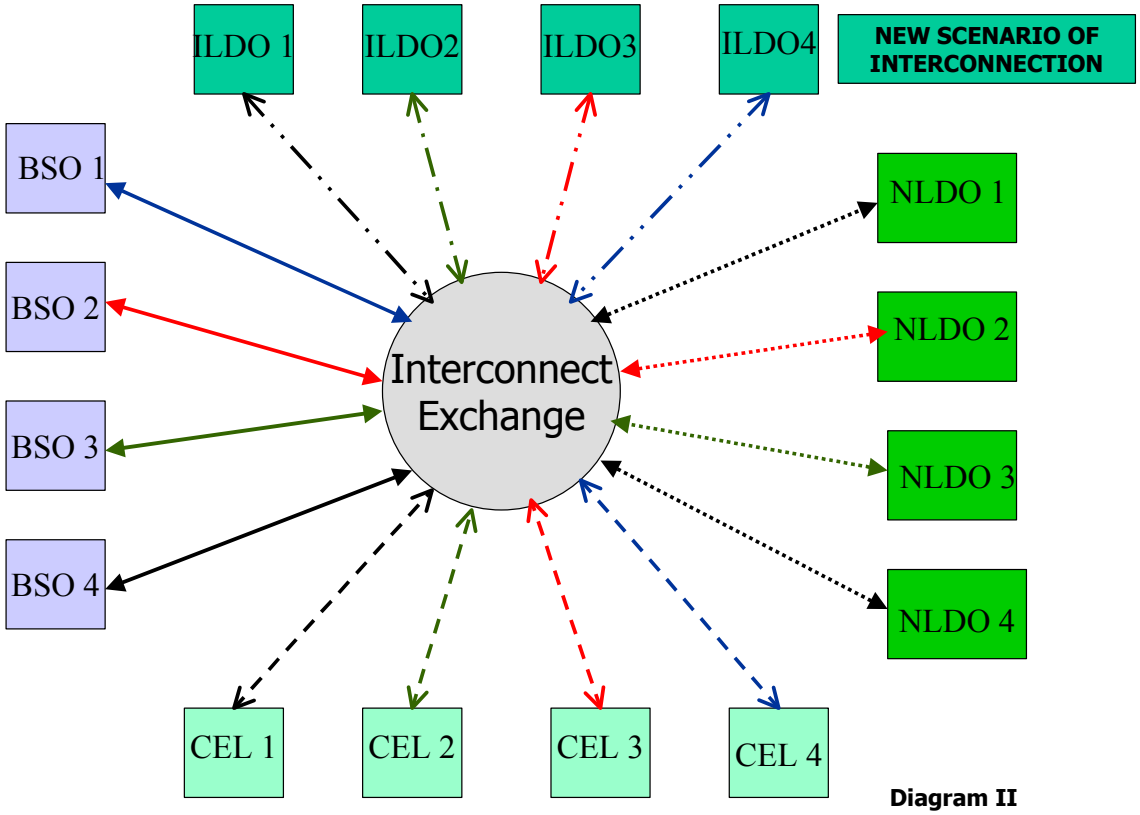


Diagram II

Features of Interconnect Exchange

1) Interconnect Exchange could be connected to each operator at POIs preferably through a duplicated interconnect link.

2) As all the operators would be connected to only one interconnect operator, uniform terms of interconnect could be applicable

3) Interconnect Exchange could be versatile enough to accommodate all type of interconnect links as per licensing/ regulatory requirements

4) Interconnect Exchange operator could work as a mediator and the Clearing House for the bills between service providers. In the first instance, incumbent operator could offer these services. In case he declines, one of the new operators could provide such interconnect exchange for all type of interconnections at designated POIs

5) In the scenario with 16 operators in a typical POI Area, with the introduction of an Interconnect Exchange the number of Interconnect links could be reduced to as little as 16 from staggering number of 240 links needed based on the present recommended interconnection architecture.

Advantages

- **Network Simplicity**: Interconnect Exchange will immediately simplify the network interconnection architecture.

- **Optimisation of number of Interconnect links**: Interconnect Exchange will drastically reduce the number of interconnects. Present requirement of interconnect link in any POI Area is N x (N-1), where N is the number of operators to be interconnected. After introduction of Interconnect Exchange, it will drop down to N, i.e. equal to number of operators.
- **Simplicity in Digit analysis/ Route selection**: The Interconnect Exchange will take over the load of digit analysis for all Inter operator calls and Inter circle calls from the exchanges connected to it.
- **Simplicity of Operation**: The Exchanges of service operators will be responsible for analysing and routing calls within their network only. This will dramatically simplify their operational and coordination problems.
- **Simplification of Carrier selection function**: the Interconnect Exchange, making all type of carrier selection possible even in the present network scenario, making National Long Distance Operation more users friendly, may handle Carrier selection responsibility for LDCA.

Simple, Cost effective and reliable POIs

- As any operator will need to maintain only one POIs in any POI Area, it will cost effective for each operator to go for most reliable and upgradeable media like SDH Rings for POIs in each Local Area, which will provide much more dependable service to the end users. The Interconnect Exchange operator will be in a position to collate the requirements of all operators and plan out augmentation of POI capacities in a time bound and cost effective manner.

Efficient handling of New and Traditional Interconnects

- As in near future, a part of the national network will be IP based, it will be very expensive for every incoming IP operators to have different type of protocol conversion hardware and software installed at their end to handle interconnections with different traditional operators. If the same is handled in the Interconnect Exchange, it will be much more cost effective, efficient and uniform.

Better utilisation of Interconnect links

- As the peak traffic period of different services is not identical, an Interconnect Exchange can help in more efficient usage of the Point of Interconnects.

Interconnect Exchanges Responsibility

As the Interconnect Exchanges will handle all inter operator calls, it is in a unique position to work for

- Inter Operator bill settlement (Clearing House function)
- Reconciliation and MIS generation.
- Tariff based/ Time based route selection.
- Route related announcements.
- Carrier selection.
- Promotion handling in coordination with operators etc.

These functions could even be controlled by Financial Institutions in case the traditional or upcoming service operators are not in a position to offer such facilities.

Centralised data base control for nation wide uniformity of service

- All Interconnect Exchanges at Local Area level then could be connected through a nation wide network, to Regional/ Centralised data base, so that the operational data of all Interconnect Exchanges will be uniform, to support uniform service quality through out the country.

Source of Revenue for Interconnect Exchange

- Being a common facility, each operator could pay a small part of the outgoing inter-operator call revenue to the Interconnect operator
- For Clearing House operation, it could get a separate charge from each operator.
- Reconciliation service and MIS could also be a charged service.
- Announcement handling on behalf of different operators and promotion handling could also be a source of revenue.
- Carrier selection feature charge if controlled by Interconnect Exchange could be another source of revenue.

Cost of Interconnection with Interconnect Exchange

- The cost of bringing an interconnect link to an Interconnect Exchange could be the responsibility of Interconnect seeking operator. Terminal equipments at both ends and media could be commissioned and maintained by Interconnect seekers at their cost. Interconnect Exchange could provide space, power etc. for entry and installation of terminal equipments.
- The specification and type of terminal equipment should be guided by the applicable National standards. The minimum capacity of Interconnect for a particular service operator may be mutually decided on local basis.
- The rental to be levied by Interconnect Exchange operator to an interconnect seeker for Space, Power, Air Condition environment and for Hardware & Software to support the interconnect links could be determined and proclaimed by Regulator on time to time through cost base analysis.

Equality in Terms of Interconnect

- A standard interconnect agreement format may be created in consultation with Regulator and to be followed by all operators. It will bring uniformity in terms of interconnect and all operators will receive same treatment.

Annex VII

Functional Requirements of an Interconnect Billing System as an illustration

Source: Extracts from 22nd APT Study Group Reports on Study Question 2.10 and 2.11. Full text of the Report is available on APT Web Site.

Key Requirements of an Interconnect Billing System would include:

- To provide interconnect billing information for calls being carried on behalf of other operators
- To verify bills received from other operators
- To provide MIS information on wholesale products, services, customers and network usage
- To meet audit and integrity requirements
- To support the development of the company's strategy in the interconnect market
- To support specific interconnect billing mechanisms.

Functional System Requirements

- Data Integrity.

  It is imperative that the end-to-end system and the business processes put in place to operate it, from capturing the records at the exchanges to producing the bills, do so without losing any records. This issue becomes more important as the operator matures and both the complexity of its interconnect business and the volume of interconnect calls increases.

- Audit-ability.

  Operators may have the right to audit your interconnect system and the quality of the system must be demonstrable to an external auditor. There must be a clear and unambiguous audit trail through the system. This may be especially true of incumbents who may have to prove to the regulator that they are not cross-subsidising their retail business from their interconnect operations (accounting separation).

- Accuracy.

  The system must process the data correctly and accurately. This is particularly important because the operators you are dealing with are still competitors. Disputes over the accuracy of bills could make relationships extremely uncomfortable and give rise to accusations of deliberate miscounting. Long-running disputes could also delay the payment of very large bills with the associated impact on cash flow.

- Robustness.

  Because of the huge volume of data it handles and because interconnect is of the critical importance to the business, the system has to be robust and reliable. Data is produced 24 hours a day, every day of the year and resilience must be considered when designing an interconnect system.

- Flexibility.

  Interconnect billing is a fast changing area and the system has to be designed so that it can be enhanced and updated quickly in line with changes in the business environment. Flexibility needs to be reflected in the design of the system, the structure of the database and application and the choice of hardware and software tools.

- Scalability.

  Because of the difficulty in forecasting future interconnect volumes, it is important to design a system that will not be limited by its own capacity to process calls.

- Operability.

  From a computing perspective the system has to be easy to operate and upgrade.

- Maintainability.

  Interconnect systems require large amounts of reference data. The data storage structures and data entry mechanisms must allow users to maintain the system with minimum effort. Tools are required to enable data to be entered into the system easily, quickly and accurately in an auditable manner.

- Ease of use.

  The system should be easy to use and intuitive for users to learn. It should have the same "look and feel" as the other desktop applications the user may be us

Other Requirements

Other functional requirements which would vary from country to country are:

- Cost and Tariff models for Multi-Operator Multi-Service interconnection
- Network components for call conveyance
- Point of Interconnections
- National Fundamental Plans including Routing, Charging and Signalling Plans
- Costing Interconnection services
  - Call termination
  - Call origination
  - Call Transit
  - Single/ Multi Tandem services
- Network Components
  - Local switch, Tandem Switch, Local loop, Concentrators, POIs, MDF etc
  - Traffic sensitive versus non traffic sensitive components
- Typical Routings for Retail and Wholesale call services
- CDR details to contain at least the following information: -
  - Carrier Related Information
  - Identity of the Originating carrier
  - Identity of the Terminating carrier.
  - Identity of the Transit Carrier.
  - Geographical Information
  - Originating Charging Area
  - Terminating Charging Area
- Interconnection Agreements and Interconnect Billing issues
- Charging areas of Point of Interconnects (POI) located at Entry and Exit of the Transit Network

- Accounting Separation and Interconnect Pricing
- Features of Mobile telecommunications networks, costs and tariffs
- Features of Fixed telecommunications networks, costs and tariffs
- The importance of robust cost allocation principles
- Traffic sensitive versus non traffic sensitive costs
- New options like using an Element Based Charge Matrix approach
  - How to construct an Element Based Charge matrix
  - Separation of routing from costing
  - Building and testing of the EBC matrix
- What information is needed to bill an operator
  - Switch call records
  - Number groups and ranges for identification of call types
  - Call classes
  - Operator identifier
- How basic information is processed to produce an inter-operator bill
  - Elements needed to compute call charge
  - Database systems (Routing reference model etc.)
- Reconciliation of billing charges.
- Licensing issues with regard to billing

Annex VIII

Interconnect Billing in British Telecom

(Based on EMAIL Response from BT Consultants)

There are two main billing systems in British Telecom (BT):

- CSS which is used to provide retail billing for end (retail) customers and
- INCA which is used to bill for Interconnected calls from other operators.

The two systems are completely separate. In general long distance calls are handed over at a BT Tandem switch and can be routed through the BT Network to either the same operator or a second operator i.e. OLOI – BT – OLOI or OLOI – BT – OL02. Interconnected calls handed over at a local switch must terminate on that local switch,

BT does not provide long distance conveyance for Interconnected calls handed over at a BT local switch. To provide long distance transit for calls handed over at a local exchange would require additional local to tandem exchange capacity, modifications to local exchange and modifications to the billing systems.

The retail billing system uses only the BT local switches to determine call charges for retail billing. Billing information collected from tandem switches, when collected, is used only for Interconnect billing.

Until the need arose to perform Interconnect billing (early 90s) there was generally no need for billing at the tandem switches. The Interconnect billing system has grown substantially and handles more calls than a regional retail billing system. This is a reflection of the number of the number of other operators in the UK market who Interconnect with BT.

The call information recorded at the tandem switch where the calls enter, is used in conjunction with an Element Based Cost EBC matrix to compute the cost of the calls. This concept is increasingly being used in Europe. The process essentially characterises the calls as types for example single tandem or double tandem depending on the number of switching stages used. The UK also uses a further splitting of the double tandem in to double tandem long and double tandem short to accommodate the transmission length.

For BT the call charges are regulated and BT is required by Oftel to demonstrate that the charges are cost oriented. As a quick and crude example of how this works, a double tandem call would require the use of two tandem switches and some length of transmission. The total call cost would be calculated by summing the call costs of the components used: switching and transmission. The cost of the transmission would be calculated from the unit cost (Pence/ Km/ Min) of inter-tandem transmission and the average distance a double transit call would be carried. Historical traffic data is used to determine the average distances. Thus the call charges calculated are averaged over the appropriate distance. We can provide more about the method of calculating charges if required.

It is possible that between two points there are many alternative routes. The Network routing system therefore employs a least cost routing algorithm. Essentially the algorithm determines several routes and then looks at the number of switches on each route. The route with the lowest number of switches is selected as the quickest route. The key point is that although the routing of the call through the Network may vary the call charge depends only on the point where the call enters the Network and where it leaves, not the actual route taken.

Annex IX

Functional specification of carrier selection: Indian example

(Details on TRAI Web Site www.trai.gov.in)

1 Call by Call Carrier Selection.

1.1 Call by Call Carrier Selection facility shall be provided to all subscribers of CMSOs /BSOs including pay phone lines and also to pre-paid card customers. However, Call by Call Carrier Selection shall not be provided to operator-assisted calls, including transfer /reverse charge calls.

1.2 Adequate storage capacity will be provided in the switching nodes of both Cellular Mobile /Basic service operator's networks to store additional four digits (CAC) dialed by the subscribers. Adequate depth of digit analysis capabilities will be provided in switching nodes for proper routing of long distance calls to the POP of the long distance operator based on the analysis of CAC and long distance trunk prefix (0 / 00) dialed by the subscriber.

2 Carrier Pre-selection (CPS)

2.1 CPS facility shall be provided to all cellular subscriber including pre-paid card subscribers of CMSOs. CPS shall be available only in the service area of a CMSO. It will not be available to roaming subscribers visiting another service area.

2.2 The applicable CACs of pre-selected carriers shall be stored in the subscriber's database. Pre analysis of initial 3 / 4 digits and the calling line category shall indicate to the call processing program that it is a pre-selected long distance call, accordingly the CAC (four digits) will be read from the subscriber data memory area and inserted after '0' or '00' i.e., trunk prefix by the call processing program. Subsequent processing of the call will be identical to what is applicable in case of Call by Call selection.

2.3 Pre-para provides a conceptual view of processing required to be done in a typical local exchange /MSC and is based on discussions in the High Level Technical Committee. The operators are free to implement the CPS facility in their switching nodes in the manner they like. However, the switching nodes should be treated like a black-box and the CPS modification should not necessitate changes to the standard signaling systems (CCS7 / MFC), specified by TEC, for the Indian Telecom Network.

Annex X

Methodology for recovery of costs incurred by Access Providers in setting up of Carrier Pre-Selection : Compilation of International Practices

(Extracts from TRAI Directions on Carrier Selection, Details on TRAI Web Site www.trai.gov.in)

United Kingdom (UK)

- In the UK, significant costs had to be incurred in upgrading older generation switching systems like AXE-10 (earlier version), TXE-4 / UHD-5 etc.
- BT's 'System set-up' costs include costs of upgrading BT's switches to be recovered through a pence-per-minute surcharge on BT's wholesale call origination charges. This will be for a duration of 5 years. The surcharge applies to all calls carried on BT's network that are capable of being pre-selected even if the call is not actually carried by a pre-selected operator. This decision was taken since the OFTEL's economic analysis showed that all customers originating calls on BT's network would benefit from the increased competition created by CPS, even if the customer does not actually use CPS.
- In the UK, all operators pay an initial 'per operator' charge of about Pound Sterling 23,000 to cover BT's data amendment and forecast handling costs. This charge applies to all the operators even if they enter at a later date. It is presumed that after 5 years, BT's cost recovery should be complete and no operator has to pay this surcharge.

Ireland

Cost Allocation

Three broad cost categories associated with the provision of CPS as below are identified: -

a) *General system provisioning costs:* These are once-off costs mainly incurred by the incumbent operator in modifying network and support systems to enable CPS. System provisioning costs are independent of operator demand.

b) *Operator-specific enabling costs:* These are the costs of enabling CPS for any individual operator, including the setting up of commercial arrangements for the electronic transfer of customer orders.

c) *Per-line enabling costs:* These are the mainly administrative costs of implementing CPS for individual customer lines.

Allocating Per-Line and Operator-Specific Enabling costs

Six guiding principles for cost apportionment were used to determine the Regulator's initial proposals for apportioning the three costs.

1) *Cost causation:* the party responsible for causing costs should help to bear the costs.

2) *Distribution of benefits:* the party(ies) benefiting from the process should help to bear the costs.

3) *Effective competition:* the cost allocation mechanism should inherently encourage competition.

4) *Cost minimisation:* the cost allocation mechanism should encourage operators to minimise costs and in particular to adopt technically efficient solutions.

5) Reciprocity: Charges between operators should be equal for the same service (generally applicable to a service like number portability only, as only Incumbent is currently mandated to offer CPS).

6) Practicability: the allocation mechanism should be practical to implement.

Note – Oftel is also following the same set of guiding principles

Applying cost causation as the primary principle is generally sound, on the grounds that economic efficiency is enhanced by requiring parties to pay for costs, which they directly cause to be incurred.

Using these guiding principles, the Regulator proposed that per-line and operator-specific enabling costs should be recovered from CPS operators. This ties in with the cost causation principle, which is generally straightforward to apply and normally the key factor in cost allocation.

The Regulator further proposed that these costs should be recovered from CPS operators directly, not through conveyance charges. CPS operators are free to pass the per-line cost on to their customer directly or to recover it in some other way.

1) Per-line and operator-specific enabling costs can be recovered from CPS operators directly.

2) The operators are free to pay the per-line enabling cost on behalf of the consumer, and recover it in some way other than by a direct charge to the consumer. This is a commercial decision for each CPS operator.

3) Per-line and operator-specific charges shall include only the costs of an efficient operator using an efficient technical solution.

Applying the Principles to General System Provisioning Costs

The burden of general system provisioning costs could be shared between Incumbent and the CPS operators. This was mainly justified on the basis of effective competition and distribution of benefits, given that all customers, including Incumbent, will benefit from the increased competition brought about by CPS. Arguments about practicability and cost minimisation tend to support the same conclusion.

Other European Countries

In Austria and Holland, system setup costs are recovered by the Incumbent from other Carriers.

In Germany and Norway, System setup costs are not recovered by the incumbent from other Carriers.

Mexico and Argentina

Some of the Developing Countries like Mexico and Argentina had worked out the cost for the implementation of Carrier Pre-selection based on the number of Carrier Pre-selection transactions. The work was assigned to an outside consultant known to be a leading third party provider for pre-subscription data base setup and administration plus associated services such as balloting and verification.

A cost of £ 19,20,000 per year was worked out as processing cost based on 80,000 transactions per month at a rate of £ 2 per transaction.

South Africa

The providing carrier's reasonable costs incurred in providing carrier pre-selection facilities for new subscribers and for changes to pre-selected operators shall be categorized as System Set-Up Costs, Per Operator Set-Up Costs and Per Subscriber Set-Up Costs and shall be allocated accordingly.

On or following 7 May 2002, each providing carrier may impose a one-time charge upon each new subscriber and upon each subscriber making a change in its pre-selected operator. Where a providing carrier imposes a charge pursuant to this section, such charge shall consist of the Per Subscriber Set-Up Costs and the proportional share of the System Set-Up Costs and Per Operator

Set-Up Costs associated with such new-service or change in pre-selected operator. Allocations of System Set-Up Costs and Per Operator Set-Up Costs shall be based upon reasonable estimates of the number of new lines and pre-selected operator changes expected by the providing carrier.

In respect of any individual item of cost under this section, the Authority may determine into which category of cost it falls, and if it considers that any such item of cost cannot be reasonably categorized as System Set-Up Costs, Per Operator Set-Up Costs or Per Subscriber Set-Up *Costs,* the Authority may determine .whether and to what extent the providing carrier may reasonably recover such costs. The Authority may determine whether a providing carrier's estimates of new subscribers and pre-selected operator changes are reasonable and may substitute its own values where it determines that such estimates are unreasonable.

Any eligible costs recoverable through carrier pre-selection cost recovery mechanisms shall not result in any burden, as determined by the Authority, to the implementation of carrier pre-selection. Should such recoverable eligible costs result in a burden to the implementation of carrier pre-selection, the Authority may determine by notice in the *Gazette* that such costs are not recoverable and are to be borne by the operator incurring such costs.

Annex XI

Polling and Subscriber Education as applicable for Pre-selection

(Extracts from TRAI Directions on Carrier Selection, Details on TRAI Web Site www.trai.gov.in)

General

Polling is a term used to indicate the process of ascertaining the choice of every subscriber in relation to his preferred carrier for long distance calls. Polling is an essential pre-requisite to Pre-selection. However, proper publicity and customer education have to be carried out prior to Polling. For polling to be successfully carried out, the following actions have to be taken:

- Proper publicity and customer education
- Definition of the polling process.
- Prescription of procedures for change of choice and post-Pre-selection default traffic

Subscriber Education

Publicity and subscriber education can be grouped into two categories, those relating to the polling process, description of Pre-selection and Call by Call selection processes and announcements, and those relating to use of specific Call by Call selection codes, change of choice, rates etc.

The former has to be done by the entity carrying out the polling process. The latter is a matter purely relating to competition and can be left to the respective carriers.

Definition of the Polling Process

The polling process may be as follows:

- Publicity regarding the choices available to customers and the manner in which such choices are required to be exercised.
- Individual letters to every subscriber enclosing explanatory material and forms for registering choice within a specified time.
- Telephone calls to all subscribers who have not responded in time, indicating difficulties that may be encountered if no choice is made.
- A second round of publicity and letters
- Entering Pre-selection choice of subscribers in exchange data followed by a brief period of special announcements.
- Supply of lists of subscribers failing to exercise choice, to other operators on payment, so that they can supplement the polling exercise.
- Subscribers, who respond to the announcements to be brought on to the pre-selected list.
- Introduction of the default announcement procedure.

Announcements

The announcement procedure requires investment and creates an initial disturbance in the free flow of traffic, it is therefore desirable to reduce its impact to the extent desirable by giving ample opportunities to subscribers to exercise their choice.

Post Polling Period

Once polling is complete and Pre-selection data entered in an exchange, a subscriber who has not exercised his choice will have to dial the Carrier Selection Access Code for each long distance call failing which, he will be routed to an announcement. For subscribers who exercise a late choice after the polling process is over, a fee should be recovered from the subscriber by the Access Provider.

Annex XII

Interconnect Usage charges (IUC) for use of Unbundled Network Elements (UNEs) involved in carriage of various types of calls: Indian Model

(Extracts from TRAI Consultation Paper. Details on TRAI Web Site www.trai.gov.in)

No.	Network Elements	Total OPEX per DEL	Mean Capital Employed per DEL	Cost of Capital (%)	Annual CAPEX	Annual CAPEX+OPEX per DEL	Minutes of Usage	Av. Cost per minute
1	Wireline/ Wireless Access Loop							
2	Local Exchange							
3	Local Tandem							
4	Toll (L.Dist.) Switch							
5	Local Exchange – Tandem transmission (terminal eqpt.)							
6	Local Exchange – Tandem transmission (distance comp.)							
7	Tandem to Toll (L.D.) Switch transmission (terminal eqpt.)							
8	Tandem – Toll Switch transmission (distance comp.)							
9	Inter-Toll Switch transmission Terminal eqpt. (Intra-License Service Area)							
10	Inter-Toll Switch Transmission distance comp. (Intra-License Service Area)							

No.	Network Elements	Total OPEX per DEL	Mean Capital Employed per DEL	Cost of Capital (%)	Annual CAPEX	Annual CAPEX+OPEX per DEL	Minutes of Usage	Av. Cost per minute
11	Inter-Toll Switch transmission Terminal eqpt. (Inter Service Area)							
12	Inter-Toll Switch Transmission distance comp. (Inter Service Area)							

NOTES:

1 Based on the above average cost per minute/per unit indicated in the table, it should be possible to calculate carriage/ access charges involving various types of switching and transmission elements such as Double TAX call for transit, Single TAX/ILT call for originating and termination.

2 The element costs may be different for different network sizes/ configurations.

Annex XIII

Interconnect usage charges derived from Annex IX: Indian Model

(Extracts from TRAI Consultation Paper. Details on TRAI Web Site www.trai.gov.in)

TYPE OF ACCESS/ CARRIAGE	NETWORK ELEMENTS INVOLVED	CHARGE/ MINUTE
Originating	Local Loop-Local Exchange-Tandem Exchange plus Transmission Link & Length	
Transit	Single TAX –Transmission Link & Length (Intra-Circle)	
Transit *	Two TAXs –Transmission Link & Length (Intra-Circle and Inter-Circle)	
Transit *	Three TAXs –Transmission Link & Length (Intra-Circle and Inter-Circle)	
Transit *	Four TAXs –Transmission Link & Length (Inter-Circle)	
Terminating	Tandem exchange plus Transmission Link & Length – Local Exchange – Local Loop	

* Usage charges are generally derived from the costs of traffic sensitive network elements, such nodes & links of the core network excluding Local Loop. The cost of the latter is generally recovered from Rentals.

Annex XIV

Inputs on Liaison including Handbook on Costing Methodologies

INTERNATIONAL TELECOMMUNICATION UNION

COM 3 – LS 12 – E

TELECOMMUNICATION STANDARDIZATION SECTOR
STUDY PERIOD 2001-2004

English only

Original: English

Question(s): 2/3

LIAISON STATEMENT

Source: ITU-T STUDY GROUP 3 MEETING

Title: REQUEST FOR COMMENTS ON THE DRAFT OUTLINE FOR THE SEPTEMBER 2003 REPORT FOR ITU-D STUDY GROUP 1

LIAISON STATEMENT

To: ITU-D Study Group 1, Q6-1/1

Approval: Agreed at the ITU-T Study Group 3 meeting in June 2003

For: **Action**

Deadline:

ITU-T Working Party 1/3 thanked ITU-D Q.6-1/1 for its liaison statement on the above-mentioned subject. ITU_T SG3 informed that they are willing to contribute to the work of Q.6-1/1. For that purpose, they referred to the Handbook on Costing Methodologies which contains useful information related to the development of a cost model. This Handbook explains the TAF, TAS and TAL cost models.

The Handbook is available at ITU-T SG3 website:

http://www.itu.int/ITU-T/studygroups/com03/index.asp

The Handbook can be seen at present if the user has ITU's TIES Account.

The Handbook is also available at ITU-D website:

http://www.itu.int/ITU-D/webdocuments/list_new.asp?meeting=B406011&lang=en&period=2002.

The table of contents for the Handbook is attached below.

Handbook on Costing Methodologies

Table of Contents

8 Annex 6 – WIK Model

List of abbreviations/Glossary

Annex XV

Cost Model for Interconnection Charges

Source: ITU World Telecommunication Regulatory Database

World: Africa

S.No.	Country	Does the regulatory framework prescribe a particular cost model for determining interconnection charges?	If Yes, is it		Is accounting separation used to establish interconnection charges?
			Based on a forward looking incremental cost model(e.g. LRIC, TELRIC)	Based on a fully allocated historical cost model (e.g. FDC)	
1	Botswana	No			Yes This is a license condition.
2	Burkina Faso	Yes	☑	☑	No
3	Cote d'Ivore	Yes			No
4	Gabon	Yes			Yes
5	Kenya	Yes	☑	☑	Yes
6	Malawi	Yes	☑		
7	Mali				Yes
8	Seychelles	Yes			No
9	Sierra Leone		Cost model: Incremental cost model.		
10	Sudan	Yes	Cost model: LRIC		
11	Tanzania	Yes	☑ Cost model: Not yet developed.		Yes
12	Zimbabwe	Yes	☑		No

Cost Model for Interconnection Charges

World: America

S.No.	Country	Does the regulatory framework prescribe a particular cost model for determining interconnection charges?	If Yes, is it		Is accounting separation used to establish interconnection charges?
			Based on a forward looking incremental cost model(e.g. LRIC, TELRIC)	Based on a fully allocated historical cost model (e.g. FDC)	
1	Argentine	Yes	☑		Yes
2	Bahamas	Yes		☑ Cost model: the service provider is expected to provide information on fully allocated, historical cost model (FDC).	Yes There is a provision within the License that state that the Licensee is required to prepare and maintain accounting records in a form that enables the activities of any business unit specified in any instruction given by the Commission to be separately identifiable, and which the Commission considers to be sufficient to show and explain the transactions of each of those business units.
3	Canada	Yes	☑ Cost model: Model used is similar to TELRIC		No
4	Colombia	Yes		☑	Yes
5	Costa Rica	Yes			Yes
6	Cuba	Yes		☑	

World: America

S.No.	Country	Does the regulatory framework prescribe a particular cost model for determining interconnection charges?	If Yes, is it		Is accounting separation used to establish interconnection charges?
			Based on a forward looking incremental cost model(e.g. LRIC, TELRIC)	Based on a fully allocated historical cost model (e.g. FDC)	
7	Honduras	Yes	☑		No
8	Nicaragua	Yes	☑		Yes
9	Panama	Yes	☑		No
10	Paraguay	Yes			
11	Peru	Yes	☑		No
12	Saint-Vincent-et-Grenadines	Yes	☑		Yes
13	Etats-Unis	Yes	☑ Cost model: The methodology for estimating and allocating costs varies with the type of interconnection charge. For example, interconnection rates for local traffic exchanged by local carriers are based on forward looking LRIC. Interstate access charges, however, are subject to price-cap regulation and involve the allocation of facilities costs between interstate and intra-state services.		No
14	Venezuela	Yes			Yes

Cost Model for Interconnection Charges

World: Asia Pacific

S.No.	Country	Does the regulatory framework prescribe a particular cost model for determining interconnection charges?	If Yes, is it		Is accounting separation used to establish interconnection charges?
			Based on a forward looking incremental cost model(e.g. LRIC, TELRIC)	Based on a fully allocated historical cost model (e.g. FDC)	
1	Australia	Yes	☑ Cost model: For declared services, TSLRIC is most often used. See www.accc.gov.au		No
2	India	Yes	Cost model: Please refer to Annex III of TRAI's Consultation Paper on "Telecom Pricing", dated 9th September, 1998. This is available on TRAI's website.		No
3	Indonesia	Yes	☑		
4	Japan	Yes	☑ Cost model: Interconnection accounting of designated telecommunication facilities, and long run incremental cost method based on regulation for interconnection charges. LRIC is applied to tandem switch , transmission line between tandem/local switch and signalling network.		Yes NTT East and West shall keep accounts in order relating to the interconnection with designated telecommunication s facilities.
5	Korea (Rep.)	Yes		☑	Yes
6	Malaysia	Yes	☑	☑	No
7	Singapore	Yes	☑		No
8	Sri Lanka	No			Yes
9	Maroc	Yes		☑	No

Cost Model for Interconnection Charges

World: Europe & CIS

S. No.	Country	Does the regulatory framework prescribe a particular cost model for determining interconnection charges?	If Yes, is it		Is accounting separation used to establish interconnection charges?
			Based on a forward looking incremental cost model(e.g. LRIC, TELRIC)	Based on a fully allocated historical cost model (e.g. FDC)	
1	Autriache	Yes	☑ Cost model: FL-LRAIC according to EU-Commission for details http://www.tkc.at (FL-LRAIC available only in German).		Yes
2	Azerbaidjan	Yes	☑		No
3	Belgique	Yes		☑ Cost model: Fully allocated historical top down model.	No
4	Tcheque (Rep.)	Yes		☑ Cost model: The actual cost-model is based on a fully allocated, historical cost model, System divides these cost into elements of the network.	

World: Europe & CIS

5	Denmark	Yes	Cost model: Modified historic and Best Practice. LRAIC to be introduced in 1-2 years.		Yes
6	Spain	Yes	☑		Yes
7	Estonia	Yes	☑ Cost model: LRAIC bottom up, soon top down.		Yes Only costs connected to the interconnection could be attached.
8	France	Yes			Yes
9	Georgia	Yes		☑ Cost model: Historical cost base and embedded direct costing methodologies.	Yes To ensure cost orientation transparency and non-discrimination.
10	Germany	Yes	☑ Cost model: WIK model for the network to be used in the next decision; actual tariffs were set on the basis of international benchmarks.		Yes Required by law; checked in each decision.
11	Greece	Yes	☑		Yes Based on Accounting Separation.

World: Europe & CIS

12	Hungary	Yes		☑	No
			Cost model: The model applies the principles of the activity based costing methodology and fully allocated the operators' audited historical costs (FDC, HCA). The cost base of the allocation is all types of operating costs and other expenses (with the exception of foreign exchange losses) based on the Hungarian Accounting Standards. The model ensures that non-PSTN related costs are not allocated onto interconnect services.		
13	Ireland	Yes	Cost model: LRIC and Historic cost models are used.		Yes The incumbent publishes separated accounts in addition to the statutory accounts.
14	Italy	Yes	☑		Yes According to EU Recommendations.
15	Kazakhstan	Yes			
16	Kirghizistan	Yes		☑	Yes
17	Luxembourg	Yes	☑		Yes
18	Malta	Yes	☑ Cost model: Looking at options.		Yes Priotised.
19	Pays-Bas	Yes			No
20	Norway	No			Yes New regulations under Implementation.
21	Poland	Yes	☑ Cost model: It is being worked out.		No

World: Europe & CIS

22	Portugal	Yes		☑	Yes
23	Rumania	Yes	☑		No
24	Russia				
25	Suisse	Yes	☑		Yes
26	Rumania	Yes	☑		Yes Accounting separation is used to demonstrate cost-orientation non discrimination for interconnection charges. However, to set interconnection charge controls of the RPI-x format require in addition considerable financial modelling work and the calculation of cost of capital.

Annex XVI

Compilation covering Technical Issues as reported by all member countries

Source: ITU World Telecommunication Regulatory Database- 2003

A	AFRICA	Does the regulatory framework prescribe technical requirements of interconnection?	If so does it address			Is the technical quality of access for new entrants equivalent to that of incumbents?	Numbering Plans	Tariff proposal	Tariff approval	Technical standards	Interconnection rates	Monitor service quality	How do customers access different carriers?		
			Number and location of points of interconnection	Network management across the points of interconnection	Other requirements								Carrier-selection prefixes	Carrier pre-selection (equal access)	Others
1	Angola	…				…	R	R Op Om	M R	R	R Op	R			Only one Operator
2	Benin						M Op	Op	M Op	M Op	M Op				
3	Botswana	No					R	Op	R	R O*	Op O*	R			
4	Burkina Faso	Yes	Yes			Yes	R	R Op	R	R	R Op	R			
5	Burundi	…				…	R	Op	R	R	Op	R	Yes		
6	Cameroon	Yes		Yes		Yes	M R	Op	M R	M R	M R	M R	Yes	Yes	
7	Cape Verde						R	M R	M Om R	M R		M R	Yes		
8	Central African Rep.						Op	Op	M	Op	Op	Op	Yes		
9	Chad	No					R	R Op	R	R	R Op	R			
10	Congo	Yes				Yes	Op	Op	M	M	Op	M			
11	Congo (Dem.Rep)	…				No	Op	Op	M	M	Op	M			
12	Cote d'Ivoire	Yes	Yes	Yes	Yes*[1]	Yes	R	R Op	R	R	R O*	R	Yes		
13	Equatorial Guinea						M	Op	O*	M	O*		Yes		
14	Eritrea	No					R	Op	R	R	Op	R			
15	Ethopia						R	Op	M	R	Op	R			Yes. Only one Carrier
16	Gabon	No				Yes	R	R	R	R	R Op	R		Yes	
17	Gambia						M Op O*	Op	M	M	M Op O*				Yes. N/A
18	Ghana	Yes	Yes			Yes	R	Op	Om R	R	R Op	R	Yes		
19	Guinea					NO	R	Op	M R O*	R	R	R	Yes		
20	Guenia -Bissau						R	Op	R	R	R Op	R			
21	Kenya	Yes	Yes	Yes		Yes	R	Op	R	R	Op	R		Yes	
22	Lesotho						R	Op	R	R	R Op O*	R			
23	Liberia						M	NR	NR	NR	NR	M NR			
24	Madagascar	Yes		Yes		Yes	R Op	Op	R	R Op	R Op	R	Yes		
25	Malawi						R		R	R	Op	R			
26	Mali	No				Yes	M R O*	Op	M R O*	R Op O*	R Op O*	R			
27	Mauritius	No					R	Op	R	R	R	R	Yes		
28	Mozambique						R	Op	M O*	R	Op	R	Yes		

A	AFRICA	Does the regulatory framework prescribe technical requirements of interconnection?	If so does it address			Is the technical quality of access for new entrants equivalent to that of incumbents?	Numbering Plans	Tariff proposal	Tariff approval	Technical standards	Interconnection rates	Monitor service quality	How do customers access different carriers?		
			Number and location of points of interconnection	Network management across the points of interconnection	Other requirements								Carrier-selection prefixes	Carrier pre-selection (equal access)	Others
29	Namibia						Op	R Op O*	M R O*	R	R	M R			Yes. Only one carrier
30	Niger	Yes	Yes	Yes		Yes	M	M	M	M	Op	M	Yes		
31	Nigeria	No				Yes	R	Op	R	R	Op O*	R			Yes. Only one carrier
32	Rwanda						M	M	Om	M	M	Om			
33	Sao Tome-et-Principe						Op	Op	M	NR		Op			
34	Senegal	No					R	R	R	R	R	R			
35	Seychelles	No					M	Op	M	M	M	M			Yes. We are presently working on indirect access.
36	Sierra Leone	Yes	Yes			Yes	M Op O*	M	M	M	M	M			
37	South Africa	Yes			Yes*[2]	Yes	R	Op	R	R	R Op	R			
38	Swaziland						Op	Op	M	Op	Op	Op			
39	Tanzania						R	Op	R	R	R Op	R			
40	Togo	Yes				Yes	R	R Op	R	R	R Op	M R	Yes		
41	Uganda	No				No	R	R	R	R	R Op	R			
42	Zambia				Yes*[3]		R	Op	R	Op	R	R			
43	Zimbabwe		Yes	Yes		Yes	R	Op	Om	Om	Om Op	OM Op	Yes		

B	AMERICAS	Does the regulatory framework prescribe technical requirements of interconnection?	If so does it address			Is the technical quality of access for new entrants equivalent to that of incumbents?	Numbering Plans	Tariff proposal	Tariff approval	Technical standards	Interconnection rates	Monitor service quality	How do customers access different carriers?		
			Number and location of points of interconnection	Network management across the points of interconnection	Other requirements								Carrier-selection prefixes	Carrier pre-selection (equal access)	Others
1	Antigua & Barbuda	No					M Op O*	Op	Om O*	NR	Op	Om O*			Yes. Only one international (cable & wireless)& domestic carriers (APUA)
2	Argentina						R	R O*	M R O*	M R	R O*	R O*			
3	Bahamas						R	R Op	R	R	R Op	R Op			
4	Barbados						M	Op	R	M	Op O*	R			
5	Belize	No					Op	Op	M	R	Op	Op			
6	Bolivia	Yes	Yes	Yes	Yes*[4]	Yes.	R	Op	R	R	Op	R	Yes		
7	Brazil		Yes	Yes	Yes.[*5]	Yes.	R	R	R	R	R	R	Yes		
8	Canada	Yes	Yes	Yes		Yes	R	Op	R	M	R	R		Yes	
9	Chile						M	Op	M Om O*	M	M Om O*	Om			
10	Colombia	Yes	Yes	Yes	Yes.[*6]	Yes	R	R	R	M R	R	Om O*	Yes		
11	Costa Rica	Yes	Yes	Yes			Op	R Op	R	R Op	R	R Op			Yes. Only one Operator
12	Cuba	Yes	Yes	Yes		Yes	M Op	Op	M	M	M Op	M		Yes	
13	Dominica						M	Op	M	M Op	Op	Op			
14	Dominican Rep.	No				No	R	NR	NR	R	R Op	R	Yes		Yes. Feature Groups B
15	Ecuador	Yes	Yes	Yes		Yes	R	R	R	R	R	R			Yes
16	El Salvador		Yes			Yes	R	Op	R	R	Op	Op	Yes	Yes	
17	Grenada						M	Op	M	M	Op	Om			
18	Guatemala	No					R	NR	NR	R	Op	NR	Yes	Yes	
19	Guyana														
20	Haiti						R	Op	R	R	R	NR			
21	Honduras						R	Op	R O*	R	Op	R			
22	Jamaica						R	Op	R		R	R			
23	Mexico	Yes	Yes	Yes	Yes.[*7]	Yes	R	R	R	R	R	R		Yes	
24	Nicaragua	Yes	Yes	Yes		Yes	R	Op	R	R	R Op	R	Yes		
25	Panama						R	R O*	O*	R	R Op O*	R	Yes		
26	Paraguay	Yes			Yes		R	Op	R	R	Op	NR			Yes

B	AMERICAS	Does the regulatory framework prescribe technical requirements of interconnection?	If so does it address			Is the technical quality of access for new entrants equivalent to that of incumbents?	Numbering Plans	Tariff proposal	Tariff approval	Technical standards	Interconnection rates	Monitor service quality	How do customers access different carriers?		
			Number and location of points of interconnection	Network management across the points of interconnection	Other requirements								Carrier-selection prefixes	Carrier pre-selection (equal access)	Others
27	Peru	Yes	Yes			Yes	M	R Op O*	R	M	R Op O*	R		Yes	Yes.After 2 years (Nov 2001) carrier preselection + carrier pre selection prefix.
28	St. Lucia	No				No	M Op	Op	M	M Op		R			Yes. No other carriers
29	St. Vincent and the Grenadines	No					R	R	R	R	R	R			
30	Suriname						Op	Op	M	Op	Op	Op	Yes		
31	Trinidad & Tobago						R	R	R	R	R Op	R			
32	United States						R	Op	R O*	R Op	R	R Op			
33	Uruguay						Op	M Op	M	M Op	Op	M Op			
34	Venezuela	Yes			Yes[*8]	Yes	R	Op	R	R	R	R	Yes		

C	ASIA PACIFIC	Does the regulatory framework prescribe technical requirements of interconnection?	If so does it address			Is the technical quality of access for new entrants equivalent to that of incumbents?	Numbering Plans	Tariff proposal	Tariff approval	Technical standards	Interconnection rates	Monitor service quality	How do customers access different carriers?		
			Number and location of points of interconnection	Network management across the points of interconnection	Other requirements								Carrier-selection prefixes	Carrier pre-selection (equal access)	Others
1	Afghanistan										NR	M	Yes		
2	Australia	No				Yes	R	Op	NR	R Op	Op	R	Yes	Yes	
3	Bangladesh						R	Op	R	R	Op	R			
4	Bhutan						R Op	Op	R	R	R Op	R			Yes. Only one carrier.
5	Brunei Darussalam						M	Op	M	M	Op	Om			
6	Cambodia	No				Yes	M	Op	M O*	M	M	M	Yes		
7	China	Yes	Yes			Yes	M	M	M Om	M	M	M	Yes		
8	D.P.R. Korea														
9	Fiji						Op	Op	M	R	Op	R			
10	India	No				Yes	M	R	R	Om O*	R O*	R			Not applicable at present
11	Indonesia	Yes	Yes			No	R	Op	M	R	R	R	Yes		
12	Iran (I.R.)						M Op	Op	M	M	M Op	M Op			
13	Israel	Yes	Yes		Yes.[*9]	Yes	M	M	M O*	M Om O*	M Om O*	M	Yes		
14	Japan	Yes			Yes.[*10]	Yes	M	M Op O*	M	M	M Op O*		Yes		
15	Kiribati						Op	Op	M	Op	Op	Op			
16	Korea (Rep.)	Yes		Yes		Yes	M	M R	M	M	M	M		Yes	
17	Lao P.D.R.						M	M Op	Om	M	M Op	M Op			
18	Malaysia	Yes	Yes		Yes.[*11]	Yes	R	R Op O*	Om O*	R O*	R	R	Yes		
19	Maldives						Op	Op	Om	Om		Om			Yes. N/A
20	Marshall Islands						Op	Op	R	NR	Op	Op			
21	Micronesia						Op	Op	NR	NR	NR	NR			
22	Mongolia	No				Yes	R	R Op	M R	Om R	R	R			Yes. There are no alternative carriers.
23	Myanmar	No					Op	Op	M Om	M Op	M Op	M Op			Yes. Not applicable
24	Nauru						M Op	M Op	M Op	Op	Op	Op			
25	Nepal		Yes			Yes	R	Op	R	R	R Op	R			
26	New Zealand	No					Op O*	NR	NR	Op	R	R	Yes	Yes	
27	Pakistan	Yes	Yes	Yes		Yes	R	Op	R		R Op	R	Yes		
28	Papa New Guinea						R	Op	R O*	R	R O*	R			
29	Philippines	Yes	Yes			Yes	R	Op	R	R	Op	R	Yes		
30	Samoa						Op	Om	Om	M	Op	Om	Yes		

C	ASIA PACIFIC	Does the regulatory framework prescribe technical requirements of interconnection?	If so does it address			Is the technical quality of access for new entrants equivalent to that of incumbents?	Numbering Plans	Tariff proposal	Tariff approval	Technical standards	Interconnection rates	Monitor service quality	How do customers access different carriers?		
			Number and location of points of interconnection	Network management across the points of interconnection	Other requirements								Carrier-selection prefixes	Carrier pre-selection (equal access)	Others
31	Singapore	Yes	Yes			Yes	R	Op	R	NR	R Op	R	Yes		
32	Solomon Islands								M						
33	Sri Lanka	Yes	Yes			Yes	R	Op	MR	R	R Op O*	R	Yes		
34	Thailand						M Op	Op	M Op	M Op	M Op	M Op	Yes		
35	Tonga	No					Op	Op	Op		M Op	Op			Yes. Only one carrier in Operation now.
36	Tuvalu						Op	Op	Om	Op	Op	Op			
37	Vanuatu														
38	Viet Nam	Yes				Yes	R		R	R		R	Yes		

D	ARAB STATES	Does the regulatory framework prescribe technical requirements of interconnection?	If so does it address			Is the technical quality of access for new entrants equivalent to that of incumbents?	Numbering Plans	Tariff proposal	Tariff approval	Technical standards	Interconnection rates	Monitor service quality	How do customers access different carriers?		
			Number and location of points of interconnection	Network management across the points of interconnection	Other requirements								Carrier-selection prefixes	Carrier pre-selection (equal access)	Others
1	Algeria						M	M	Om	M	M	Om			
2	Bahrain						R	R	R	R	R Op	M R			
3	Comores						Op	Op	O*	Op		Op			
4	Djibouti						Op	Op	O*		Op	Op			
5	Egypt	NO				Yes	R	Op	R	R	Op	R			
6	Iraq														
7	Jordan	Yes	Yes	Yes	Yes.[*12]	Yes	R	R Op	R	R	Op	R			
8	Kuwait	No				Yes	M	M	M	M	M	M			
9	Lebanon						M	M	M		M	M			
10	Libya						Op	Op	M	Op	Op	Op			
11	Mauritania	Yes			Yes.[*13]	Yes	R	R Op	R Op O*	R	R	R			Yes. Under study.
12	Morocco	Yes	Yes	Yes	Yes.[*14]	Yes	R	R Op O*	R O*	R	R Op O*	R			
13	Oman						R	M Om R	R O*	R	R Op	R			
14	Qatar	No					Op	Op	Op	O*		Op			Yes. Not applicable.
15	Saudi Arabia						R	R Op	R	R	R Op	R			
16	Somalia														
17	Sudan	No					R	Op	M R	R	Op	R			Yes. One carrier up to now.
18	Syria						Op	Op	Om	Op	Op	Op			
19	Tunisia						M	M R	M	M	Op	R			
20	United Arab Emirates	No					Op	Op	Op	Op	Op	Op			
21	Yemen	Yes	Yes	Yes		Yes	M Op	Op	M	M Op	Op	M Op			

E	EUROPE & CIS	Does the regulatory framework prescribe technical requirements of interconnection?	If so does it address			Is the technical quality of access for new entrants equivalent to that of incumbents?	Numbering Plans	Tariff proposal	Tariff approval	Technical standards	Interconnection rates	Monitor service quality	How do customers access different carriers?		
			Number and location of points of interconnection	Network management across the points of interconnection	Other requirements								Carrier-selection prefixes	Carrier pre-selection (equal access)	Others
1	Albania	Yes	Yes	Yes		Yes	R	Op	R	R	R Op	R	Yes		
2	Andorra						Op	Op	Om	Op	Op	Op			
3	Armenia	Yes	Yes	Yes		Yes	Op	Op	M	M Om	N R	M	Yes		
4	Austria	Yes				Yes	M	Op	R	M	R Op	R	Yes	Yes	
5	Azerbaijan	Yes	Yes	Yes		Yes	M	M	M	M	M	M	Yes		
6	Belarus						M O*	M Op	Om O*	M O*	M Op O*	M O*			
7	Belgium	Yes	Yes			Yes	R	Op	R	R	R	R	Yes	Yes	
8	Bosnia and Herzegovina						R	R	R	R O*	R Op	R			
9	Bulgaria	Yes	Yes	Yes		Yes	R	R	O*	R O*	Op O*	R	Yes		
10	Croatia	Yes	Yes			Yes	R	Op	R	R	R Op	R			
11	Cyprus	No					R	M R	R	M R	R	M R			Yes. Only one Operator.
12	Czech Republic	No				Yes	R Op	R Op	R	Om	R Op	R Op			Yes. No selection yet.
13	Denmark	No				Yes	R	Op	R	R	R Op	R Op	Yes	Yes	
14	Estonia	No				Yes	M R O*	Op	Op	Om R O*	Op	R			
15	Finland					No	R	Op	Op	R	Op	Op	Yes	Yes	
16	France	Yes	Yes			Yes	R O*	Op O*	M R O*	Om O*	R Op	R O*	Yes	Yes	Yes. Double numbering.
17	Georgia						M R	R Op	R	Om R	R	R			
18	Germany	No				Yes	R	Op	R O*	N R O*	R O*	R O*	Yes	Yes	
19	Greece	NO				Yes	R	Op	R	R	R Op O*	R			Yes. During the derogation period, liberalised services are accessed through dial-up to normal or freephone PSTN numbers.
20	Hungary	Yes	Yes		Yes.[*15]	Yes	M R O*	R Op O*	M R O*	M Om, O*	M R Op O*	R O*			Yes. Not implemented
21	Iceland	NO				Yes	R	Op O*	R	R	Op	R Op O*	Yes	Yes	
22	Ireland	No				Yes	R	Op	R	Om	R	R	Yes	Yes	

E	EUROPE & CIS	Does the regulatory framework prescribe technical requirements of interconnection?	If so does it address			Is the technical quality of access for new entrants equivalent to that of incumbents?	Numbering Plans	Tariff proposal	Tariff approval	Technical standards	Interconnection rates	Monitor service quality	How do customers access different carriers?		
			Number and location of points of interconnection	Network management across the points of interconnection	Other requirements								Carrier-selection prefixes	Carrier pre-selection (equal access)	Others
23	Italy	Yes			Yes.*16	Yes	R	Op	R	M R	R	R	Yes	Yes	
24	Kazakhstan	No			Yes.*17	Yes	M	Om Op	Om	M Om	Om Op	M		Yes	
25	Kyrgyzstan	Yes				Yes	R	Op O*	R	R	R	R		Yes	
26	Latvia	No					R	R Op	R	M R	R Op O*	R			Yes. Lattelekom has a monopoly.
27	Liechtenstein						R	R Op	R	R O*	R Op O*	R			
28	Lithuania	No				No	R	Op	Op O	O	Op	R	Yes		
29	Luxembourg	Yes			Yes.*18		R	OP	R	Om	R	Op			Yes. Carrier selection prefixes and carrier pre selection from 01.07.2000 onwards.
30	Malta	Yes			Yes.*19	Yes	R	Op	R	R	R Op O*	R			Yes. Numbering Plan under construction.
31	Moldova	Yes			Yes	Yes	M r O*	Op	Om R O*	M Om R Op O*	Op	M R O*			
32	Monaco	No				Yes	Op	Op	M	M	NR	M Op			Yes
33	Netherlands	NO				Yes	M O*	R	R	M	R	R	Yes	Yes	
34	Norway	No				Yes	R	Op	R O*	R	R Op O*	R Op	Yes	Yes	Yes. National free phone numbers.
35	Poland	Yes					R	Op	N R O*		R Op O*	R	Yes		
36	Portugal	Yes			Yes.*20	Yes	M R O*	Op	Om R Op O*	Om R Op O*	R Op O*	R O*	Yes	Yes	
37	Romania	No				Yes	M	Op	M Om O^	M	Op	M			Yes. Only one carrier.
38	Russia	Yes	Yes	Yes			R	Om Op	Om Op	R	Om	Om		Yes	
39	San Marino						R		M	R					
40	Serbia & Montenegro						M	Om	Om		Om	Om			

E	EUROPE & CIS	Does the regulatory framework prescribe technical requirements of interconnection?	If so does it address			Is the technical quality of access for new entrants equivalent to that of incumbents?	Numbering Plans	Tariff proposal	Tariff approval	Technical standards	Interconnection rates	Monitor service quality	How do customers access different carriers?		
			Number and location of points of interconnection	Network management across the points of interconnection	Other requirements								Carrier-selection prefixes	Carrier pre-selection (equal access)	Others
41	Slovak Republic	No				Yes	M	M Om	Om	M	Op	R			Yes. Monopoly until 31.12.2002.
42	Slovenia						M	M Om	Om	M	Op	M R			
43	Espafia						M R O*	Om R Op O*	Om R Op	Om O*	R Op O*	M O*			
44	Spain	Yes			Yes.*21	Yes							Yes	Yes	Yes. Direct numbering in the case of cable operators and the incumbent.
45	Sweden	No				Yes	R	Op	R	N R O*	Op	R	Yes	Yes	
46	Switzerland	Yes			Yes.*22	No	R O*	N R	NR	R O*	R Op O*	R	Yes	Yes	Yes. Assignment to telecommunication service providers and at their request of blocks of numbers under E.164.
47	Tajikistan						M	Op	M	M	Op	Om			
48	TFYR Macedonia	Yes			Yes.*23	No	M	Op	O*	M	Op	M			
49	Turkey	Yes	Yes	Yes		Yes	R	Op	R	R	R Op	R		Yes	
50	Turkmenistan						Op	M Op	Om	M Op	O*	Op			
51	Ukraine						M	M	Om	M	M	Om			
52	United Kingdom	No				Yes	R	R Op	Op O*	O*	R Op	R Op	Yes		Yes. Via a free phone number.
53	Uzbekistan						M	M Op	M Om	M Om	M Op	Om			
54	Yugoslavia														
55	Vatican														

Note: M= Ministry, R=Regulator, Op=Operator, Om+Other Ministry, O=Other, NR= No Response.

[*1]The rules on interconnection capacity tests and controls, test plans for switching, transmission, and signaling, performance indicators, and levels of performance required for interconnection service; a schedule of meetings where any changes required to improve the functioning of interconnection services are proposed and discussed.
[*2] POI at appropriate switch nearest to the point which the call originated.
[*3]. Harmonisation of systems
[*4].Article 118 of the Regulations to the Telecommunication Act.
[*5]. Signaling, transmission, quality
[*6]. Each operator must meet certain quality parameters.
[*7]. Provision of interconnection at any switching point, or other technically feasible points; ensuring that the equipment required for interconnection can be provided by any of the concession-holders and be housed within the facilities of any of them; establishment of mechanisms to ensure that adequate capacity and quality exist to process traffic demand between the two networks; delivery the call to the operator selected by the subscriber at the closest point that is technically efficient; provision of the information necessary to identify the originating and destination numbers, and the users who must pay for the call, the time, and any operator assistance involved.
[*8]. Must be in line with the standards laid down in the basic telecommunication plans approved by the regulatory body.
[*9]. Customer service
[*10]. They are imposed on connecting policy and price.
[*11]. Services covered.
[*12]. Interconnection should be made at any technically feasible point.
[*13]. Mauritel is required to provide other operators with interconnections wherever this is technically feasible.
[*14]. The interconnection decree includes technical, financial and administrative requirements that have to be reflected in the interconnection contract.
[*15]. Seamless interworking.
[*16]. Unbundling of the offer, minimum technical requirements, technical interface should not restrict access to mobile services.
[*17].The operator regulates itself the access to PSTN.
[*18]. Type approval of equipment.
[*19]. Conformity with ETSI standards.
[*20].The minimum elements that should be considered on the Reference Interconnection Offer and the general and previous conditions to the negotiations of Interconnection agreements included some technical requirements.
[*21]. Meeting of technical specifications laid down in the regulations.
[*22]. Recommendation on interfaces.
[*23]. Technical Standards.

Annex XVII

Reference Tables on Web Site Addresses covering RIOs, Interconnection Agreements, Regulations, Rulings and other specific issues as raised in Administrative Circular CA/16

S.No	Name of Country	Website Link for RIO	Website link for Interconnection Regulation	Website link for Interconnection Issues
1	Algeria	No	–	–
2	Argentina	No	www.secom.gov.ar [Decreto N° 764/00]	www.secom.gov.ar
3	Austria	No	http://www.rtr.at/web.nsf/englisch/startseite?Opendocument	http://www.rtr.at/web.nsf/englisch/startseite?Opendocument
4	Bahamas	No	Below are links to the Telecommunications Act, 1999, section 13 addresses Interconnection, The Telecommunications Sector Policy and its amendment. http://www.lexbahamas.com/Telecommunications%20Act%201999.pdf http://www.lexbahamas.com/Telecommunications_Sector_Policy_2001.pdf http://www.lexbahamas.com/Telco_policy_Order_amendment.pdf	No
5	Belgium	www.bipt.be, wholesale, regulatory, voice interconnect.	The interconnection regulation of the BIPT forms part of the general telecom Act of the 21st of March 1991, which can be accessed via the following links : www.bipt.be, legislation, the telecom sector, national framework, legal text of the Act of the 21st of March 1991. Article 109 ter concerns interconnection.	www.bipt.be, telecommunications, interconnection. Here you'll find the decisions of the BIPT with regard to interconnection issues. It also contains a link to the Belgacom reference interconnect offer.

S.No	Name of Country	Website Link for RIO	Website link for Interconnection Regulation	Website link for Interconnection Issues
6	Bhutan	In the process of drafting an Interconnection Agreement Model.	No	*www.aptsec.org*, *www.oftel.gov.uk*, *www.ofta.gov.hk*, *www.itu.int*, *etc.*
7	Bolivia	http://www.sittel.gov.bo/sittel/sirai.nsf/($All)?OpenView&Start=7.52&Count=30&Expand=7#7	http://www.sittel.gov.bo/archivos/apmer02.pdf	http://www.regulatel.org/sitios/sitiosreg.htm
8	Canada	No	The Commission has issued a large number of decisions that rule the interconnection of local exchange carriers. The two most important ones are Decision 97-8 and Order 98-486. These can be found at by going to: "http://www.crtc.gc.ca/cisc/eng/crtc-doc.htm" and clicking on the appropriate document.	
9	Côte d'Ivoire	www.atci.ci	–	www.atci.ci
10	Denmark	www.itst.dk Choose English Interconnection – Interconnection Agreements – Standard Agreements	Published on www.itst.dk – choose English – Legislation**.**	www.itst.dk -choose English – Interconnection.
11	Dominican Republic	–	http://www.indotel.org.do/site/marco_legal/ley153-98.htm http://www.indotel.org.do/site/marco_legal/consejo/Resoluciones_2002/Resolucion_042-02.pdf	No

S.No	Name of Country	Website Link for RIO	Website link for Interconnection Regulation	Website link for Interconnection Issues
12	Estonia	–	http://www.sa.ee	-
13	Finland	No	http://www.ficora.fi/englanti/tele/yhteenliittaminen.htm	http://www.ficora.fi/englanti/tele/yhteenliittaminen.htm
14	Gabon	No	No	No
15	Greece	www.eett.gr (telecommunications / interconnection).	No	No
16	India	http://www.trai.gov.in/RIO Regulation12th July.htm	The Telecommunication Interconnection (Charges and Revenue Sharing) Regulation of 1999 (1 of 1999) http://www.trai.gov.in/interregu.html The Register of Interconnect Agreements Regulation 1999 (2 of 1999) http://www.trai.gov.in/reguinter.htm The Telecommunication Interconnection (Charges and Revenue Sharing) Regulation of 2001 (5 of 2001) http://www.trai.gov.in/intwll.html The Telecommunication Interconnection (Port Charges) Regulation, 2001 (6 of 2001) http://www.trai.gov.in/port_charges_27_12_2001.htm	http://www.trai.gov.in

S.No	Name of Country	Website Link for RIO	Website link for Interconnection Regulation	Website link for Interconnection Issues
17	Italy	No	www.agcom.it/novit.htm, in particular deliberations 4/02/CIR, 5/02/CIR and 6/02/CIR.	www.agcom.it
18	Jamaica	No	http://www.cwjcarrierservices.com	www.cwjcarrierservices.com
19	Jordan	No	No	www.trc.gov.jo.
20	Lithuania	No	Interconnection obligatory requirements and treaty terms is the interconnection regulation document (www.rrt.lt) but there is no english version of this legal act.	No
21	Malaysia	No	www.cmc.gov.my link "Legislation" Consultation Paper: Access List Determination and Statement on Access Pricing Principles 21 Dec 2000 www.cmc.gov.my link "Discussion/Consultation Papers" Consultation Paper: Access Pricing Principles 13 May 2002 www.cmc.gov.my link "Discussion/Consultation Papers" Determination on Access List (Determination No 1 of 2001) and is a legal instrument that regulates access www.cmc.gov.my link "Register" / "Register of Determinations"	No

S.No	Name of Country	Website Link for RIO	Website link for Interconnection Regulation	Website link for Interconnection Issues
22	Mali	No	http// :www.mali-reforme-telecom.mctmtl .com	No
23	Mexico	No	The Federal Law of Telecommunications, in its chapter IV section I. **(**http://www.cft.gob.mx/frame_marc_juridico_leyes.html**).**	No.
24	Moldova	http://www.anrti.md/regulations	The Romanian version of Interconnection regulation is at www.anrti.md, and the English version will be placed soon at the address www.anrti.md/regulations.	No
25	Morocco	– RIO is in the process of discussion	www.anrt.net.ma	www.anrt.net.ma
26	Nepal	"Guidelines for Interconnection" is available on web site: (www.nta.gov.np/intconguide.html).	No	www.nta.gov.np.
27	New Zealand	http://www.telecom.co.nz/content/0,3900,200656-1553,00.html	No	http://www.comcom.govt.nz/telecommunications/Pricing.cfm
28	Norway	We have no reference interconnection offers at our web-pages. The relevant offer are published by Telenor (incumbent in Norway), who have a reference offer published in Norwegian. Telenor may be contacted by e-mail on interconnection issues at: samtrafikk@telenor.com –	http://www.npt.no/no/system/no_script/index.html, click on “regulations”, “telecommunications” and “Regulations on public telecommunications networks and public telecommunications services”,	

S.No	Name of Country	Website Link for RIO	Website link for Interconnection Regulation	Website link for Interconnection Issues
29	Pakistan	No	http// www.pta.gov.pk	No other web site links/references are available with PTA
30	Papua New Guinea	No	–	The official website is www.pangetl.gov.pg. This site has not been updated for sometime now.
31	Peru	In our norms, the interconnection is a negotiation between the parties, and has not been contemplated the use of Reference Interconnection offer	In the following website, the compilation of the effective norms on interconnection can be found: http://www.osiptel.gob.pe/Index.ASP?T=P&P=2671	-
32	Philippines	No	-The law prescribing compulsory interconnection among telecommunication carriers in the Philippines is Executive Order No. 59, Series of 1993. (1. EXECUTIVE ORDER NO. 59 http://www.ntc.gov.ph/laws/eo-59.html>)	Our organization has no Web site references on interconnection issues but our government regulatory body has: http://www.ntc.gov.ph/laws-frame.html
33	Samoa	No	No	No
34	Sri Lanka	No	–	http:www.trc.gov.lk
35	Tanzania	No	http://www.tcc.go.tz/Regulations-Interconnection.htm	http://www.tcc.go.tz/Regulations-Interconnection.htm

S.No	Name of Country	Website Link for RIO	Website link for Interconnection Regulation	Website link for Interconnection Issues
36	Venezuela	In Venezuela, a study of international comparison was made (Benchmarking) to establish the referential positions of use with occasion of the opening of the telecommunications The study is in the electronic direction: http://www.conatel.gov.ve/ns/downloads/marco_legal/Benchmark%20%206-4.zip	Statutory law of Telecomunicaciones (LOTEL) can be seen at: http://www.conatel.gov.ve/ns/downloads/marco_legal/ley_gaceta.zip Regulation of Interconnection http://www.conatel.gov.ve/ns/downloads/marco_legal/Regl_inteconexion.zip	http://www.conatel.gov.ve/ns/Interconexion.htm
37	Zambia	No	–	under 'Engineering and IT' page of website –URL: http://www.caz.gov.zm

Annex XVIII

Setting Up Interconnection Regimes: References for Regulators

[FCC Document]

This document provides a list of references designed for regulators in the midst of developing their interconnection regimes. The first section, "Significance of interconnection," offers general interconnection principles on which regions in the world have reached agreement. The second section, "Regulatory Framework," offers links to interconnection rules of individual countries. The third section lists some citations of interconnection agreements, some are reference or model agreements, others are actual agreements in force. This section also lists cites for information on dispute resolution mechanisms for individual regulators. The fourth section offers links to interconnection prices. The fifth section identifies mechanisms used by regulators to monitor compliance with interconnection agreements. The final section offers an example of an enforcement action against an operator that had not fulfilled its interconnection obligations.

Significance of interconnection

When there is more than one operator in a market, interconnection between operators is essential for subscribers of one network to communicate with subscribers of another network. In an environment where one operator is significantly larger than the others and possesses individual market power, however, it may have little or no incentive to negotiate reasonable terms of interconnection with other carriers. Under such circumstances, therefore, it is necessary for the regulator to have a role in the interconnection regime.

Reference materials- international statements:

- APEC Principles of Interconnection: http://www.apectelwg.org/apecdata/telwg/interTG/principl.html
- General information on interconnection in APEC region: http://www.apectelwg.org/apec/atwg/pritgtgr.html
- CITEL interconnection best practices: http://www.citel.oas.org/pcc1/guidelines/guidelines%20and%20practices.doc
- **European Union** "Directive 2002/19/EC of the European Parliament and of the Council of 7 March 2002 on access to, and interconnection of, electronic communications networks and associated facilities (Access Directive)." http://europa.eu.int/eur-lex/pri/en/oj/dat/2002/l_108/l_10820020424en00070020.pdf
- **WTO** Basic Telecommunications Agreement. Reference Paper on Regulatory Principles.

Reference materials – international training materials:

- Wright, Julian, and D. Mark Kennet. "Telecommunications Interconnection: a Literature Survey." Prepared for Asia Pacific Economic Cooperation (APEC).This note provides a brief overview of the interconnection problem, issues of cost measurement, and common methods of interconnection pricing. Following this is a large sampling of literature from professional journals and regulatory agency publications that discusses interconnection between telecommunications networks. Each paper is reviewed and categorized for its relevance according to a set of guidelines laid down by representatives of the APEC economies. http://www.apectelwg.org/apecdata/telwg/interTG/ATTZ2FG1.htm

- APEC Telecommunications Working Group Training Workshop. July 30- August 1, 2002. Discusses interconnection negotiations, pricing, enforcement, and dispute resolution, among other issues. http://interconnect.ovum.com/

The regulatory framework for interconnection

If operators can agree to interconnection agreements on their own, this is generally preferable to government intervention in the market. A good regulatory framework can increase the likelihood that operators will reach agreements on their own in a timely fashion. In the U.S., examples of operators reaching interconnection agreements on their own include agreements between wireless operators and agreement between Internet backbone providers. There are often times, however, when operators are unable to agree on the terms for interconnection. There are a variety of tools that regulators can use to create an environment that encourages the conclusion of interconnection agreements and to resolve disputes when they arise. These include

1) Publishing a reference interconnection agreement or the actual interconnection agreements previously negotiated, especially those negotiated with dominant operators in the market. This improves the quality of information available in the market on interconnection possibilities.

2) Setting a timeline for conclusion of an interconnection agreement, after which the regulator will intervene.

3) Establishing a set of default prices and other terms that will go into effect should the regulator intervene that are designed to encourage operators to conclude agreements of their own accord.

4) Requiring each of the operators in question to make a final best interconnection offer and then have the regulator choose one of them. This forces an operator with more market power to either make a reasonable offer or be forced to accept the other operator's demands. This option tends to work best where only a limited number of clearly defined issues are in dispute.

5) Regulators can also simply mandate certain rates and terms for interconnection as generally available to carriers.

Reference materials – legislative mandate for interconnection

- **United States:** Communications Act of 1934. amended 1996. See especially Title II, Sec. 251.
- **France:** Telecommunications Act of 26 July 1996. www.art-telecom.fr/textes/corps-ang.htm and www.art-telecom.fr/textes/corps.htm (French).
- **Hong Kong, China:** Telecommunications Ordinance (http://www.justice.gov.hk/blis.nsf/e1bf50c09a33d3dc482564840019d2f4/fc7ef990d740c089c82564800040c259?OpenDocument)

  with the Telecommunication (Amendment) Ordinance 2000 (http://www.ofta.gov.hk/whats_new/to-amend-2000-eng.pdf)
- **Singapore:** Info-communications Development Authority of Singapore Act 1999 (www.ida.gov.sg, "Policy & Regulation" -> "Legislation"; Second Schedule, Sec. 7(1))
- **Spain:** Telecommunications Law, Articles 22-29. Ley 11/1998, de 24 de abril, General de Telecomunicaciones. www.cmt.es, under "Centro de información" under "Legislacion."

Reference materials- administrative rules:

- **Argentina:** Interconnection regulation, from 2000. http://www.secom.gov.ar/normativa/d764-00/interconexion.htm
- **Canada:** Canadian Radio-Television Commission. "Local Competition." Telecom Decision CRTC 97-8. May 1, 1997 http://www.crtc.gc.ca/archive/ENG/Decisions/1997/DT97-8.HTM
- **Hong Kong, China:** Office of the Telecommunications Authority. "Review of the Telecommunications Authority's Statements No. 4, 5, 6, 7 (Revised) and 8 on Interconnection and Related Competition Issues." Statement of the Telecommunications Authority. March 18, 2002. http://www.ofta.gov.hk/frameset/documents_index_eng.html
- **United States:** Federal Communications Commission. "In the Matter of Implementation of the Local Competition Provisions in the Telecommunications Act of 1996 and Interconnection between Local Exchange Carriers and Commercial Mobile Radio Service Providers." Released August 8, 1996. http://www.fcc.gov/Bureaus/Common_Carrier/Orders/1996/fcc96325.pdf
- **United States:** Federal Communications Commission. "In the Matter of Developing a Unified Intercarrier Compensation Regime." CC Docket No. 01-02. Released April 27, 2001. This Notice of Proposed Rulemaking discusses and seeks comment on alternative approaches to interconnection pricing, including "bill and keep." http://ftp.fcc.gov/Bureaus/Common_Carrier/Orders/2001/fcc01132.doc

III Interconnection agreements – technical conditions

There are typically two key aspects of interconnection agreements, the technical conditions and the pricing conditions.

Because incumbents lack incentive to interconnect, regulators may need to mandate the technical aspects of interconnection, upon which other carriers will depend. For example, the regulatory may need to set deadlines within which the incumbent must respond to a request for interconnection and provide the actual interconnection facilities. Similarly, the regulator may need to require the incumbent to make space available within its central offices so that other carriers can install their equipment necessary for physical interconnection.

Below are listed some agreements as examples of how different regimes have approached interconnection.

Reference- general:

- "Globalization of Interconnection." International Engineering Consortium. A short, basic introduction to the technical issues related to interconnection. www.iec.org/online/tutorials/global_interconnect/

Reference – reference agreements posted by governments and/or regulatory bodies:

- **Canada:** Model Tariff. September 2002. http://www.crtc.gc.ca/cisc/eng/cisf3g5.htm
- **European Union members:** Reference Interconnect Offerings. www.analysys.com/atlas/news.asp?ids=10.
- **Singapore:** SingTel's reference interconnection agreement. http://www.ida.gov.sg/Website/IDAContent.nsf/dd1521f1e79ecf3bc825682f0045a340/291eca20f80f8425c8256a160036af2f?OpenDocument
  Alternatively, from the IDA homepage, follow the "Policy and Regulation", "Interconnection & Access", and "Reference Interconnection Offer" links.

- **United States:** New York State Public Service Commission makes interconnection agreements public. A list of agreements is available at http://www.dps.state.ny.us/Interconnection_Agreements.htm.
- **United States:** A list of California interconnection agreements are available at http://www.cpuc.ca.gov/static/industry/telco/current+information/ordering+interconnection+agreements/index.htm
- **United States:** Illinois Commerce Commission has interconnection agreements available to download from their website. http://www.icc.state.il.us/icc/tc/tcIa.asp

Reference – reference agreements posted by incumbent carriers:

- **France:** France Telecom. http://www.francetelecom.com/vfrance/pdf/L33-1-2002.pdf
- **Germany:** Deutsche Telekom http://www.telekom.de/dtag/ipl1/cda/level3_a/0,3680,161,00.html
- **Japan:** Guidebook for interconnection with NTT East. http://www.ntt-east.co.jp/info-st/e/conguide/guidebook_EASTe/pdf-e/NTT_EASTe.pdf
- **New Zealand:** Telecom New Zealand interconnect agreements. http://www.telecom.co.nz/content/0,2502,200656-1553,00.html
- **United Kingdom:** British Telecom. http://www.btinterconnect.com/refoffer.htm
- **United States:** Qwest. www.qwest.com/wholesale/clecs/negotiations.htm.

Reference – collocation rules:

- United States. "In the Matter of Deployment of Wireline Services Offering Advanced Telecommunications Capability." FCC 01-204. August 8, 2001. http://www.fcc.gov/Bureaus/Common_Carrier/Orders/2001/fcc01204.pdf

Reference – dispute resolution rules:

- **Australia:** "Resolution of telecommunications access disputes – a draft guide." 2002. Australian Consumer and Competition Commission. www.accc.gov.au/telco/disp_res/resolution.htm
- **United Kingdom:** "Requesting the Director General of Telecommunications to resolve an interconnection dispute: guidance for the telecommunications industry." November 2001. Office of Telecommunications, United Kingdom http://www.oftel.gov.uk/publications/ind_guidelines/disp1101.htm
- **United States:** California Public Utilities Commission's rules for mediation and arbitration of interconnection are available at http://www.cpuc.ca.gov/PUBLISHED/FINAL_RESOLUTION/2853.htm

Reference – dispute resolution cases:

- **United Kingdom:** Enforcement of interconnection obligation. "Interconnection with BT's ATM Network. June 14, 2002. http://www.oftel.gov.uk/publications/broadband/dsl/atmi0602.htm
- **United States:** Texas Public Utilities Commission. The major documents on interconnection dispute resolution, before and after agreements have been reached are available at http://www.puc.state.tx.us/telecomm/interconn/index.cfm

IV. Interconnection agreements – pricing conditions

If the regulator decides it is necessary for the regulator to set prices, there are a variety of strategies that can be deployed.

1) Best practices approach. A regulator can look at a set of prices used in other telecommunications markets and develop benchmarks based on the experiences of others.

2) Cost model approach. A regulator can study the costs involved in interconnection and make a determination on what prices are appropriate for interconnection. There are basically two kinds of cost approaches:
   - historical approach. Historical cost approaches use those costs an operator actually used to build a network.
   - forward-looking economic cost approach. Forward-looking costs are those costs an operator would use to build a comparable network today.

Most economists agree that a forward-looking cost approach contributes to an interconnection regime that will be more efficient in the future, while a historic cost approach tends to introduce the inefficiencies of an incumbent operator into future development.

Among forward-looking economic cost approaches, there are

- top-down financial/accounting models, which start with an incumbent's actual investment and attempt to make adjustments to reflect a forward-looking approach and
- bottom-up engineering approaches, which design a forward looking network without reference to any existing network facilities.

Reference- pricing:

- **European Union:** Member countries interconnection tariffs. http://www.analysys.com/atlas/Series/Default.asp
- **Germany:** RegTP current rates. http://www.regtp.de/aktuelles/02285/01/index.html
- **Organization of Economic Development and Cooperation (OECD):** "The Practice of Access Pricing in Telecommunications." Directorate for Financial, Fiscal, and Enterprise Affairs, Competition Committee. DAFFE/COMP/WP2(2002). Discusses pricing of access services in OECD member countries. [check website]
- **United States:** A list of rates set for unbundled network elements for New York is available at http://www.dps.state.ny.us/UNE_Rates.htm
- **United States:** "A Survey of Unbundled Network Element Prices in U.S." by Billy Jack Gregg. July 2002. www.nrri.ohio-state.edu/programs/telecommunications.html
- **United States:** The Federal Communications Commission's Electronic Tariff Filing System is an Internet based system through which incumbent Local Exchange Carriers must submit official tariffs. Click "Public Access" to view information. http://svartifoss2.fcc.gov/prod/ccb/etfs/. For a direct link to tariff flings. http://svartifoss2.fcc.gov/cgi-bin/ws.exe/prod/ccb/etfs/webpublic/selectlec.hts

Reference – pricing models:

- **United States:** Federal Communications Commission. Hybrid Cost-Proxy Model. http://www.fcc.gov/wcb/tapd/hcpm/welcome.html
- **Germany:** RegTP Analytical Cost Model. http://www.regtp.de/en/ under "Telecoms Regulation," under "Analytical Cost Model."

V Monitoring compliance with interconnection agreements

Once interconnection agreements are reached, frequently there can be problems with operator compliance. Issues that may arise include

1) Delays in providing interconnection
   a) Delayed response to request for interconnection orders
   b) Once orders are acknowledged, delay in provisioning the interconnection
   c) Preferential treatment of own affiliates' requests over competitors' requests
   d) Refusal to provide adequate information concerning the network
2) Disputes over technical conditions
   a) Denying interconnection is possible at a requested point
   b) Demanding excessive compensation for network changes that may be required to provide interconnection or charging for changes not directly related to interconnection
   c) Denying to competitors physical access to networks, when required to provide service
3) Disputes over billing and settlements

There are a number of mechanisms that can ameliorate such problems. For example, requiring the incumbent carrier to provide interconnecting carriers with data on the types and amount of traffic exchanged may reduce billing disputes. Similarly, imposing performance measures and performance reporting requirements on the incumbent can help the regulator detect discrimination.

In the United States, the proposed approach is to identify a series of performance measures in the provision of interconnection. When operators fail to perform adequately, the proposal is for the regulator to take action against them. While still a proposal at the federal level, such measures have been implemented at the state level.

Reference:

- "Operations Support Systems (OSS)." International Engineering Consortium. A discussion of operations support systems that perform management, inventory, engineering, planning, and repair functions for communication service providers and their networks. http://www.iec.org/online/tutorials/oss/
- **United States:** A proposal to identify a number of national performance measurements and standards for evaluating the provision of unbundled network elements (UNEs) by incumbent local exchange carriers with the aim of providing greater consistency, certainty, and clarity in the marketplace. http://www.fcc.gov/wcb/cpd/special_access/
- **United States:** "Section 271 Compliance Monitoring of Southwestern Bell Telephone Company of Texas. Project Archive #20400." Beginning in 2000, performance remedy plans issued by the Texas Public Utility Commission. www.puc.state.tx.us/telecomm/projects/20400/20400arc/20400arc.cfm
- **United States:** "Verizon Performance Assurance Plan. Case 99-C-0949." Beginning in 2002, performance assurance plans issued by the New York State Public Service Commission. www.dps.state.ny.us/Case_99C949.htm
- **United States:** Bell South performance results. http://pmap.bellsouth.com/content/documentation.aspx)
- **United States:** Qwest performance results. (http://www.qwest.com/wholesale/results/)

VI Enforcement of interconnection agreements

If the regulator determines that an operator has violated an interconnection agreement, there should be a mechanism to increase incentives to comply, sometimes by penalizing the operator. Common tools are to impose fines or other monetary penalties on operators who fail to comply with their interconnection agreements.

- **United States:** Federal Communications Commission Enforcement of regional Bell operating companies' local market opening requirements, including information on Bell Atlantic consent decree case. http://www.fcc.gov/eb/LoTelComp/271.html

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