



INTERNATIONAL TELECOMMUNICATION UNION

Document: WFMI/04
14 September 2000

FIXED-MOBILE INTERCONNECTION WORKSHOP

Original: English

GENEVA — ITU NEW INITIATIVES PROGRAMME — 20 - 22 SEPTEMBER 2000

BRIEFING PAPER *

TABLE OF CONTENTS

1	Introduction	2
2	Market power and market structure	6
3	Interconnection rates between fixed and mobile networks.....	9
3.1	Interconnection rates for fixed-to-mobile and mobile-to-fixed calls.....	9
3.2	Interconnection rates between mobile networks.....	10
3.3	Charges for physical links	12
3.4	Rules on points of interconnection affecting interconnection rates.....	12
3.5	Charges affecting international calls	13
3.5.1	Settlements Regime	13
3.5.2	WTO Regime.....	13
4	Regulating fixed-mobile interconnection	15
4.1	Overarching principles	15
4.2	Regulatory process	15
5	Interconnection costing.....	19
5.1	The role of cost-related mandates.....	19
5.2	Cost methodologies	20
5.3	Benchmarking.....	21
6	The Mobile Internet: Implications for Interconnection	21
6.1	One-to-one messaging	21
6.2	Information retrieval.....	22
7	Concluding Remarks	22

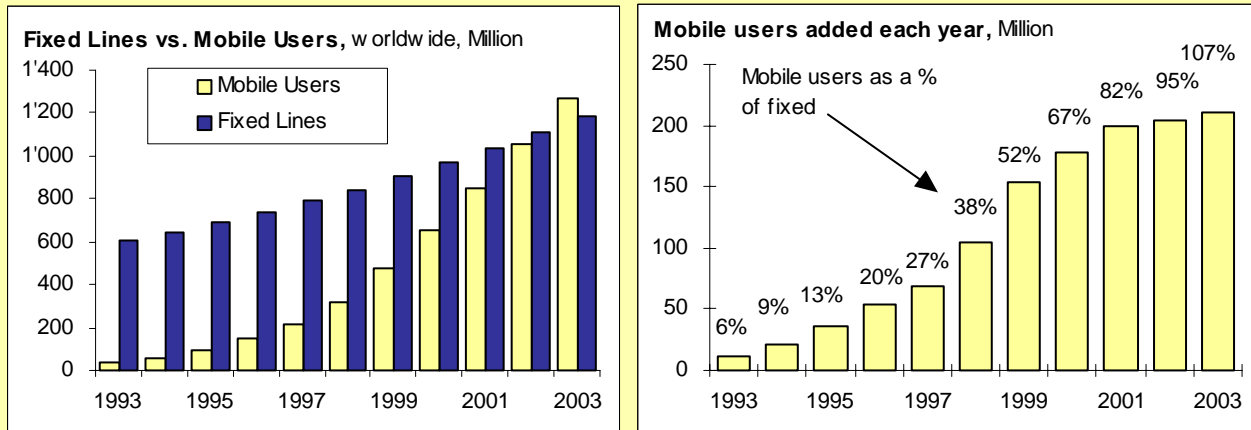
* This paper was written by Rohan Samarajiva and William H. Melody of the Economics of Infrastructure Programme, Delft University of Technology (Netherlands), in conjunction with Lara Srivastava of the ITU's Strategies and Policy Unit (SPU). The authors gratefully acknowledge valuable discussions with Vineeta Shetty (Communications International), Sam Paltridge (OECD), Lorne Salzman (McCarthy Tétrault), Divakar Goswami (The Ohio State University) and Henrik Rood (Delft University of Technology), and the assistance of ITU staff including Tim Kelly and Susan Schorr. The responsibility for errors and omissions lies with the authors. The views expressed in this paper are those of the authors and do not reflect the views of the ITU or its membership.

1 INTRODUCTION

1 Most ITU Member States are witnessing a veritable explosion in cellular mobile services (Figure 1).¹ The fast growth of mobile networks has led to almost half the calling opportunities in the worldwide telecommunication network of networks being related to mobile lines. By 2003, that number will have reached more than three-quarters (Figure 2).² Mobile networks have made tremendous contributions to institutional reform in telecommunication by demonstrating the benefits of competition and innovation and by extending connectivity to hitherto marginalized groups such as young adults and the less creditworthy.

Figure 1: The growth of mobile cellular services

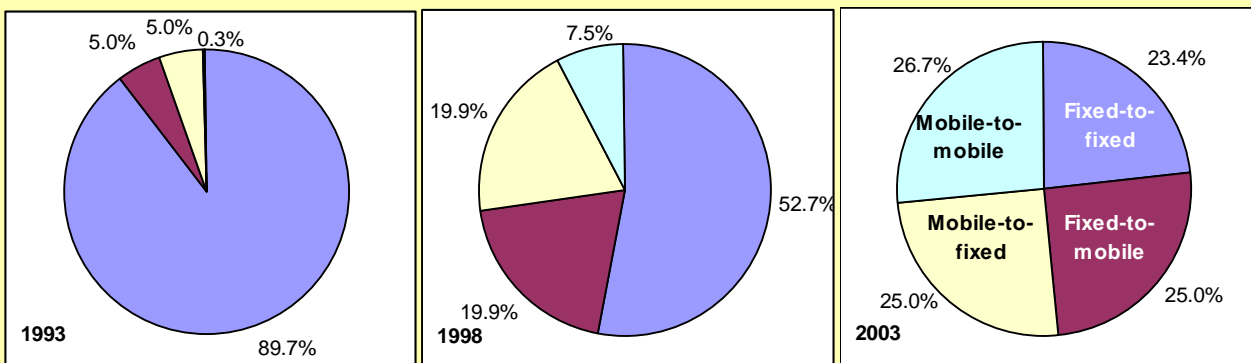
1993-1999 actual, with forecasts to 2003, in millions



Source: ITU World Telecommunication Indicators Database and ITU forecasts.

Figure 2: Worldwide calling opportunities

Among mobile and fixed-line users, in 1993, 1998 and forecast 2003

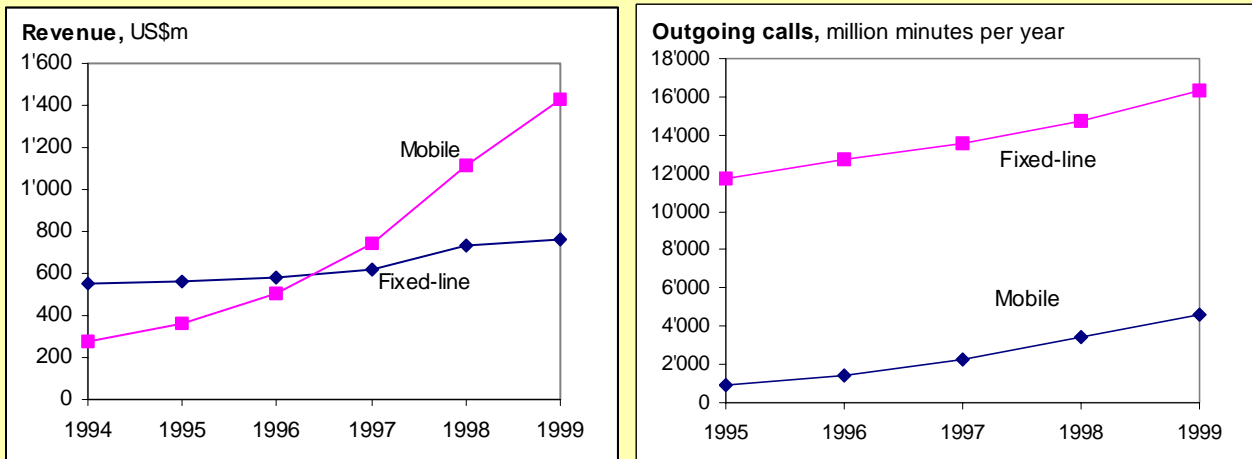


Source: ITU World Telecommunication Indicators Database, ITU forecasts.

2. Revenues from mobile services are predicted to overtake revenues from fixed-line services in 2004, and have already overtaken fixed-line revenues in leading mobile markets such as Finland (Figure 3).³ However, mobile calls, being shorter in duration than fixed-line calls, generally amount to a smaller proportion of total traffic volumes, but are growing at a faster pace than fixed-line volumes (Figure 3).⁴

Figure 3: Mobile and fixed-line networks in Finland

By revenue, in US\$ million, 1994-99, and by outgoing call volumes, 1995-99



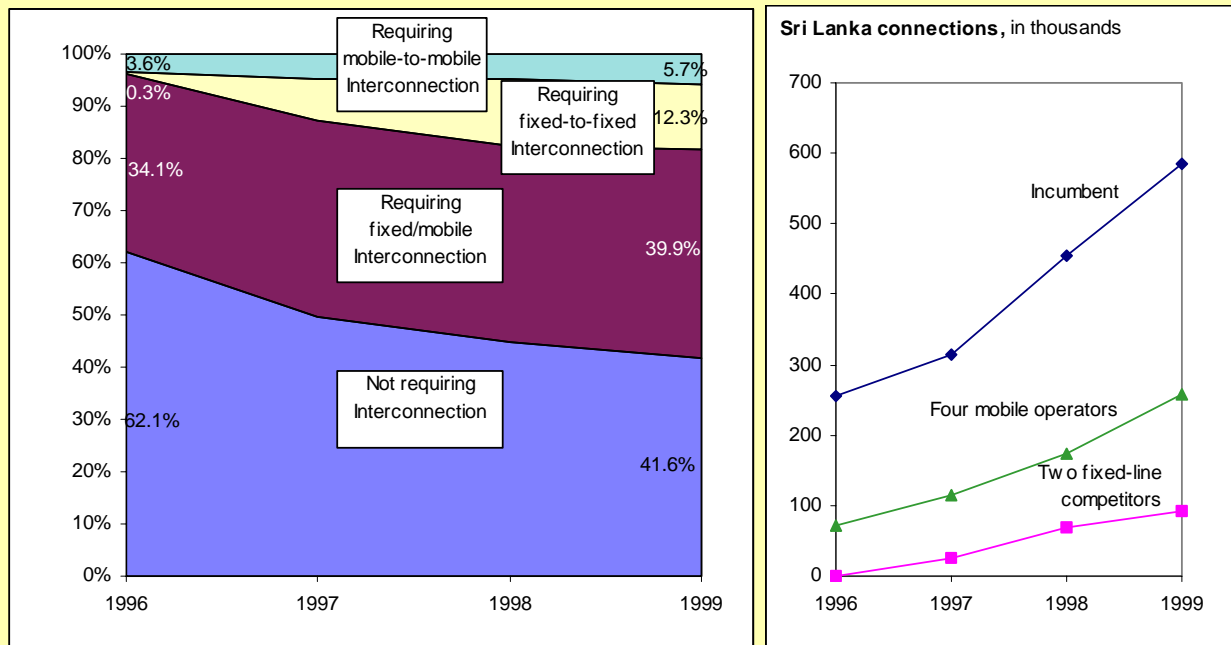
Source: Statistics Finland, Arno Wirzenius, "Fixed Mobile Interconnection: The Finnish Case" at <http://www.itu.int/interconnect>

3. As Box 2 illustrates, some of the fastest growth rates in mobile services are found in the developing Member States, partly because of difficulties in meeting demand in fixed-line services but also because mobile meets a real need.

4. The significance of interconnection in general, and fixed-mobile interconnection in particular, in a Member State (Sri Lanka) that has achieved competition-driven fast growth in fixed and mobile connectivity is shown in Figure 4. Within a short period of four years, the proportion of intra-network calling opportunities that do not require interconnection has fallen from 60 per cent to just above 40 per cent. Despite a compound annual growth rate (CAGR) of almost 40 per cent in the fixed-line network in 1995-99, the proportion of calling opportunities that require fixed-mobile interconnection had increased almost to the level of intra-network calling opportunities by 1999.

Figure 4: Calling opportunities and interconnection in Sri Lanka, 1996-1999

Calling opportunities in percentages, and connections in thousands



Source: Authors; Data from Telecommunications Regulatory Commission of Sri Lanka

Box 1: Calling-Party-Pays (CPP) vs. Receiver-Party-Pays (RPP)

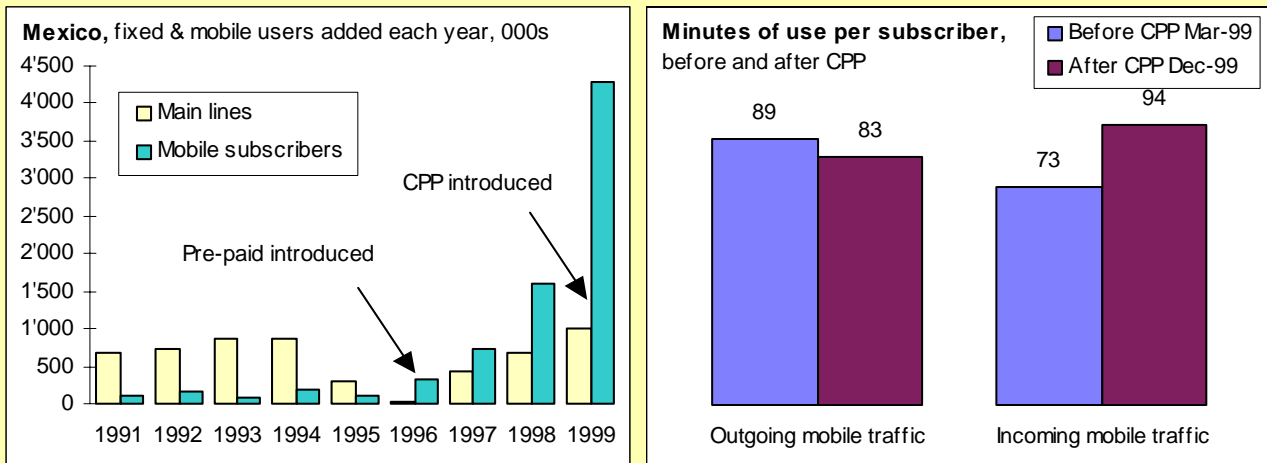
The Calling-Party-Pays (CPP) regime is the most common pricing structure for mobile communications, notably in Europe and in other markets where the GSM standard is used. Exceptions include the United States and Canada. Under CPP, the person initiating the call pays the entire cost of the call, whether it originates from a mobile or from a fixed-line telephone. Under the Receiving Party Pays (RPP) regime, the recipient of the mobile call directly contributes to the cost of each call. For the most part, the RPP system exists in countries with unmetered local calls on the fixed network. The main reason for the adoption of RPP in these countries was that it provided a simple transition from the billing systems of the traditional fixed network. This, however, was not the case in countries with metered local calls, where CPP could be more easily introduced. Once a decision was made whether to adopt CPP and RPP, other aspects were considered. For instance, in CPP countries, different numbering schemes are generally used for mobile networks in order to alert the fixed user that they will be paying a premium to contact a mobile number. In RPP countries, such as Canada and the United States, mobilephone numbers and fixed-line phone numbers have similar prefixes – there is no need to make a distinction since there is no price differential. However, this makes it difficult to move to CPP at a later date.

In countries where RPP is predominant, there is much debate about the suitability of a transition to CPP. According to the OECD, although RPP markets may outperform CPP markets in the early years of mobile communications, recent figures demonstrate that CPP countries have much higher subscriber growth than RPP countries. CPP has also stimulated the development of pre-paid schemes for mobile. Proponents of the CPP system argue that RPP discourages mobile use. Subscribers in RPP countries are much more likely to turn their phone off, or refuse to answer calls, in order to avoid paying for them. Calls to mobilephones are increasing dramatically in CPP countries, where mobile users can receive calls free of charge on their home network.

Although a transition to CPP may increase mobile penetration in some RPP countries, there are many regulatory barriers to its introduction. The main obstacles revolve around user notification and billing. Since fixed subscribers were not paying a premium for mobile calls, some method would have to be applied nationwide in order to advise them that the charge for calling a mobilephone will be higher. Furthermore, arrangements may have to be made in order to bill and collect from the called (mobile) party. Regulators must ensure that such arrangements are entered into without creating any undue barriers to entry or stifling competition.

Mexico introduced CPP on 16 April 1999. One of the incumbent’s arguments against the introduction of the regime was that the fixed-to-mobile traffic would decrease as a consequence of the higher fixed-to-mobile charge. However, as can be seen from the charts below, there was a significant increase in incoming mobile traffic (+28.7 per cent), despite the fact that the effective fixed-to-mobile tariff went up from US\$ 0.115 to US\$ 0.403 per minute (i.e. 250 per cent).

Box Figure 1: The impact of CPP introduction in Mexico



Source: Mexico Case Study available at http://www.itu.int/osg/sec/spu/ni/fmi/case_studies/index.html, OECD, Mobile Cellular Pricing and Trends, DSTI/ICCP/TISP(99)11/FINAL, April 2000.

5. The mobile sector has been extremely innovative, introducing new service features at a rapid pace.⁵ Generally subject to lighter regulation than fixed services, including exemption from retail-price regulation in most countries, the mobile sector has recently attracted regulatory attention because of massive mergers and acquisitions spanning multiple markets,⁶ high (in many cases, non-transparent) termination and roaming charges in some countries⁷ and disputes over the division of fixed-to-mobile call revenues.⁸ The increased regulatory attention should not take away from the achievements of the mobile sector so far and the utility of

the competition-centred regulatory policies that were pioneered in this sector. The challenge is to develop appropriate solutions that will advance the sector and increase benefits to the broad user population, while preserving the achievements of the first phase of development.

6. In the early years, policies relating to mobile services were premised on the notion of mobile as a luxury service, peripheral to the fixed-line service.⁹ This is no longer the case. Mobile connections are overtaking fixed connections not only in high-income Member States, but also in low-income Member States such as Cambodia and Uganda (Box 2, Table 1).

Table 1. Mobile overtaking fixed

	Date mobile overtook fixed	Mobile subscribers in 1999 (000s)	Fixed Line Subscribers in 1999 (000s)	Mobile Density	Fixed Density	Total Density
Cambodia	1993	89	28	0.81	0.25	1.07
Finland	Dec-98	3'445	2'856	66.7	56.29	121.99
Paraguay	May-99	436	297	8.13	5.54	13.67
Uganda	Jul-99	87	59	0.4	0.27	0.68
Venezuela	Aug-99	3'400	2'586	14.34	10.91	25.25
Italy	Sep-99	30'296	26'500	52.83	46.21	99.05
Portugal	Sep-99	4'671	4'230	46.81	42.39	89.2
Cote d'Ivoire	Oct-99	257	219	1.77	1.51	3.28
Korea (Rep.)	Nov-99	23'443	21'250	50.44	45.72	96.16

Note: Mobile has overtaken fixed-lines in a number of other economies during 2000 including France, Hong Kong SAR, Japan and Netherlands.

Source: ITU World Telecommunication Indicators Database.

7. Potential users who were excluded from full access to the fixed networks because they lacked permanent addresses or did not meet credit requirements have gained access to mobile services through prepaid card schemes, notably in countries using the Calling Party Pays (CPP) pricing structure, under which mobile users generally receive incoming calls free of charge (Box 1).

8. Leading information-communication technology providers duel over whose systems are better positioned to reach the Internet through mobile handsets.¹⁰ It is increasingly becoming clear that mobile services can no longer be considered merely as a luxury. Implicitly, if not explicitly, many Member States are beginning to develop policies that seek to recognize mobile networks as integral components of their national telecommunication systems, equal in importance to the older fixed networks.

9. This paper is intended to provide a useful background for a discussion of regulatory questions pertaining to fixed-mobile interconnection. These issues include:

- The role played by market structure and competition in the setting of mobile-to-fixed and fixed-to-mobile interconnection rates;
- The rationales behind the wide degree of variation for mobile termination rates. For instance, in some Receiving Party Pays (RPP) Member States, mobile termination rates are zero (in Singapore, Sri Lanka), while in Member States employing a Calling Party Pays regime, rates can go as high as US\$ 0.293 per minute (in Antigua and Barbuda), or US\$ 0.30 (in Switzerland);
- The asymmetry of prices for fixed-to-mobile and mobile-to-fixed calls, caused partly by asymmetrical interconnection rates;
- The effects of RPP (Receiving Party Pays) and CPP (Calling Party Pays) on interconnection rates;
- Difficulties experienced in some countries in obtaining technical interconnection, including quality-of-service problems;
- Disputes regarding charges for the provision of interconnection links;

- Intervention by National Regulatory Authorities (NRAs) in fixed-mobile interconnection disputes, including the timing and form of intervention and the pros and cons of allowing/encouraging joint participation by mobile operators in negotiations/regulatory proceedings;
- The lack of transparency in pricing for fixed-to-mobile and mobile-to-fixed calls;
- The design of appropriate interconnection arrangements for Short Messaging Services (SMS) and GPRS and "always on" services and, more generally, the emerging mobile Internet.

2 MARKET POWER AND MARKET STRUCTURE

10. Competition is at the core of current telecommunication policy, especially policy pertaining to mobile networks that were introduced within the past twenty years. More than 99 per cent of mobile users across the globe have a choice of service providers. The basic premise is that competition encourages innovation, increases efficiency, gives choice to customers, reduces prices and increases quality of service commensurate with price. Dilution, if not elimination, of market power is at the core of contemporary regulatory practice.

11. The first step of regulatory analysis is to examine the market power and market structures affecting fixed-mobile interconnection. Technical interconnection between a fixed network and a mobile network is necessary for completion of a fixed customer's call to a mobile customer, and *vice versa*. If the two networks are disproportionate in size, as is the case when a new competitor enters a market, the larger/incumbent network operator has greater negotiating power and may refuse interconnection or impose unfavourable terms. Generally, regulators constrain the use of this power, mandating interconnection by incumbents or operators with significant market power (SMP).¹¹ Where such a power asymmetry does not exist, i.e., when both networks lack SMP, current regulatory practice, and in some cases the governing legislation, tends to leave interconnection to negotiation between the operators. Generally, interconnection is not mandatory for networks without SMP and is not subject to regulatory intervention. Box 2 shows how the negotiating relationship changes in the case of a mobile network overtaking fixed network in connectivity.

12. Resources of both the fixed network and the mobile network are utilized for the completion of a fixed-to-mobile or a mobile-to-fixed call. Therefore, both must be compensated. The form of compensation can range from sender-keeps-all (SKA) to mutual measured compensation, generally on a per-minute basis. The SKA method is preferred when traffic is more or less equal in both directions, the transaction costs are high relative to the compensation, measurement mechanisms are unavailable and/or where a simple solution is sought. In the case of mutual compensation, the payments can be symmetrical or asymmetrical. Symmetrical payments are generally associated with fixed-fixed interconnection regimes and the asymmetrical ones with fixed-mobile regimes (with some significant exceptions).

13. Current regulatory practice favours commercial negotiation between the operators, with the regulator intervening as a last resort. Negotiation in the pure form would include the ability for either party to refuse interconnection if the other party's offer is unacceptable. Where public policy deems one operator to have SMP, that operator is generally prevented from refusing interconnection and is obliged to offer cost-oriented termination rates. The operator without SMP is usually not subject to any such obligations. An unintended consequence of this, however, is that the less dominant operator can gain significant negotiating power.¹²

14. The patently unfair early terms of interconnection imposed on new-entrant mobile operators in China¹³ and Sri Lanka¹⁴ by an incumbent abetted or unrestrained by a regulator, demonstrate the power of unconstrained incumbents and the vulnerability of fledgling mobile operators (Box 3). The high termination fees imposed by many European mobile operators demonstrate the effects of regulating interconnection by incumbents, thereby constraining their negotiating ability, while at the same time not imposing any requirements on the other operators at the negotiating table.

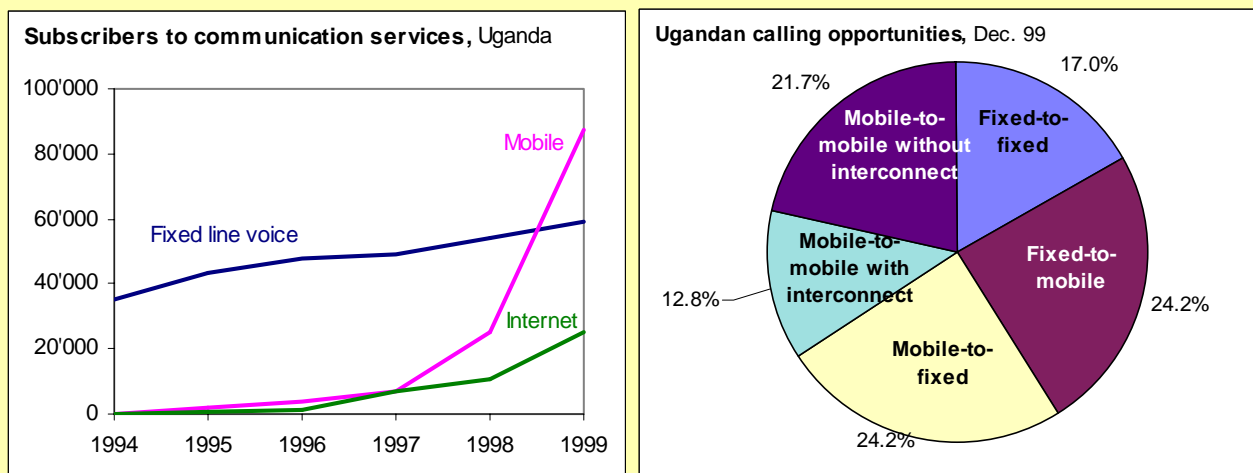
Box 2: The changing balance of power in Uganda

In most competitive markets, interconnection rates are negotiated. Because the relative positions of the players can change over time, the process can yield different outcomes at different stages, as shown in the case of Uganda. Mobile has gone from being a minority of the mix to a majority very quickly (see left chart in Box Figure 3.1). Uganda licensed a “second” full-service operator—MTN Uganda, a joint venture between MTN of South Africa and Telia of Sweden—in April 1998 and within 18 months of starting operations, it had already surpassed the incumbent fixed-line operator, UTL, in number of subscribers. As of the end of 1999, there were some 87’000 mobile users in Uganda compared with just 59’000 fixed users. With UTL poised to enter the mobile market and a third operator, Celtel, newly revitalised, the mobile market seems likely to grow even faster.

While UTL was still the dominant operator, it charged relatively high prices for calls terminated on its fixed network. Now, with a significant and rising proportion of UTL-billed calls going to Celtel or MTN mobile subscribers, UTL is seeking lower interconnection prices. The original negotiation between Celtel and UTL set interconnect rates at 500 Ush (USD 0.33) per minute for termination of calls on Celtel’s network (mobile) and 300 Ush (USD 0.2) per minute for terminating on UTL’s network (fixed). These high rates contributed to Celtel’s early difficulties in popularising mobile services.

MTN’s entry into the market changed the situation radically. It offered UTL a termination rate for calls on the mobile network of just 350 Ush (USD 0.23) per minute and agreed to pay UTL 150 Ush (USD 0.1) for calls terminating on the fixed network. With these low rates in place, MTN was able to offer considerably reduced prices to consumers. MTN’s initial efforts to negotiate a low rate of interconnect with Celtel for mobile to mobile calls was rejected and a rate of Ush 210 (USD 0.14) per minute was established. However, this was subsequently reduced and Celtel is now negotiating a lower interconnect rate with UTL too as part of its efforts to relaunch its service. As from 1 March 2000, Celtel’s new interconnect rates are 160 Ush (USD 0.107) per minute for calls to and from the fixed network.

Box Figure 2: Mobile overtakes fixed-lines in Uganda



Source: ITU, *Uganda Internet Case Study*, available at: <http://www.itu.int/ti/casestudies/uganda/uganda.htm>.

15. Interconnection involves two sets of opportunities. First, an operator seeks to provide increased calling opportunities to its customers, thereby increasing the utility of the service it provides as well as its revenue potential. Interconnection to a larger network dramatically increases calling opportunities for the customers of a new network. In addition, the presence of many key social actors such as government agencies, emergency services, and commercial organizations on the incumbent's network makes those calling opportunities more valuable. Second, the operator seeks to increase the number of parties from whom its customers may receive calls, or to increase call-receiving opportunities.

16. True competition does not exist in either of the markets for these opportunities. The nature of human communication is such that one does not want opportunities to call just anyone, or opportunities to receive calls from just anyone. One wishes to call, or receive calls from, specific individuals or organizations. The only way there could be a competitive market in either of these opportunities is if each individual and organization were to become a customer of multiple competing networks. A given subscriber would thus have the possibility of choosing among different networks to originate a call, based on price and other factors, and would have the same possibility for the termination of the call. In the current environment, there

is a direct relationship between the subscriber and the operator in the case of call origination. Users choose an operator on the basis of price and other information.¹⁵ However, under current conditions, the subscriber originating a call does not have a direct relationship with the call-terminating network and is unable to receive, let alone respond to, price and quality signals from the call-termination market. The following discussion, therefore, focuses on call termination, which is the more problematic issue.

Box 3: The power of state-owned incumbents

The Indian case provides a prime example of one of the main issues facing developing countries on the path to liberalization: the power of state-owned incumbents. Until the 1980s, the Department of Posts and Telegraphs was given the mandate of both regulating and providing telecommunications services in India. In 1985, it was split up into the Department of Telecommunications (DoT) and the Department of Posts. The DoT was thus established as state operator, licensor and regulator. Although a regulatory agency, TRAI, was created in TRAI, it was only in late 1999 that the government made a serious effort to separate the incumbent service provider from the DoT, via the creation of the Department of Telecom Services (DTS). In theory, the DTS is responsible for offering telecommunications services whereas the DoT is responsible for licensing and policy-making. However, there is still significant overlap between the activities of both Departments. They are effectively one and the same organization. In fact, many officials still hold posts in both the DTS and the DoT simultaneously.

The effect of this *de facto* regulatory structure is an incumbent with increased negotiating power. The close organizational relationship between the traditional operator and the policy-maker means that new entrants find it difficult to obtain fair treatment, notably in the case of interconnection. For instance, when mobile operators were first licensed in 1995, the requirement that all inter-circle mobile traffic had to pass through the incumbent's network was written into their agreements. Furthermore, under the license, the DoT/DTS was not required to make any payments to mobile operators for calls terminating on the mobile network. Thus, the incumbent operator kept all revenues from fixed to mobile calls, and still does, under a sender-keeps-all arrangement. Mobile operators have since appealed to the national regulator, the TRAI, but this regime has yet to be altered.

The government plans to move ahead with the privatisation of DTS as India Telecom, and with the liberalization of the long-distance market. Although this may be a slow process, it is hoped that it will serve to reduce the current overlap between the DoT and the DTS, as well as provide more suitable interconnection environment for mobile operators.

For more detail, see the India Case Study at http://www.itu.int/osg/sec/spu/ni/fmi/case_studies/indiaFMI_final.doc

17. If subscribers had the choice of terminating network, a network's ability to obtain quality, low-cost termination services would be a factor in attracting and retaining customers. In reality, a caller seeks to terminate his/her call at a specific address (even though the called party may have multiple addresses).¹⁶ A single operator controls access to that address, thereby excluding the possibility of competition in termination services.¹⁷ Because every operator controls access to a set of addresses (except a new entrant at the moment of entry), the issue then becomes one of bilateral negotiation, rather than competition.

18. Access terms for the purposes of termination can be decided on the basis of reciprocity, as part of a bundle of rights that include origination and other services. In some cases, access can be gained through the use of refile through a different interconnected network. In situations where one network with SMP is mandated to interconnect, the bilateral negotiation may yield an outcome that favours the network without SMP. Where the network with SMP is able to pass on the termination costs to its customers (as in a CPP regime) and/or collect a retention/administrative fee, it may have less incentive to negotiate a lower termination fee. In sum, the relation of bilateral monopoly that characterizes interconnection tends to yield power-based outcomes: favourable to the larger network with SMP when there is no regulatory mandate to interconnect; and unfavourable to the network with SMP when interconnection is mandated. The latter outcome may be further exacerbated by the CPP regime, as well as by cross-ownership between fixed and mobile operators.

19. Interconnection involves bilateral negotiation between operators, rather than between the calling subscriber and the called subscriber. Yet the actual calling parties are directly affected by the outcomes of interconnection, especially in the case of CPP where the calling party pays a non-transparent charge that has been set directly or indirectly by an operator with whom he/she does not have a relationship. In conditions of effective competition (for customers affiliating with operators for purposes of originating and receiving calls) and transparency of tariffs, the operators may be expected to fairly represent their customers. But these conditions do not exist, especially in relation to call termination. For example, mobile operators (who generally face more competition) may be more likely to negotiate lower termination rates for mobile-to-fixed

calls, than fixed operators (who generally face less competition). In addition, a fixed operator may have the incentive to keep fixed-to-mobile charges high to enable its lightly regulated mobile affiliate to offer lower prices for outgoing calls. Both mobile and fixed operators may have the incentive to cross-subsidize other parts of their businesses from interconnection revenues.

3 INTERCONNECTION RATES BETWEEN FIXED AND MOBILE NETWORKS

20. The primary objective of interconnection is the enabling of seamless communication between any customer of a network and any customer of another network. The increase of calling opportunities maximizes network externalities. Ideal interconnection arrangements will be compatible with competition policy and will provide effective incentives for optimal use of existing networks and for investment in new network capacity.

21. Unlike in the case of fixed-to-fixed interconnection, where use of unbundled network elements is generally involved, interconnection between fixed and mobile networks generally occurs at the interface of the networks. The rates usually take the form of minute-based termination fees (fixed-to-mobile and mobile-to-fixed) and assorted charges connected with the physical links that connect the networks (e.g., leased line and collocation charges). In a few cases such as Canada, the charges are based on capacity of links (see Box 5). This mode may become more important with the proliferation of IP-based networks. Where CPP prevails, the fixed-to-mobile termination fee is collected from the call-originating customer by the fixed operator (along with an administrative fee that is retained) and transmitted to the mobile operator. One exception to this system is in Finland, where a unique billing arrangement exists between fixed and mobile operators, one that does not require specific interconnect rates (Box 4).

3.1 Interconnection rates for fixed-to-mobile and mobile-to-fixed calls

22. Figure 5 provides a comprehensive summary of fixed-to-mobile and mobile-to-fixed interconnect rates in Europe. For fixed-to-mobile calls, the average is US\$ 0.21 per minute, with Deutsche Telekom and Swisscom at the high end (0.24 and 0.30 respectively). Norway and the United Kingdom have the lowest interconnect rates. The United Kingdom has recently carried out a detailed investigation into high termination rates and this may account for its position on the interconnect scorecard¹⁸. The ratios of fixed-to-mobile and local mobile-to-fixed rates range from a low 8.7 in Norway to a high of 34 in France and 30 in Germany.

23. Figure 6 summarizes the latest data from the 2000 ITU survey for CPP and RPP countries. The average interconnect charge in CPP countries for fixed-to-mobile calls is 13.8 US cents per minute and for mobile-to-fixed calls is 5.9 US cents. Of the CPP countries for which fixed-to-mobile rates are available, Antigua and Barbuda has the highest at 29.3 US cents while Costa Rica has the lowest charge at 1.7 US cents. The global average fixed-to-mobile interconnect rates for the selected CPP countries (13.8 US cents per minute), is lower than the figure for European countries (21.0 US cents). The average for the RPP countries in the set is just 0.056 US cents per minute.

24. Examination of the available data for industrialized countries (i.e. OECD member states) shows a range of 1 to 4 for fixed-to-mobile and mobile-to-fixed charge ratios in CPP countries. Hong Kong SAR, Canada and the United States have a ratio of 1, which contrasts with the other RPP countries where the rates are not symmetrical. This suggests cases where the fixed operators negotiated strongly. Singapore and Sri Lanka have fixed-to-mobile rates of zero.

25. In some countries, such as France and Portugal, mobile operators unilaterally set the mobile termination rates that are paid by fixed customers. This could lead to different fixed-to-mobile call rates to consumers, depending on different terminating networks. Where the fixed operator is allowed to set the price, under regulatory oversight, it is likely that the rates for calls from each mobile network will be identical, leading to simpler tariffs.

26. Among industrialised CPP countries, local mobile-to-fixed termination rates in 2000 range from a low of 0.5 US cents (United Kingdom, BT) to a high of 2 US cents per minute (Spain, Telefonica). In non-industrialised CPP countries, there is a wide range from Costa Rica at 1.7 US cents to Antigua and Barbuda at 29.3 US cents per minute. The average is considerably higher than that for the higher-income countries.

All CPP countries in this set have fixed-to-mobile rates that are higher than or equal to mobile-to-fixed rates, as in OECD countries.

Box 4: CPP does not always involve mobile termination rates: Peculiarities of the Finnish Case

Finland is home to a unique form of mobile cellular pricing in the Calling-Party-Pays (CPP) world. Interconnection arrangements differ greatly from other European countries. The main differences are the following

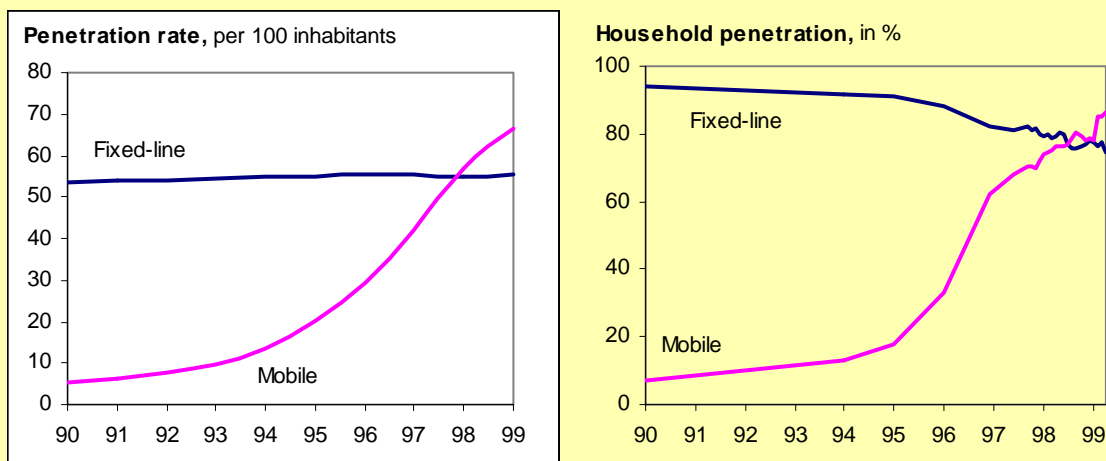
1. Local fixed operators act as invoicing agents for long distance, international and mobile operators. Thus, mobile operators charge the fixed user for calls to mobile via local fixed operators;
2. End-to-end retail call charges are not in use in most interconnection cases. Retail calls apply to call segments and therefore consumers usually pay two separate charges for each call;
3. In most cases, interconnection access and termination rates are not used. Rather, retail charges are used as the basis for revenue-sharing between operators.

For fixed-to-mobile calls, mobile operators set the retail charges for their own call segments, and forward the charging information to the local fixed operators on a call-by-call basis. The local operator then invoices the subscriber and collects the charge. The local operator does not have the power to amend the charge set by the other operator. It only provides an invoicing service, for which it collects an invoicing fee (between 4 and 10 per cent of the invoiced amount). The calling party pays a separate local network tariff (from the caller to the local point of interconnection) to the local fixed operator and a separate mobile call charge to the mobile operator. This is different from most other countries, where the local fixed operator sets and bills the tariff for the entire call and pays a mobile termination charge (MTC) to the mobile operator.

For mobile-to-fixed calls, the calling party pays only the mobile call charge. The mobile operators then pay a local fixed termination charge to the local fixed operators. This charge covers the segment from the destination local point of interconnect to the called subscriber.

One cannot conclude with certainty that the Finnish system for revenue-sharing between fixed and mobile operators has been pivotal to the phenomenal growth of mobile services in that country. What is clear, however, is that the interconnection regime in Finland has meant transparency in tariff setting, which in turn has contributed to increased usage and lower retail charges.

Box Figure 4: Fixed and Mobile Penetration in Finland
Per 100 inhabitants and per 100 households



For more detail, see the Finland Case Study at http://www.itu.int/osg/sec/spu/ni/fmi/case_studies/finlandFMI_final.doc

3.2 Interconnection rates between mobile networks

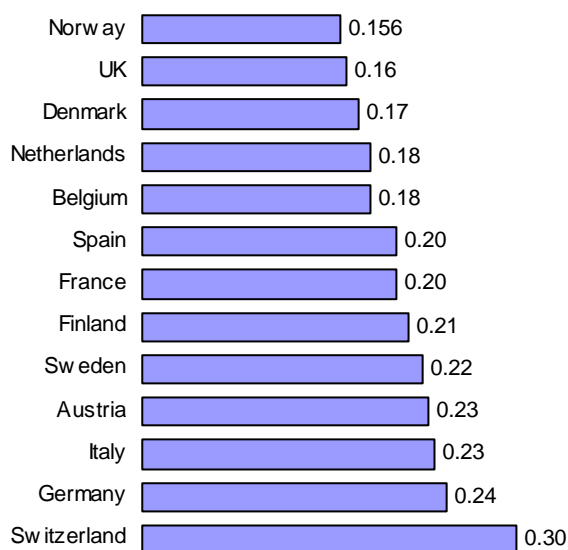
27. Calling opportunities among mobile networks are rapidly increasing. In Finland, for instance, mobile to mobile calling opportunities accounted for more than 27.4 per cent of all domestic calling opportunities in June 1999¹⁹. Mobile-to-mobile interconnection rates are generally subject to commercial negotiation between operators and have not generally formed the basis for any regulatory intervention. Regulators have been more concerned with fixed-to-mobile interconnection rates, because typically, mobile-to-mobile charges have tended to be significantly lower. In many cases, mobile subscribers pay less to reach other mobile subscribers than to reach a fixed subscriber.

Figure 5. Interconnection rates in Europe under CPP

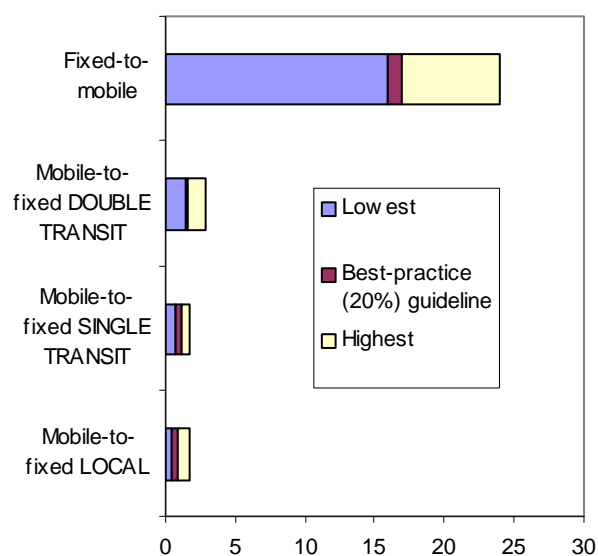
In US\$ per minute

	Fixed-to-mobile interconnect rate	Mobile-to-fixed interconnect rate LOCAL	Mobile-to-fixed interconnect rate SINGLE TRANSIT	Mobile-to-fixed interconnect rate DOUBLE TRANSIT
Austria	0.23	0.017	0.017	0.022
Belgium	0.18	0.008	0.014	0.018
Denmark	0.17	0.008	0.011	0.016
Finland	0.21	0.013	0.013	0.024
France	0.20	0.006	0.012	0.018
Germany	0.24	0.008	0.017	0.021
Greece	n.a.	0.018	0.018	0.025
Italy	0.23	0.009	0.015	0.021
Ireland	n.a.	0.010	0.015	0.021
Luxembourg	n.a.	0.015	0.015	0.015
Netherlands	0.18	0.009	0.013	0.016
Portugal	n.a.	0.009	0.015	0.024
Spain	0.20	0.009	0.015	0.028
Sweden	0.22	0.008	0.011	0.015
UK	0.16	0.005	0.007	0.016
Switzerland	0.30	n.a.	n.a.	0.020
Norway	0.156	n.a.	n.a.	0.018
Average	0.21	0.010	0.014	0.020

European fixed-to-mobile interconnect charges, (US\$/min)



EU, range of interconnect rates, (US cents per min.)



Notes:

Mobile to Fixed Interconnection rates are based on a 3 minute call duration and are exclusive of VAT

The Finnish rates assume a low volume of traffic.

In Finland, Austria, Greece and Luxembourg, the lowest interconnection charge covers interconnection at a local or tandem exchange. Thus the "local rate" is the same as the "single transit rate."

Mobile to fixed charge for Switzerland refers to national fixed termination rate. From OFCOM Website (March 2000).

Fixed to Mobile Rates for Austria, Denmark, Switzerland and Norway are based on January 1999 data from OVUM & OECD.

The "best practice" guideline for fixed-rate interconnection is defined as the upper limit of the three lowest published rates (three being 20 per cent of the 15 EU Member States).

Source: ITU, compiled from ECTA/Analysys, EU Interconnection Tariffs in Member States, ITU Regulatory Survey 2000

Box 5: Canada's Fixed-Mobile Interconnection Regime

The Canadian Radio-Television and Telecommunications Commission (CRTC) has devised a unique two-tier system, that may attract greater attention as IP-based networks become more common. A mobile operator can choose to interconnect as a wireless service provider (WSP) or as a competitive local exchange provider (CLEC). In the former mode, the mobile operator is treated as a large customer, receiving no compensation for calls it terminates and paying for termination on the fixed network (on a "bulk" basis that could actually amount to around 0.3 US cents per minute, assuming 12'000 minutes per month per trunk). If the mobile operator were to interconnect as a CLEC, which two operators are in the process of applying for, the relationship would be as between peers. A mobile operator that is a CLEC interconnects with a fixed operator for local traffic on a sender-keeps-all basis. Thus, no payment is made by either party to the other for traffic termination within the same exchange. If there is a large traffic imbalance, sender-keeps-all will not apply, and specific per-trunk rates apply.

Source: Lorne Salzman, McCarthy-Tétrault

28. Mobile-to-mobile calls are subject to the same form of market failure as fixed-to-mobile calls in a CPP environment - the originating party still has to pay for the cost of the entire call but has no choice of the terminating network or the terminating charge. However, while mobile operators have little incentive to reduce termination rates for fixed-to-mobile calls, this is not necessarily the case for mobile-to-mobile calls. In the process of negotiation for mobile termination rates, mobile operators are relatively indifferent to the actual prices set for termination, since their pricing decisions affect only the call-originating customers of other operators. Therefore, two mobile operators of similar size involved in negotiation can set above-cost termination rates with little consequence to their own customer base. However, they would have to decrease subscriber fees used to attract new customers. Although this would reduce the profits of both networks, termination service revenue would increase to the same extent²⁰. Overall operator profits, therefore, would not be affected. As a result, mobile operators are not deterred from negotiating lower cost-based rates in the case of mobile-to-mobile termination.

29. The above typically applies to negotiations within the context of a highly competitive and dynamic environment. Incentives vary in the case of negotiations between new and established operators, and between operators of different sizes. Generally, a younger, smaller operator will send more traffic than it receives from the older, larger one. Even though mobile-to-mobile interconnect rates are symmetrical, there is an incentive for the younger, smaller operator to argue for lower rates, and for the older, larger one to keep rates elevated. These incentives are likely to change over time (Box 2). What has been consistently observed, however, is that mobile-to-mobile interconnection rates are significantly lower than fixed-to-mobile rates in most ITU member states. This offers further evidence that fixed-to-mobile charges are far from being cost-oriented.

3.3 Charges for physical links

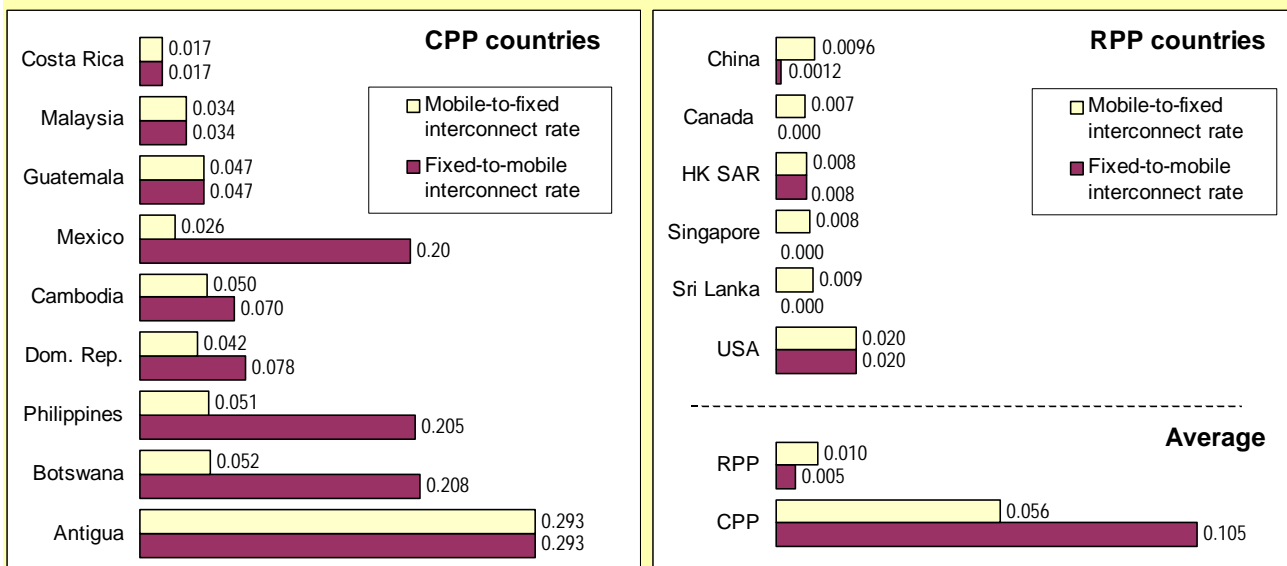
30. Interconnection requires the establishment of physical links between the connecting networks. Depending on how mobile services were treated at the time of their initial deployment (e.g., as a peripheral or luxury service or as an integral element of the national system), the rules are likely to differ. In some cases, the mobile operator has to bear the costs of the links and the interfaces/gateways at both ends, as set by the incumbent fixed operator (e.g., China and Sri Lanka, prior to 1999). In other cases, the mobile operator has to bear the costs, but these are set by the regulator (e.g., Hong Kong SAR, Costa Rica). In other cases, the fixed and mobile operators share the costs.

3.4 Rules on points of interconnection affecting interconnection rates

31. Depending on the national policy, there may be advantages in proliferating points of interconnection (POIs). If the mobile networks are seen as integral elements of the national system, the policy is likely to encourage national coverage, allowing mobile operators to make the "build or buy" decisions with regard to long-distance carriage. In such an environment, which is increasingly prevalent, the regulatory agency will encourage multiple geographically dispersed POIs. Usually incumbent fixed operators prefer to limit the points of interconnection (Box 6 and 7).²¹ The regulatory response will include the "stick" of mandatory POIs and the "carrot" of appropriately designed local and long-distance interconnection rates.²² Constrictive POIs usually result in higher rates for mobile operators and also increase their vulnerability to congestion and interconnection failure.

Figure 6. Interconnection rates in selected non-European countries

Calling Party Pays (CPP) vs. Receiving Party Pays (RPP). In US\$ per minute.



Note: The average on the right hand side refers to the average of countries responding to the ITU survey as well as the European countries in Fig. 5.
 Source : ITU 2000 Regulatory Survey .

3.5 Charges affecting international calls

3.5.1 Settlements Regime

32. Many countries still consider international services a distinct market segment, and have provisions governing which operators are allowed to operate international gateways. However, with the international settlements regime, premised on bilateral monopolies, coming under mounting pressure from ongoing technological developments and from the United States, restrictions on international gateways are becoming increasingly difficult to enforce. In the past, most mobile operators had to transfer international calls originated on their network to an international gateway controlled by another operator, usually the incumbent, and terminate those calls from outside the country, which came across the international gateway.²³ However, increasingly, mobile operators are being allowed to operate their own international services.²⁴

33. Under the traditional international settlements regime, settlement charges were generally much higher than domestic interconnection rates, except in sender-keeps-all environments. Consequently the termination rates for calls to mobile customers paid by international gateways to mobile operators tended to be higher than even the highest fixed-to-mobile termination rates in most CPP countries. However, with the recent decreases of many international accounting rates, international termination rates have also fallen. In some cases, especially in Europe, there are situations where the termination charge paid by an international gateway to a mobile operator is significantly lower than that operator's fixed-to-mobile termination rates. This has created incentives for “tromboning”, or the routing of domestic fixed-to-mobile calls via foreign networks to benefit from the least cost route.

3.5.2 WTO Regime

34. The Fourth Protocol of the General Agreement on Trade in Services (GATS) of the World Trade Organization (WTO), which came into effect in February 1998, specifies the terms of market access for basic telecommunication services. As it is gradually implemented (according to the schedules that different countries have committed to and as the various exemptions expire), the Fourth Protocol will create a new regime for international telecommunication services, extending also to some aspects of domestic

regulation.²⁵ The Fourth Protocol applies to all telecommunication services, both public and private, that involve end-to-end transmission of customer-supplied information (e.g., simply the relay of voice or data from sender to receiver). Basic telecommunication services provided over network infrastructure, as well as those provided through resale (over private leased circuits), fall within its scope. Voice telephony, data transmission, fixed and mobile satellite services, mobile telephony and mobile data services are some of the services that are covered.

35. The GATS envisages that services can be traded through cross-border supply as well as through commercial presence. In effect, a telecommunication operator does not even need to establish a commercial presence in another country in order to supply international telecommunication services and benefit from domestic interconnect rates on equal terms with locally-based suppliers.

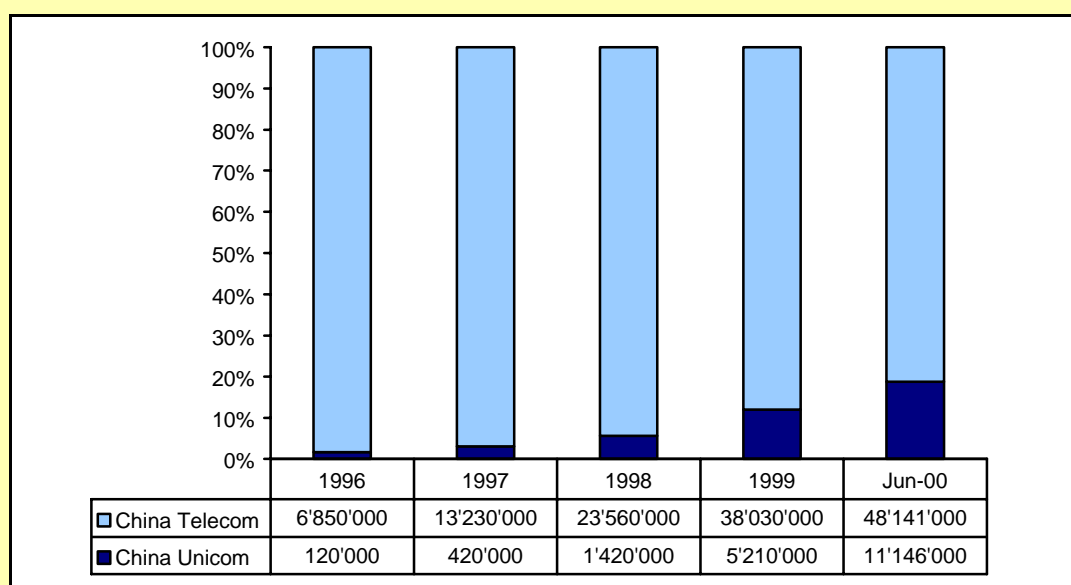
36. The Fourth Protocol to the GATS contains a Regulatory Reference Paper to which some 65 signatories have made commitments. The interconnection provisions of the Reference Paper (see Box 8) are to be applied to interconnection arrangements between major suppliers and other operators, subject to levels of commitments by countries.

Box 6: Restructuring the Regulatory Framework in China – A boon for new entrants

In 1998, the Chinese regulatory framework was restructured in order to encourage competition in the industry. The environment for interconnection was greatly altered by the newly established regulator.

The first major step was that the new entrant mobile operator (China Unicom) was permitted to provide service in any city without gaining specific permission from the regulator. This meant that the time and resources needed to launch services in each individual city and region was greatly reduced. In addition, China Unicom was permitted to use a single mobile switching centre (MSC) to cover more than one local area network. This had the effect of reducing the overall cost and increasing network efficiency. The most recent regulatory move has obliged the incumbent operator (China Telecom) to provide roaming service to China Unicom's subscribers in areas that have not yet been covered by new entrant's mobile network. Thus, China Unicom's subscribers can benefit from nationwide roaming services, just like China Telecom's subscribers. The fixed to mobile interconnection rate (payable to China Unicom for calls terminating on its mobile network) remains at 0.01 Yuan. However, the interconnection rate for mobile to fixed calls (payable to the incumbent fixed operator) was cut from 0.08 Yuan to 0.05 Yuan. It is as a result of these changes that China Unicom has achieved rapid network expansion in 1999: its market share jumped from less than 6 per cent in 1998 to more than 13 per cent in 1999. With the addition of 8.3 million new customers by China Unicom in the First Quarter of 2000, China is now considered the largest mobile market in Asia, with 51.7 million customers against Japan's 51.1 million, according to a report published in August 2000 by Gartner Group's Dataquest Division.²⁶

Box Figure 6: Increase in China Unicom's Market Share 1995-1999



For more detail, see the China Case Study at http://www.itu.int/osg/sec/spu/ni/fmi/case_studies/chinaFMI_final.doc

Box 7: Getting technical in India

In India, mobile operators have been arguing for some time that the terms of access to the incumbent's network are discriminatory and have the net effect of increasing the cost of market entry. On the one hand, mobile operators are obliged to use the incumbent's network for all long-distance (inter-circle) traffic. On the other hand, their access to this network is often limited. There are two main aspects to this limited access:

1. Points of Interconnect (POIs) and Secondary Switching Areas (SSAs):

It is clear that mobile operators stand to benefit from access to multiple points of interconnect. This would enable them to carry calls on their own network to the maximum extent and keep fixed line charges down. On the other hand, it is in the interest of the incumbent (DoT/DTS) to minimize the number of POIs so as to be able to charge long-distance rates for calls originating on mobile networks. In an effort to rectify this situation, the regulator issued an order in 1997 directing the incumbent to grant multiple POIs to the mobile operators subject to the "technical feasibility" of the network and on the basis that POI should not affect the network's "technical integrity". Mobile operators continue that the incumbent is not implementing the 1997 order. Rather, they are insisting that only one point of interconnection per Secondary Switching Area (SSA) should be permitted. However, in most cases, the nearest SSA through which the mobile operator can route a call lies further than the actual point of termination. Due to the DoT/DTS's reluctance to provide more POIs, mobile operators are forced to incur the cost of carrying traffic over longer distances.

2. Notional Points of Interconnection

In certain areas, mobile operators are "deemed" to interconnect at a "notional point", rather than an actual point. This may be more expensive than if the termination point of the call were used. The fixed network portion of the call is billed based on this notional point rather than on the actual destination point. This may mean that the call is deemed to have travelled a longer distance. Mobile operators are therefore saddled with long-distance charges irrespective of the actual routing of the call.

For more detail, see the India Case Study at http://www.itu.int/osg/sec/spu/ni/fmi/case_studies/indiaFMI_final.doc

4 REGULATING FIXED-MOBILE INTERCONNECTION

37. Interconnection in general requires regulatory intervention because of the lack of alternatives to terminate a call with a specific person, other than through a specific operator that controls that person's network address. The rather inflated termination rates for fixed-to-mobile calls in many CPP environments have given rise to special concern. The traditional phenomenon of incumbent fixed operators coercing new entrants into unfair interconnection arrangements that range from restrictive rules regarding POIs to high mobile-to-fixed terminations rates, can still be found in many countries still. Where competition does not yield an optimal price, regulatory intervention may be invoked. However, current regulatory practice anchors such intervention to (a) prior unsuccessful negotiation between the parties, and (b) determination of interconnection rates on the basis of costs or cost-orientation.²⁷ This will tend to introduce delays which may well favour the incumbent.

4.1 Overarching principles

38. The actions of the European national regulatory agencies (NRAs) regarding fixed-mobile interconnection are governed by the principles embodied in the Interconnection, Voice Telephony and Leased Lines Directives.²⁸ These principles currently specify interconnection obligations for operators with significant market power, but there are proposals to add a category of operators with dominance.²⁹ NRAs from a larger number of countries with WTO telecommunication commitments must formulate their interconnection policies in relation to the interconnection principles applicable to major suppliers, as defined by the Regulatory Reference Paper which is part of the GATS Fourth Protocol (Box 8).

4.2 Regulatory process

39. Interconnection is perhaps the most contentious of regulatory issues in telecommunication and has been likened to a waving red rag in the face of a bull.³⁰ For this reason, national authorities give careful consideration to the benefits and pitfalls of regulatory intervention. Some authorities are hesitant to intervene while others feel compelled to take a firm stand.³¹ Generally, most jurisdictions require interconnection to be negotiated among the parties first. However, some observers have described this as naïve and based on a misunderstanding of dominance and call termination. It is argued that incumbents have no incentive to negotiate.³² It is in this context that a "primary interconnectivity rule"³³ of some form has been applied with varying consistency across jurisdictions. However, as discussed above, the mandating of

cost-oriented interconnection by fixed operators with SMP without imposing any obligations on mobile operators has the unintended result of inflating termination rates under CPP. The problem is partly caused by the general practice of defining operators with SMP based on market share, and not on market power over termination.³⁴ The Australian Competition and Consumer Commission's (ACCC) declaration of GSM termination services as affected by SMP is an example of a definition based on market power.

40. Any regulatory action in the field of fixed-mobile interconnection should naturally take into account the specific legislative and policy framework in each country and the quality and quantity of human resources at the command of the regulatory authority. Ideally, however, regulators should aim to establish commercial and technical principles governing interconnection and become actively involved in setting terms and conditions.³⁵

41. It is unrealistic to expect all NRAs to have the resources to intervene in a timely manner in all interconnection disputes. Some form of market-power based classification would have to be used to assign priority to disputes. Instead of conventional market-based criteria, it would seem appropriate to develop indicators of market power related to interconnection based on calling opportunities (defined in endnote 2) which most closely relates to interconnection.

Box 8: Interconnection Provisions of Regulatory Reference Paper in Fourth Protocol, General Agreement on Trade in Services

2. Interconnection

2.1 This section applies to linking with suppliers providing public telecommunications transport networks or services in order to allow the users of one supplier to communicate with users of another supplier and to access services provided by another supplier, where specific commitments are undertaken.

2.2 Interconnection to be ensured.

Interconnection with a major supplier will be ensured at any technically feasible point in the network. Such Interconnection is provided under non-discriminatory terms, conditions (including technical standards and specifications) and rates and of a quality no less favourable than that provided for its own like services or for like services of non-affiliated service suppliers or for its subsidiaries or other affiliates:

- a) In a timely fashion, on terms, conditions (including technical standards and specifications) and cost-oriented rates that are transparent, reasonable, having regard to economic feasibility, and sufficiently unbundled so that the supplier need not pay for network components or facilities that it does not require for the service to be provided; and
- b) Upon request, at points in addition to the network termination points offered to the majority of users, subject to charges that reflect the cost of construction of necessary additional facilities.

2.3 Public availability of the procedures for Interconnection negotiations.

The procedures applicable for Interconnection to a major supplier will be made publicly available.

2.4 Transparency of Interconnection arrangements.

It is ensured that a major supplier will make publicly available either its Interconnection agreements or a reference Interconnection offer.

2.5 Interconnection: dispute settlement.

A service supplier requesting Interconnection with a major supplier will have recourse, either:

- a) At any time; or
- b) After a reasonable period of time which has been made publicly known; To an independent domestic body, which may be a regulatory body as referred to in paragraph 5 below to resolve disputes regarding appropriate terms, conditions and rates for Interconnection within a reasonable period of time, to the extent that these have not been established previously.

Note: A major supplier is a supplier which has the ability to materially affect the terms of participation (having regard to price and supply) in the relevant market for basic telecommunications service as a result of: (a) control over essential facilities; (b) or use of its position in the market.

Source: World Trade Organization (1997). *Fourth Protocol to the General Agreement on Trade in Services*, Regulatory Reference Paper. Geneva: WTO. At: <http://www.wto.org/wto/services/tel20.htm> and <http://www.wto.org/wto/services/tel23.htm>

42. Interconnection proceedings take different forms, depending on the stage of market opening, the number of new entrants, and the resources available to each of the parties. At the moment of market opening

(which many countries have now passed through), the parties to the dispute are few (incumbent versus one or two new entrants); the primary objective of the new entrants is to establish a foothold in the market by gaining some form of interconnection so that customers can be attracted. It is very likely that the terms of interconnection established at this stage, even if resulting from negotiation, will be unfairly biased against the new entrants. It is in the interests of the NRA as well as the new entrants to qualify these arrangements as transitional or interim, leaving open the possibility of revision.

43. After the new entrants have established themselves in the market, the negotiation can take place in a somewhat more "equal" environment. However, there may be an added level of complexity introduced by the increased number of parties. Most Member States have licensed multiple mobile operators, generally with national scope. In some cases, the fixed-line market may also have been opened to competition. What was, at most, a three-player game in the market-opening stage can have as many as seven to ten players at a later stage. Unless specific attention is paid to the management of this complexity, the negotiation and/or proceeding may become difficult to manage.

44. The WTO Regulatory Reference Paper seeks to address this problem by requiring that major suppliers make public their interconnection agreements or release a reference interconnection offer.³⁶ The intention is to reduce the possibilities of a major supplier playing off one competitor against another. A stronger form of implementing this intention is to adapt to interconnection, and to interconnecting operators, the "Most Favoured Nation" (MFN) rule common in trade negotiations and applicable to all signatories to the GATS. The principle behind MFN is that the terms and conditions of an agreement with one country are automatically extended to others in the same class. If this were to be applied to operators domestically (just as it is applied internationally to countries), transaction costs may be reduced and discrimination and gaming thwarted. However, regulatory authorities in each country have to carefully define the classes of competitors and set other ground rules. Between the complexity of a seven or ten-party game and the relative simplicity of a "most favoured operator" rule, lies a range of solutions. It may be feasible, for instance, to create incentives for groups of players to negotiate collectively.

45. The simplification of the procedure by clustering operators as well as by the more radical MFN approach may be criticized as leading to collusion among mobile operators.³⁷ Such a process is likely to yield uniform fixed-to-mobile and mobile-to-fixed termination rates across networks, but not necessarily uniform prices for consumers. Because costs of termination in the incumbent's network do not usually vary from one mobile operator to another, the uniformity of mobile-to-fixed termination rates is likely to arise under any form of cost-oriented process.

46. Fixed-to-mobile termination rates are paid not by mobile customers but by fixed-line customers in CPP environments. Therefore, it is unlikely that these rates, uniform or not, will affect the competitive positions of the mobile operators.³⁸ In terms of customers' ability to understand the price signals, different prices to different mobile networks can cause significant problems, especially where number portability is allowed. In RPP environments, there may be merit in uniform costs of interconnection to an essential facility. It would allow mobile operators to compete on how much of the customer payment for incoming calls they are willing to absorb in the form of free airtime.

47. The resources at the command of various operators when they participate in interconnection negotiations or proceedings must be taken into account. Relative to the fixed-line sector, the mobile sector in many Member States has attracted greater foreign investment and management participation. In many cases, mobile operators have ownership, management or alliance-based relations with large, global players (e.g., Vodafone-Airtouch and Hutchison Whampoa). As a result, mobile operators are likely to be quite sophisticated in their interventions, even in the early stages.

48. Increasingly, knowledge from advances in game theory and dispute resolution is being applied to the difficult problems of interconnection. In fact, the nature of interconnection demands that NRAs make best efforts to reduce the levels of hostility that can be engendered by a formal adversarial process. Unlike many matters of dispute, interconnection requires long-term, day-to-day cooperation among operators. It is important also for NRAs to be aware of the potential for market failure. As Figure 7 shows, while there may be vibrant competition in the market for retail mobile customers, this is progressively reduced as one moves from retail call pricing to wholesale call origination and termination.

49. Depending on the specific national circumstances, NRAs may consider applying mediation or arbitration, or a combination thereof, backstopped by formal regulatory action, such as a hearing or a

determination. NRAs have used workshops to build consensus around cost methodologies and various other non-formal mechanisms to lubricate difficult interconnection proceedings.³⁹ Sri Lanka used mediation in the fixed-fixed phase of the interconnection proceeding, but relied exclusively on a formal process for the fixed-mobile phase (Box 9). "Final offer" or "baseball" arbitration is attracting considerable attention.⁴⁰ In this form of arbitration, the arbitrator does not have the power to devise compromise solutions, but must pick one or the other proposal, which creates incentives for both parties to be reasonable. This contrasts with conventional arbitration, which creates incentives for the two parties to stake out extreme positions. Final-offer arbitration is mentioned as an example only. It is necessary to assess different techniques carefully, especially in terms of their suitability for multi-party negotiations and the legal environment in each country.

Box 9: Fixed-Mobile Interconnection in Sri Lanka in three phases

The Sri Lankan interconnection proceeding was conducted in three phases, the first addressing fixed-fixed interconnection (1998), the second addressing fixed-mobile and mobile-mobile interconnection (1999), and the third being a public hearing on CPP (1999-2000). The first phase involved the incumbent and two fixed access competitors that had achieved a combined share of around 10 per cent of the fixed-line market over a period of two years. In practical terms, the first phase was a two-player game, with the two competitors closely coordinating their positions.

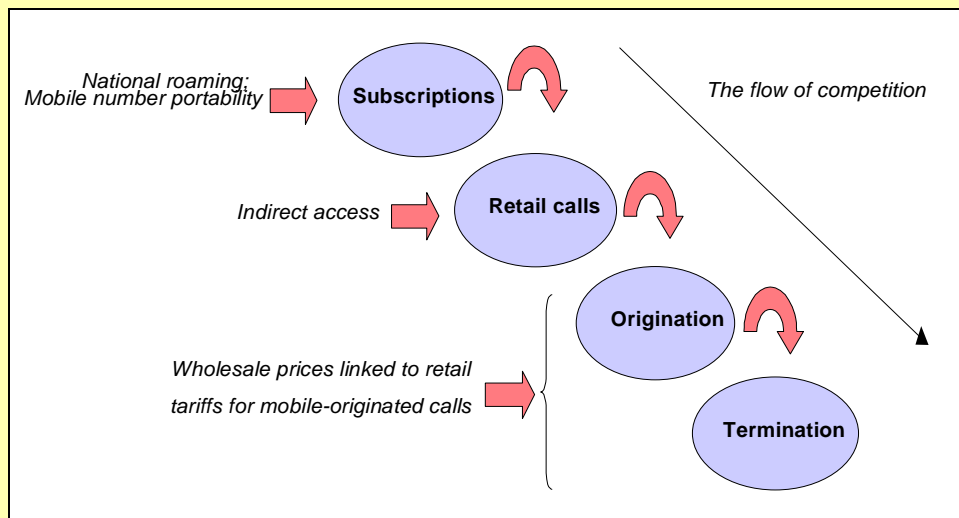
The second phase could have become a seven-player game, with four mobile operators, having a combined total of around one-third of the total fixed and mobile connections, being added to the mix (see Figure 4). The parties were not compelled to collaborate, but the fixed-mobile interconnection proceeding became a manageable three-player game, with the mobile operators adopting a common position (despite one having the fixed-line incumbent operator as a minority owner) and the fixed-line competitors continuing their collaboration, but not joining with the incumbent. The process was facilitated by early and proactive attention paid to reduction of complexity, including procedures that precluded provisions affecting the mobile operators in the first phase. The results of the public hearing, the third phase, were scheduled to be released in August 2000.

Sources: Authors; www.trc.gov.lk

50. Whatever techniques are used, the monitoring of progress in fixed-mobile interconnection in other Member States is important for NRAs. For the internal purposes of the NRA, it is important that up to date and complete information about what other NRAs have done be available both to its staff and also to the stakeholders. Many regulatory proceedings deteriorate into competitions on who can spin the scariest scenarios of what will happen if their proposals are not accepted. Being able to point not only to best practices, but also to the concrete results achieved after certain regulatory actions have been taken serves to prevent scenario building from becoming too divorced from reality. The ITU and/or regional organizations could play a useful role in making such information easily and widely available, for example, through the fixed-mobile interconnection website at <http://www.itu.int/interconnect> and other means.

Figure 7: The competitive cascade

Examples of potential market failure in the negotiation of fixed-mobile interconnect rates



Source: David Rogerson, Ovum.

5 INTERCONNECTION COSTING

51. An increase in the interconnect charge or revenue share of one operator results directly in a decrease in the interconnect price or revenue share of the other. Thus there are major potential rewards for effective competition in the context of interconnection negotiations (even when incumbents are not competing in the marketplace) and intense scrutiny of the methodology used to arrive at the interconnect price. Moreover, interconnection arrangements must be modified periodically to reflect changing conditions, including technical arrangements relating to new technologies and network upgrading, the costs of equipment and other resources, the growth of demand, new service development and evolving market structure.

52. When interconnection negotiations involve competitors for broadly similar services in the same area, the criteria for negotiation are much more sharply focused on market standards of efficiency and profitability of individual operators, and the incentives for strategic and opportunistic behaviour are increased dramatically. Established incumbents are not about to give a new competitor a free ride on their network, nor allow their own efficiency to provide the foundation for a competitor to take away their business and earn high profits. New competitors, on the other hand, can only supply a portion of the overall facilities network needed to provide services to customers. In order to have any chance of demonstrating their efficiency and service capability, they must be able to obtain access to the incumbent's network capacity at reasonable prices.

53. It was recognition of this lopsided negotiating situation that led policymakers and regulators in many countries to require the incumbent to provide interconnection to new mobile operators at cost-based prices, while giving mobile operators freedom from price regulation. Presumably, the mobile services either had to compete with the regulated prices of fixed network services or fill an unsatisfied consumer desire that was viewed as a luxury. Further, it was felt that competition among mobile operators would keep consumer prices reasonable. Asymmetric prices for terminating fixed network calls were not viewed as a significant matter. In some countries, they were even seen as promoting competition and providing investment capital for expansion.

54. What was not fully appreciated was the fact that the conditions for originating and terminating services can be very different. Traditionally, telecommunication services were viewed as originating services: the calling party pays and the supplier is the seller of the originating service. However, with mobile services, there has been an unbundling of origination and termination services, and sometimes of the supplier and the seller. Incumbents, in many developed CPP countries in particular, must now provide regulated cost-based prices to consumers and to mobile operators for terminating mobile originated calls, while mobile operators can charge the incumbents very high prices for terminating fixed-line originated calls. The force of competition among mobile operators does not apply, as they all benefit from the high prices. None of them will gain from charging low prices. Similarly mobile operators have an incentive to charge one another's customers very high prices for roaming services, as all operators benefit from the practice. Thus monopoly prices for these services (or service elements) are the norm regardless of the number of mobile competitors.

55. A better possibility for short-term competition may arise if the established mobile networks are unbundled, and stronger competition arises within the mobile sector as a result of the separation of retail and wholesale functions.⁴¹ The entry of Mobile Virtual Networks Operators (MVNOs) is one possibility.⁴² However, increased retail competition will press mostly on the retail margins for customer prices for originating mobile calls, and not necessarily on the termination rates of calls originating in the fixed-line network. Yet another possibility for increasing competition would be the licensing of additional operators. But an increased number of competitors will not necessarily lead to an incentive to reduce prices for terminating calls originating on the fixed-line network. At this stage, it is difficult to see how competition will solve this problem, unless there are some fundamental changes in the institutional structure of the industry that are not currently being examined. This raises the possibility that cost-based regulation may have to be seriously considered.

5.1 The role of cost-related mandates

56. Cost-oriented interconnection rates are mandated for "major suppliers" or operators with SMP by the WTO Regulatory Reference Paper, the European Commission Interconnection Directive, the APEC principles and framework for interconnection,⁴³ the 1996 US Telecommunications Act and numerous other national statutes. Because commitments under the Fourth Protocol of the WTO apply to mobile operators, cost-oriented interconnection rates are or will be mandatory for operators that are deemed to be major

suppliers in a large number of ITU Member States, though this provision has not yet been fully enforced. In some low-income Member States, interconnection rates are set on the basis of revenue sharing, partly because of the lack of regulatory capacity. Increasingly, interconnection rates are being set on the basis of benchmarks, partly as a reaction to the time-consuming and contested nature of cost studies.

5.2 Cost methodologies

57. In situations where competition is ineffective, cost-based prices are considered desirable, for achievement of efficiency goals as well as regulatory efficacy. However, the determination of costs is anything but uncontroversial and objective.⁴⁴ In general, there has been an implicit acceptance among many regulatory agencies of the claim made by the mobile industry that termination costs are higher on mobile networks than on fixed-line networks.⁴⁵ This claim is based on the additional costs associated with mobile network elements such as stations that do not exist in fixed-line networks.

58. However, the wide range of fixed-to-mobile termination rates suggests that the extant rates bear little, if any, relation to cost. Few studies on the termination costs on mobile networks exist, and even in the few that have been undertaken, there is considerable disagreement on the appropriateness of the methodology.⁴⁶ Rapidly dropping costs of mobile equipment are cited in contexts other than interconnection, but the high rates of network expansion, the transition to second generation standards in the recent past and the imminent transition to IMT standards make cost calculations of mobile termination somewhat problematic.

59. The costing problems related to fixed-mobile interconnection are similar to those of interconnection in general, except for the faster rates of investment and technological change. There is no consensus on the best methodology, or even on the basic point that the resulting prices should be consistent with what would prevail in a competitive market. The methodologies that may be applied to the determination of interconnection rates include:

- different forms of long-run incremental cost methodologies, such as Long-Run Average Incremental Costs (LRAIC), Total Element Long-Run Incremental Costs (TELRIC), and Total Service Long-Run Incremental Costs (TSLRIC);
- different forms of Fully Distributed Costs (FDC);
- Efficient Component Pricing Rule (ECPR); and
- hybrid forms such as LRIC subject to FDC-based caps.

In addition, many Member States use revenue sharing arrangements, in the absence of basic cost data.⁴⁷

60. Analysys, a telecommunications consulting firm, conducted the most recent study of Europe-wide mobile costs for the European Competitive Telecommunications Association (ECTA), using 1999 data.⁴⁸ The study used an LRIC plus mark-up methodology that had been developed and used in OFTEL's studies of the mobile sector. The key conclusions of this study are as follows:

- a) Mobile termination costs per minute for GSM 900 operators studied range from a low of EUR 0.066 (Switzerland) to a high of EUR 0.092 (Italy); for GSM 1800 the costs ranged from EUR 0.056 (UK) to EUR 0.119 (Finland).
- b) Costs of outgoing minutes ranged from a low of EUR 0.111 (Italy) to a high of EUR 0.215 (Sweden) for GSM 900; and a low of EUR 0.220 (UK) to a high of EUR 0.379 (Spain) for GSM 1800.
- c) Actual mobile termination rates exceeded the costs estimated in the study by a range of 43 per cent to 70 per cent for GSM 900.

Understandably, representatives of the mobile industry have found fault with the ECTA study on the grounds that LRIC methodology was inappropriate for dynamic and rapidly growing markets.⁴⁹ The authors of the report appear to expect controversy on the equal proportionate mark up of common network costs, which are higher in mobile networks than in fixed-line networks. The discussion of GSM 1800 costs and the tentativeness of the conclusions drawn on these networks indicate the sensitivity of studies such as this to technological change.

5.3 Benchmarking

61. As shown above, conventional cost studies are not very efficacious in the setting of fixed-mobile termination rates because of the time required and the difficulties of gaining consensus on methodology and results. In order to meet the criteria of objectivity, it will be necessary to base the study on existing technology. However, the rapidity of technological change and market growth may make study results obsolete quickly. There is also the concern that the NRAs, especially in developing countries, may lack the necessary resources to conduct detailed cost studies.

62. Benchmarking is a pragmatic alternative to cost studies, especially for developing country NRAs. Studies undertaken in developed-country markets can be used, especially if composites of multiple studies can be constructed, as benchmarks in the process of determining cost-oriented termination rates. For instance:

- in the European Union, the upper limit of the lowest three fixed-line domestic interconnection rates (local, single transit and double transit) is used as a best practice guideline for the 15 EU Member States (see Figure 5);
- in the ITU-T draft Recommendation D.140 Annex E (Focus Group report) the average of the lowest 20 per cent of published settlement rates within a teledensity group is used as an indicative target rate for the group as a whole, to be achieved within three years

If similar benchmarks calculations could be developed for fixed-to-mobile interconnect rates, the NRA, as well as the operators, could then focus their energies on the modifications that must be made to the composite benchmark, in the process of adapting it to the local circumstances.

63. The ITU can play a very useful role in collecting information on cost studies and ensuring that the underlying assumptions and methodologies are documented. A dynamic database on fixed-to-mobile interconnection, made available on www.itu.int/interconnect, could prove to a very useful tool for NRAs, especially those in the developing Member States.

6 THE MOBILE INTERNET: IMPLICATIONS FOR INTERCONNECTION⁵⁰

64. Currently there are many ongoing efforts to enable Internet use from mobile handsets. Some of the implications of the mobile Internet may be addressed in terms of two of the key functionalities of the mobile Internet (one-to-one messaging and information retrieval) and the associated pricing paradigms and interconnection arrangements.

6.1 One-to-one messaging

65. The current dominant use of mobile networks is for one-to-one synchronous and asynchronous voice messaging. This would be an integral part of IMT or Internet-enabled mobile networks as well. Despite the current bandwidth limitations on 2G mobile systems, text-based messaging systems are growing in popularity. Burgeoning SMS use, which reached five billion messages globally in March 2000,⁵¹ shows that mobile networks will be used for one-to-one synchronous or asynchronous text messaging. It may be expected that this functionality will become relatively more important in IMT networks and beyond.

66. One-to-one synchronous voice messaging was the primary functionality of the public telecommunication networks for decades. The basic pricing paradigm of the public telephone system in a majority of the Member States has been distance-sensitive, per-minute and calling-party-pays. In some Member States, flat rates are available for local calling. There are many types of interconnection arrangements including measured compensation and sender-keeps-all.

67. One-to-one asynchronous text messaging has been the primary functionality of the postal system. The basic pricing paradigm of the postal system, especially within national boundaries, has been distance insensitive, per-message and sending-party-pays, with additional charges for larger-than-normal messages. "Interconnection" in the postal system has been generally, though not always, based on the sender-keeps-all principle.

68. E-mail, a major functionality of the Internet, also enables one-to-one synchronous or asynchronous text messaging. Here, the basic pricing scheme has been flat rate and distance insensitive. Generally, prices

have been independent of volume. Interconnection has been governed by the peering/client relationships of the Internet. The charges, when applicable, have been pegged to data volume (of which e-mail is currently but a small part), rather than minutes or messages.

69. SMS is the currently operational service on GSM mobile that is similar to e-mail, but is limited to 160 characters per message. Like conventional e-mail, it has similarities both to voice messaging and postal messaging, but the former is more pronounced. The pricing structure reflects these ambiguities. SMS originating on mobile handsets is generally priced on the basis of messages, not minutes, and is distance-insensitive, in some cases requiring no extra payment even if the addressee is roaming. In Europe, Australia, New Zealand and Korea there is no fixed fee and no charge for receiving messages. In North America and Japan, it is common for a flat rate to be levied for a specified number of messages or an unlimited number. Generally, the flat-rate pricing schemes are cheaper at high usage levels. They also create incentives for heavy usage. Flat-rate pricing has similarities with both the Internet paradigm and the pricing scheme for local telephony in the United States and Canada. SMS originating in the Internet is generally free to the sender.⁵²

70. Interconnection in SMS is generally based on sender-keeps-all, partly because an SMS message is registered only at the point at which it enters the network and partly because SMS traffic was not significant until recently.⁵³ With the recent explosion of SMS use and WAP and GPRS services coming on stream, attention is being focused on new pricing schemes as well as interconnection arrangements.⁵⁴ It is generally thought that GPRS and similar "always-on" mobile services will be priced on the basis of data volume, both for end-users and as termination rates or subscription (flat-rate).⁵⁵ A shift from minute-based interconnection pricing to volume-based pricing will require a qualitative change in interconnection costing and pricing methodologies.

6.2 Information retrieval

71. The basic information-retrieval transaction (e.g., web-browsing) usually consists of a relatively low-volume query and a much higher-volume response. Information-retrieval pricing in the world of bricks-and-mortar retailing has been based on the nature of the information retrieved (e.g., books and music) or has been paid for by advertising (e.g., television and, for the most part, newspapers). The early form of information retrieval on the public telecommunication network, audiotex, was priced on the basis of minutes of use, a proxy for volume. However, different audiotex services had different per-minute charges, allowing the nature of information and its perceived value to be factored into the price.

72. SMS has limited information retrieval capabilities. Currently, there are a few services that allow information retrieval via SMS. One example is www.hz.com, which provides information on subjects such as weather and flights in response to formatted queries from any device capable of sending e-mail, including two-way pagers and SMS-enabled mobile handsets.⁵⁶ The user pays the cost of the query while the information itself is downloaded free, apparently paid for by partnerships. The information responses are subject to the limit of 160 characters of SMS.

73. Per-message and flat-rate charging do not make a big difference at the levels of usage common with one-to-one messaging, but the former will be a serious barrier to information retrieval, especially when multiple queries are required to obtain the desired information. Information retrieval proper from mobile handsets or equivalents will have to wait for the higher-speed and "always-on" services such as IMT and GPRS. The interconnection arrangements for mobile information retrieval are likely to be shaped by the resolution of the same sorts of issues appearing in the Internet interconnection debate.⁵⁷

74. The emergence of packet-switched, "always on" services such as GPRS and IMT require the design of appropriate interconnection arrangements not based on connection time. Some of the interconnection issues of one-to-one text messaging and information retrieval using mobile handsets and equivalents are likely to emerge very quickly with the explosive growth of Short Messaging Services (SMS) and the introduction of services such as GPRS and IMT, requiring quick regulatory responses.

7 CONCLUDING REMARKS

75. This paper has presented information to form a basis for in-depth discussion on a number of issues related to fixed-mobile interconnection. The most important insight has been the critical role played by

market structure and competition in the setting of mobile-fixed and fixed-mobile interconnection rates. As a result of the monopoly on the means of terminating calls to specific addresses held by each operator, interconnection is the subject of bilateral negotiation, and not necessarily amenable to the discipline of competition under present technological conditions. Generally, incumbent operators who control a larger number of addresses are likely to impose unfavourable terms on, or deny interconnection altogether to, new entrants with fewer addresses.

76. In those special circumstances where incumbents are subject to mandatory cost-oriented interconnection, regulatory agencies do not intervene in the setting of termination charges, charges are passed on to fixed-line customers under CPP, and there is incumbent ownership of mobile operators, a different outcome of excessive fixed-to-mobile termination rates may be seen. Consequently, the prices of calls to mobilephones from fixed-line customers tend to be significantly higher than calls to fixed phones by mobile customers in CPP environments.

77. Fixed-mobile interconnection, especially in developing countries, has been plagued by the difficulties endemic to interconnection arrangements with incumbents, in the form of constrictive provisions for the establishment of points of interconnection that affect quality-of-service as well as interconnection payments. Overarching principles such as those in the WTO Regulatory Reference Paper and the European Commission's Interconnection Directive are useful but active intervention by national regulatory authorities is essential for their satisfactory resolution. Given limited resources, regulators have to develop effective rules for prioritising intervention, managing the complex interactions among large numbers of stakeholders and enforcement of decisions. The analysis suggests that determinations of SMP based on calling opportunities, or actual traffic patterns, may be superior to the conventional approach based on market share. Simplification of the regulatory process may be achieved by means ranging from the adoption of the MFN principle to allowing or encouraging the clustering of stakeholders. Transparency and the use of alternative dispute resolution techniques may facilitate enforcement. Dissemination of data on termination charges and other interconnection-related information by the ITU and/or regional organizations can be of great assistance to fledgling regulators, especially in light of the limitations of cost studies in the dynamic mobile sector and the increasing value placed on benchmarking.

78. The emergence of packet-switched, "always on" services such as GPRS and IMT-2000 require the design of appropriate interconnection arrangements not based on connection time. Some of the interconnection issues of one-to-one text messaging and information retrieval using mobile handsets and equivalents are likely to emerge very quickly with the explosive growth of Short Messaging Services (SMS) and the introduction of services such as GPRS and IMT-2000. Current debates on Internet interconnection may provide useful insights for packet-based fixed-mobile interconnection.

ANNEX I: DEFINITIONS

Calling Party Pays (CPP)	<p>Billing option whereby the person making the call is charged an extra amount by the call-originating operator. Generally, the call-originating operator will retain an administrative fee and transmit the balance of the extra amount to the call-terminating operator. The receiving party does not pay for receiving the call.</p>
Fixed-line network	<p>“The fixed-line public telephone network means the public switched telecommunications network which supports the transfer between network termination points at fixed locations of speech and 3.1 kHz bandwidth audio information, to support <i>inter alia</i>:</p> <ul style="list-style-type: none"> – voice telephony; – facsimile Group III communications, in accordance with ITU-T Recommendations in the "T-series"; – voice band data transmission via modems at a rate of at least 2,400 bit/s, in accordance with ITU-T Recommendations in the 'V-series'.”⁵⁸ <p>The definition would include both fixed-line and fixed cellular networks as long as they are publicly available.</p>
General Packet Radio Service (GPRS)	<p>GPRS is a packet switched data radio technology for GSM networks. GPRS connections are always open giving mobile terminal users the same kind of network availability they may be used to from corporate networks. There are no set up and clear down times associated with data calls made via GPRS. Terminals can therefore effectively become a part of the Internet.⁵⁹</p>
IMT	<p>International Mobile Telecommunication is a framework standard for the linking of terrestrial and/or satellite based networks. It is also known as the <i>Third Generation Mobile Systems</i>. IMT aims to encourage global service provision and convergence of the many essentially competing wired and wireless access technologies.⁶⁰</p>
Interconnection	<p>Interconnection may be described as the physical connection of two different telecommunication networks in order to allow customers connected to different networks to communicate, to ensure the interoperability of services, and to increase the choice made available to telecommunication users. Network operators typically charge a per-minute fee for use of their network by other network operators (referred to as an “interconnect payment” or “access charge”). The European Commission defines it as “the physical and logical linking of telecommunications networks used by the same or a different organization in order to allow the users of one organization to communicate with users of the same or another organization, or to access services provided by another organization. Services may be provided by the parties involved or other parties who have access to the network.”⁶¹ This may take the forms of linking two networks that have been built and are managed by two different operators; where there is a pre-existing network, allowing new entrants to lease parts of that network by unbundling the service elements; and allowing new entrants to purchase services for resale at wholesale prices. Generally, interconnection refers to the linking of telecommunication networks that are within the jurisdiction of a single National Regulatory Authority (NRA).⁶² It is customary to exclude linking arrangements governed by international settlements or roaming agreements from the scope of interconnection. With the implementation of the “single market” provisions of the World Trade Organization’s Fourth Protocol of the GATS and the Regulatory Reference Paper, linking arrangements hitherto falling outside the scope of interconnection may be brought within its scope.</p>
Mobile network	<p>“A public mobile telephony network is a public telephone network where the network termination points are not at fixed locations.”⁶³ This may be interpreted as including Global Mobile Personal Communication by Satellite (GMPCS) networks, though certain networks that are used by closed user groups such as public-safety and other networks using forms of trunked-radio technologies would be excluded.</p>

Mobile Virtual Network Operators (MVNOs)	"A mobile virtual network operator (MVNO) is an organization that offers mobile services to customers, has its own mobile network code, issues its own SIM card, operates its own mobile switching centre (including home location register), and does not have its own radio frequency (spectrum) allocation. In its purest form, an MVNO is fully independent of the physical operator - its use of the operator's network is limited to the radio infrastructure." ⁶⁴ Ovum, a telecommunications consulting firm, distinguishes an MVNO from organizations that offer mobile services but do not issue their own SIM card, describing the latter as enhanced service providers. OFTEL, the UK national regulatory agency, defined an MVNO as an operator which offers mobile subscription and call services to customers but does not have an allocation of spectrum, thereby including enhanced service providers as well. ⁶⁵
Receiving Party Pays (RPP)	Billing option whereby the person receiving the call is charged for reception by the call-terminating operator. This does not necessarily mean that the calling party is not charged. Within a RPP environment, the receiving party may be exempt from paying for receiving some calls because of tariff packages and other factors. The calling party does not have to pay any additional charge for calls to mobile phones in an RPP environment.
Roaming	A service offered by mobile operators whereby customers may originate and receive calls while in the service area of another operator. Roaming requires an agreement between operators of technologically compatible systems (sometimes facilitated by more complex handsets than are required for the "home" network). In contrast to interconnection, which increases calling opportunities, roaming also increases the geographical area within which a telecommunication service may be used. Generally, roaming is left to commercial agreement between operators. Users may be required to pay supplemental charges for roaming.
Short Messaging Service (SMS)	A service that involves the transmission of a short (usually 160 characters or less) text message to a mobile handset. The message may originate on the Internet, on another mobile handset, or elsewhere.
Termination charge	Fees paid to an operator for completing calls on its network.
Tromboning	Sending domestic fixed to mobile traffic via international routes to avoid high mobile termination rates. Instead, the call is treated as an international incoming call and the mobile operator compensated on the basis of a portion of the settlement rate.

ANNEX II: LIST OF ACRONYMS

ACCC	Australian Competition and Consumer Commission
BT	British Telecommunications plc
CAGR	Compound Annual Growth Rate
CEO	Chief Executive Officer
CLEC	Competitive Local Exchange Carrier
CPP	Calling Party Pays
ECPR	Efficient Component Pricing Rule
ECTA	European Competitive Telecommunications Association
FCC	Federal Communications Commission
FDC	Fully Distributed Costs
GATS	General Agreement on Trade in Services
GMPCS	Global Mobile Personal Communication by Satellite
GPRS	General Packet Radio Service
GSM	General System for Mobile Communications
IMT	International Mobile Telecommunications
ITU	International Telecommunication Union
LRAIC	Long-Run Average Incremental Costs
MFN	Most Favoured Nation
MVNO	Mobile Virtual Network Operator
NRA	National Regulatory Authority
OECD	Organization for Economic Cooperation and Development
OFTEL	Office of Telecommunications (UK regulatory agency)
POI	Point of Interconnection
PTO	Public Telecommunication Operator
RPP	Receiving Party Pays
SAR	Special Administrative Region
SIM	Subscriber Identity Module
SKA	Sender Keeps All
SMP	Significant Market Power
SMS	Short Messaging Service
TELRIC	Total Element Long-Run Incremental Costs
TSLRIC	Total Service Long-Run Incremental Costs
WAP	Wireless Application Protocol
WSP	Wireless Service Provider

WTO World Trade Organization

Endnotes

-
- ¹ Abbreviated as mobile services in this paper.
- ² Calling opportunities are defined as the sum total of possible connections (and therefore calls) on telecommunication networks. Fixed to fixed calling opportunities = fixed lines * fixed lines; fixed to mobile calling opportunities = fixed lines * mobile lines. Because of high call prices, interconnection difficulties, congestion, etc. the actual calling opportunities would be lower than the theoretical number. This indicator, developed by the OECD's Directorate for Science, Technology and Industry, is useful for discussion of interconnection issues, because it highlights the magnitude of the calling opportunities (and indirectly the calls) that require interconnection. Fixed phones may be used by more than one person, unlike most mobile phones. Therefore, the calculations understate the actual calling opportunities to fixed phones. In addition, high prices and less-than-seamless interconnection result in the actual calling opportunities being lower than the theoretical maximum.
- ³ ITU (1999), *World telecommunication development report 1999* (Geneva: ITU).
- ⁴ See Finland case study, at: www.itu.int/interconnect.
- ⁵ OECD, Committee for Information, Computer and Communications Policy (2000, May), Cellular mobile pricing structures and trends, DSTI/ICCP/TISP(99)11/FINAL. At: <http://www.oecd.org/dsti/sti/it/index.htm>
- ⁶ Grice, C. (2000, February 4) "Mannesmann buy could put wireless company in AT&T's league," *CNET News.com*, <http://news.cnet.com/news/0-1004-200-1543225.html>
- ⁷ OECD, Committee for Information, Computer and Communications Policy (2000, May), Cellular mobile pricing structures and trends, DSTI/ICCP/TISP(99)11/FINAL. At: <http://www.oecd.org/dsti/sti/it/index.htm>; OFTEL (1998, May). Submission to the Monopolies and Mergers Commission inquiry into the prices of calls to mobile phones; Blau, J. & D. Molony (1998, March 16). Cost of calling mobiles to fall in Europe, *Communications Week International*. At <http://www.totaltele.com>
- ⁸ McLeod, D. (1999, April 16). Telkom's turn to cry foul * phone charges. *Financial Mail* (South Africa).
- ⁹ Wirzenius, A. (1999, October 13). Mobile licensing principles--two opposite models. Session INF.7/POL.5, Telecom 99 + Interactive 99 Forum, Geneva.
- ¹⁰ E.g., presentations by Bill Gates (Microsoft) and Larry Ellison (Oracle) at the Opening Session of the Interactive Summit of the Forum at World Telecom 1999 in Geneva, November 1999. See, Molony, D. (1999, October 25). "Telecom 99: Small devices dominate the big show," *Communications Week International*. At: www.totaltele.com
- ¹¹ European legislation presumes an organization to have significant market power when it has a share of more than 25% of a particular telecommunication market in the geographical area in a Member State within which it is authorized to operate and mandates such operators to interconnect -- Article 4 of Interconnection Directive EC/97. At: <http://www.ispo.cec.be/infosoc/telecompolicy/en/d1-en.htm>. The criteria for major suppliers in the WTO Regulatory Reference Paper are parallel, but somewhat less precise. For purposes of simplicity, this paper does not differentiate between dominant operators and those with SMP, as in Lewin, D. & D. Rogerson (1999, June). *A review of the Interconnect Directive: Initial proposals for discussion*. London: Ovum. At: <http://www.ispo.cec.be/infosoc/telecompolicy/en/ovumicfn.pdf>
- ¹² Lewin, D. & D. Rogerson (1999, June). *A review of the Interconnect Directive: Initial proposals for discussion*. London: Ovum, p. 35. At: <http://www.ispo.cec.be/infosoc/telecompolicy/en/ovumicfn.pdf>
- ¹³ See China-Hong Kong SAR case study. At: www.itu.int/interconnect
- ¹⁴ Telecommunications Regulatory Commission of Sri Lanka (1999, June 17). "Telecom Commission releases mobile interconnect decision: Fairer interconnect terms now; public hearing to seek comments on calling-party-pays decision: News release." At: <http://www.trc.gov.lk>
- ¹⁵ The extensive use of "call-around" long-distance and international operators by US consumers is one example. Another, from the mobile sector, is the use of two prepaid phones or cards (or in one case from Portugal, a prepaid card with two numbers and tariffs) by users who use one or the other based on time-of-day and other factors--Johnston, M. (1999, March 8), "Doppelgangers on the move--Europe's prepaid mobile services market produces new twists as usage grows," tele.com.
- ¹⁶ In the context of voice messaging, an address is a number.
- ¹⁷ The proliferation of network addresses in the form of telephone numbers, fax numbers, and e-mail addresses may portend the emergence of markets in termination, but such intermodal competition in termination services is not developed enough at this time to base policy on.
- ¹⁸ See <http://www.mmc.gov.uk/cellnet.htm>
- ¹⁹ OECD, Cellular Mobile Pricing and Trends, DSTI/ICCP/TISP(99)11/FINAL, May 2000, available at <http://www.oecd.org/dsti/sti/it/cm/prod/>

- ²⁰ Joshua S. Gans, *An Evaluation of Regulatory Pricing Options for Mobile Termination Services*, University of Melbourne, December 1999.
- ²¹ See India case study. At: www.itu.int/interconnect
- ²² See Fixed-to-mobile interconnection determination of Telecommunications Regulatory Commission of Sri Lanka, summarized in "Telecom Commission Releases Mobile Interconnect Decision: Fairer Interconnect Terms Now; Public Hearing to Seek Comments on Calling-Party-Pays Decision" (news release of 17 June 1999). At: <http://www.trc.gov.lk/news.html>; see also Anonymous (1999, August 12). "Telkom asked to heed new transmission ruling," *Jakarta Post*.
- ²³ E.g., situation in China prior to 1998. See China case study at www.itu.int/interconnect
- ²⁴ For post-1998 situation in China, see China case study at www.itu.int/interconnect. See also, Anderson, R. (1999, July 29). Go ahead for Internet calls. *Financial Times*, p. 34.
- ²⁵ E.g., DePalma, A. (2000, July 29). US Seeks WTO Talks on Mexican Phone Market, *New York Times*, p. C2.
- ²⁶ Riseborough, S. (2000, August 14). Gartner says China now tops Asian mobile league. *Total Telecom*. At: www.totaltele.com
- ²⁷ E.g. World Trade Organization (1997). *Fourth Protocol to the General Agreement on Trade in Services*, Regulatory Reference Paper. Geneva: WTO. At: <http://www.wto.org/wto/services/tel20.htm> and <http://www.wto.org/wto/services/tel23.htm>; Directive 97/EC of the European Parliament and of the Council on interconnection in telecommunication with regard to ensuring universal service and interoperability through application of the principles of open network provision (ONP). At: <http://www.ispo.cec.be/infosoc/telecompolicy/en/d1-en.htm>.
- ²⁸ European Commission Information Society DG (1999, September 17). Explanatory note: Access to fixed and mobile network infrastructures owned by operators designated as having significant market power. XIII/A1.
- ²⁹ Lewin, D. & D. Rogerson (1999, June). *A review of the Interconnect Directive: Initial proposals for discussion*. London: Ovum, p. 27. At: <http://www.ispo.cec.be/infosoc/telecompolicy/en/ovumicfn.pdf>
- ³⁰ Shetty, V. (1998, Nov 1). "Interconnection: A red rag to a bull," *Communications International*. At: www.Totaltele.com.
- ³¹ Leive, D. M. (1995, April 19-21). "Interconnection: Regulatory issues." Report of the Fourth Regulatory Colloquium, Geneva, 19-21 April 1995. At: <http://www7.itu.int/treg/RelatedLinks/LinksAndDocs/interconnect.asp>
- ³² Sullivan, M. (1999, May 3-5). The basics of interconnection: Presentation notes to ITU Workshop on Telecommunication reform. At: <http://www7.itu.int/treg/RelatedLinks/LinksAndDocs/interconnect.asp>
- ³³ Lewin, D. & D. Rogerson (1999, June). *A review of the Interconnect Directive: Initial proposals for discussion*. London: Ovum, p. 8. At: <http://www.ispo.cec.be/infosoc/telecompolicy/en/ovumicfn.pdf>
- ³⁴ "An organization shall be presumed to have significant market power when it has a share of more than 25% of a particular telecommunication market in the geographical area in a Member State within which it is authorized to operate." --Directive 97/EC of the European Parliament and of the Council on interconnection in telecommunication with regard to ensuring universal service and interoperability through application of the principles of open network provision (ONP), Article 4. At: <http://www.ispo.cec.be/infosoc/telecompolicy/en/d1-en.htm>.
- ³⁵ Sullivan, M. (1999, May 3-5). The basics of interconnection: Presentation notes to ITU Workshop on Telecommunication reform. At: <http://www7.itu.int/treg/RelatedLinks/LinksAndDocs/interconnect.asp>
- ³⁶ World Trade Organization (1997). Fourth Protocol to the General Agreement on Trade in Services, Regulatory Reference Paper. Geneva: WTO. Download at: <http://www.wto.org/wto/services/tel20.htm> and <http://www.wto.org/wto/services/tel23.htm>.
- ³⁷ In 1999, the Italian antitrust authority fined the country's two major mobile operators for setting identical prices for fixed-to-mobile calls --"TIM fined 100.432 bln lire for price fixing by Italy's antitrust authority," AFX news, 1999, October 1.
- ³⁸ For a discussion see, OECD, Committee for Information, Computer and Communications Policy (2000, May), Cellular mobile pricing structures and trends, DSTI/ICCP/TISP(99)11/FINAL, pp. 49-50. At: <http://www.oecd.org/dsti/sti/it/index.htm>; and UK Monopolies and Mergers Commission (1998, December); "A report on a reference under section 13 of the Telecommunications Act 1984 on the charges made by British Telecommunications plc for calls from its subscribers to phones connected to the networks of Cellnet and Vodafone." At: <http://www.oftel.gov.uk/pricing/bmmc1298.htm>.
- ³⁹ Asia Pacific Economic Cooperation (APEC) Telecommunications Working Group (1999, March). APEC framework for interconnection. At: <http://www.pecc.org/ptiif/interct.cfm>
- ⁴⁰ E.g., Spiller, P. & C. Cardilli (1997). The frontier of telecommunications deregulation: Small countries leading the pack, *Journal of Economic Perspectives*, 11(4), Fall 1997: 127-38.
- ⁴¹ Reuters (2000, July 3). "Regulator orders Cellnet to stop price subsidies," *Cnet News.Com*. At:

<http://news.cnet.com/news/0-1004-200-2196632.html?tag=st.ne.1004.saslnk.saseml>

- 42 Ekman, S. & Andersson, G. (2000, February 21). "VMNOs set to go -- Established mobile operators remain a hurdle," *Tele.com*. At: <http://www.teledotcom.com/>
- 43 <http://www.pecc.org/ptiif/interct.cfm>
- 44 Leive, D. M. (1995, April 19-21). "Interconnection: Regulatory issues." Report of the Fourth Regulatory Colloquium, Geneva, 19-21 April 1995, p. 22. At: <http://www7.itu.int/treg/RelatedLinks/LinksAndDocs/interconnect.asp>;
- Gabel, D. & Rosenbaum, D. I. (2000, March). "Who's taking whom: Some comments and evidence on the constitutionality of TELRIC," *Federal Communications Law Journal*, 42: 239-71; Melody, W.H. (1997). *Telecom reform: Principles, policies and regulatory practices*, ch. 17. Lyngby DK: Den Private Ingeniofond.
- 45 OECD, Committee for Information, Computer and Communications Policy (2000, May), Cellular mobile pricing structures and trends, DSTI/ICCP/TISP(99)11/FINAL, p. 51. At: <http://www.oecd.org/dsti/sti/it/index.htm>. See also India case study at www.itu.int/interconnect.
- 46 Clark, V. (2000, April 12). ECTA pressures regulators on fixed-to-mobile access charges. *Total Telecom*. At: <http://www.totaltele.com/view.asp?ArticleID=26961&Pub=tt>
- 47 For detailed discussion of the methodologies and the ways in which they are applied by NRAs in the context of interconnection, see Melody, W.H. (ed.) (1997), *Telecom reform: Principles, policies and regulatory practices*, chs. 17 & 18. Lyngby DK: Den Private Ingeniofond; Leive, D. M. (1995, April 19-21). Interconnection: Regulatory issues: Report of the Fourth Regulatory Colloquium, Geneva, 19-21 April 1995 (briefing report). At: <http://www7.itu.int/treg/RelatedLinks/LinksAndDocs/interconnect.asp>; and Asia Pacific Economic Cooperation (APEC) Telecommunications Working Group (1999, March). APEC framework for interconnection. At: <http://www.pecc.org/ptiif/interct.cfm>
- 48 Analysys (2000, February 25). *Economic studies on the regulation of the mobile industry: Final report for ECTA*. At: <http://www.ectaweb.org/home/mobilestudy.htm>
- 49 David Dillon of Vodafone-Airtouch, quoted in Clark, V. (2000, April 12). ECTA pressures regulators on fixed-to-mobile access charges. *Total Telecom*. At: <http://www.totaltele.com/view.asp?ArticleID=26961&Pub=tt>
- 50 For general discussion of the implications of the Internet to telephony, see Background issues paper of IP Telephony Workshop, Geneva, 14-16 June 2000. IPTTEL-03. At: <http://www.itu.int/osg/sec/spu/ni/iptel/index.html>
- 51 http://www.gsmworld.com/news/press_releases_55.html
- 52 OECD, Committee for Information, Computer and Communications Policy (2000, May), Cellular mobile pricing structures and trends, DSTI/ICCP/TISP(99)11/FINAL, p. 64. At: <http://www.oecd.org/dsti/sti/it/index.htm>.
- 53 Taaffe, J. (1999, September 20). "Mobile roaming: A rude awakening," *Communications Week International*. At: www.totaltele.com
- 54 Kruger, P. (2000, May 1). "The difference with data," *Communications International*; RDSL (2000, February 2). "LHS, Alcatel present GPRS billing system," *Total Telecom*. At: www.totaltele.com; see also, <http://www.mobilegprs.com/>
- 55 Personal communication from Vineeta Shetty, 20 July 2000.
- 56 For more details see, OECD, Committee for Information, Computer and Communications Policy (2000, May), Cellular mobile pricing structures and trends, DSTI/ICCP/TISP(99)11/FINAL, P. 66. At: <http://www.oecd.org/dsti/sti/it/index.htm>.
- 57 Huston, G. (1999, June). "Interconnection, peering, settlements." Paper at INET 1999, San Jose CA. At: http://www.isoc.org/inet99/proceedings/1e/1e_1.htm; and Cukier, K. N. (1999, June). Bandwidth colonialism? The implications of Internet infrastructure on electronic commerce." Paper at INET 1999, San Jose CA. At: http://www.isoc.org/inet99/proceedings/1e/1e_2.htm
- 58 Directive 97/EC of the European Parliament and of the Council on interconnection in telecommunication with regard to ensuring universal service and interoperability through application of the principles of open network provision (ONP), Annex 1. At: <http://www.ispo.cec.be/infosoc/telecompolicy/en/d1-en.htm>
- 59 International Telecommunication Union, Telecoms technology glossary. At: <http://www.itu.int/plweb/cgi/fastweb?getdoc+view1+www+18746+28++GPRS>
- 60 <http://www.itu.int/imt/>
- 61 Directive 97/ EC, article 2. At: <http://www.ispo.cec.be/infosoc/telecompolicy/en/d1-en.htm>
- 62 In addition, the signatories to the WTO's Fourth Protocol to the GATS are subject its disciplines to the extent reservations have not been made.

- 63 Directive 97/ EC, article 2. At <http://www.ispo.cec.be/infosoc/telecompolicy/en/d1-en.htm>
- 64 Matthews, J. & S. Sweet (2000, April). *Virtual mobile services: Strategies for fixed and mobile operators. An Ovum report*. London: Ovum. Summary at : <http://www.ovum.com>
- 65 OFTEL statement on Mobile Virtual Network Operators, October 1999. At: <http://www.oftel.gov.uk/competition/mvno1099.htm>.