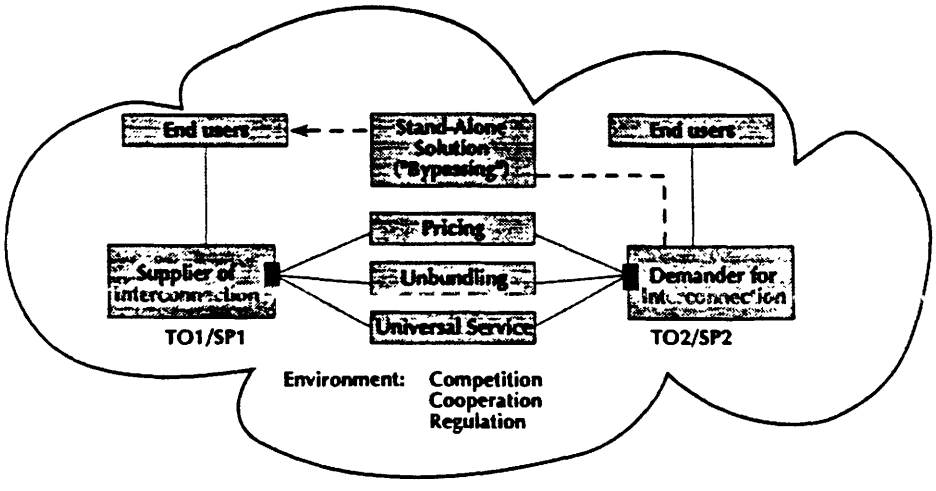
Wissenschaftliches Institut für
Kommunikationsdienste

European-American Center
for Policy Analysis

Network Interconnection in the Domain of ONP



Study for DG XIII of the
European Commission

Final Report

November 1994

Wissenschaftliches Institut für
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Preface

This report presents the results of a study on network interconnection in the domain of ONP. The study was undertaken jointly by the Wissenschaftliches Institut für Kommunikationsdienste (WIK), Germany and the European-American Center for Policy Analysis (EAC), the Netherlands on behalf of DG XIII of the European Commission between January and October 1994.

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Contributions were received from numerous representatives from NRAs, TOs, new network operators, service providers, manufacturers and from other experts.

I sincerely thank all the individuals and institutions mentioned above for their essential contributions to the performance of the study.

The views expressed in this report are those of the study team. They are not necessarily the views of the European Commission.

Dr. Karl-Heinz Neumann
Project Director

Bad Honnef, November 1994

EXECUTIVE SUMMARY

1 Background, objectives and approach of the study

Given the policy decisions towards a fully liberalised telecommunications market within the European Union by the end of the decade (or earlier?), interconnection is essential and necessary to develop a viable competitive environment. For that reason, any successful telecommunications policy has to provide a proper framework for interconnection of networks and services to reach that goal. Interconnection is the key to a future European telecommunications policy.

Given these developments it is obvious that the Commission has to identify the relevant policy issues for the interconnection of networks and potential barriers to interconnection which could inhibit the interoperability of services at a European level. The study on network interconnection should be seen in this context.

Against this background, the substantive objectives of the study may be summarised as follows:

- Develop a thorough understanding of the different forms of interconnection of telecommunications networks and services at a conceptual level.
- Assess the practice of interconnection in countries with relevant experience, in Europe as well as overseas.
- Identify and investigate the issues that arise at all levels and interfaces where interconnection may be demanded.
- Investigate mechanisms by which potential barriers to interconnection may be avoided or overcome to assure free and unimpeded Europe-wide services.
- Develop recommendations for the Commission regarding the further development of a European interconnect policy.

Besides providing an analytical framework for dealing with all relevant policy issues of interconnection the study should in particular examine the interconnection framework of the proposed voice telephony Directive and should make recommendations on further developments.

Our approach to the study is conceptual and empirical. Conceptually, we derive frameworks for interconnection including problems which have to be solved by the interested parties and/or the regulatory authorities. We derive options for solutions and performance criteria for evaluating arrangements and interconnect policy measures. This conceptual part of the work is based on our previous work on interconnection issues, a careful reading of the relevant literature and results of previous reports carried out by the Commission.

In the empirical part of the study we examined experience with interconnect policies in all Member States and in the US, Australia, Japan and New Zealand. We also identified plans and policies in those Member States which have not yet had any relevant experience. The dominant approach to gather and evaluate information in these countries has been personal interviews with TOs, new network operators, NRAs, manufacturers, service providers and independent experts. For a limited number of countries information gathering was based on a questionnaire sent out to the same group of organisations.

Our report consists basically of three parts. In the more analytical part of the study we examine the interconnection issue from three different perspectives and deal with three different aspects. We take a technical, economic and regulatory view to identify and analyse problems and their solutions concerning the interconnection of networks. These contributions form Chapters 2, 3, and 4. Chapter 5 entails the second part of the study. Here we present the empirical basis of the study in a summarised form. The empirical basis consists of country-by-country case studies where we describe and analyse the experience with interconnection, the way in which the regulatory institutions have dealt with interconnection and, of course, the solutions developed in these countries. The third part of the study develops recommendations concerning a comprehensive European interconnect policy. These are developed on the basis of the analytical results in Chapters 2 through 4 and the world-wide experience and practice with interconnection. To come to a comprehensive policy model we also examine and evaluate the current approaches and elements of a European interconnect policy in Chapter 6.

During the study timetable there was a concurrent study undertaken by Arthur Andersen. The Arthur Andersen study examines the practical questions associated with the establishment of appropriate cost allocation and accounting systems and assesses the way in which interconnect charges should be established in preparation for full service liberalisation.

2 Interconnection as a technical issue

Technology makes possible a wide variety of ways to supply telecommunications services. There are a large number of potential interfaces and points of interconnection between operators, and telecommunications technology is compatible with vertically-integrated, horizontally-integrated, and specialised operators. Economic factors - including economies of scale, economies of scope, and product differentiation - rather than strictly technical factors determine and should determine where operators and service providers will seek to interconnect.

Changes in vertical and horizontal relationships are redrawing the boundaries of telecommunications entities. Key interfaces, formerly managed within the firm or incumbent TO network, are now points of technical and commercial interconnection.

Relationships between an incumbent TO and competitors will frequently be asymmetric. Regulatory attention will be required to ensure that competitors obtain access to interfaces that constitute bottlenecks, and to insure that TOs make the technical changes needed for equal access to achieve fair competition.

Bottlenecks controlled by a dominant TO range from access to end users to intellectual property rights in software and equipment design. The principal technical issues affecting competition among interconnected fixed operators are equal access to network components and services, collocation of equipment, and numbering. Until technical alternatives to these essential resources are developed, regulatory action will be necessary to ensure fair competition.

Interconnection relationships may be classified by:

- type of player (TO, service provider, end user)
- type of facilities (fixed, mobile, satellite)
- type of services (basic, enhanced, intelligent)
- type of users (private user groups, users of public networks).

Of the many possible combinations that can occur, our analysis concentrates on four major scenarios. They are the ones that, in discussions with the Commission staff, were identified as having leading importance for interconnection: fixed-to-fixed network interconnection, fixed-to-mobile, mobile-to-mobile, and interconnection to intelligent network infrastructure and to intelligent network-based services.

Fixed networks have well-defined external interfaces at several levels of the network hierarchy, located primarily at switches but also in the distribution system that extends to the end user.

Europe-wide operation of GSM service is technically limited in areas where TOs have not implemented advanced signalling capabilities needed to support roaming by mobile subscribers. Direct interconnection of mobile operators can overcome this limitation and should not be restricted by regulatory action.

Interconnection to intelligent network services and resources will be of interest to many fixed and mobile network operators and to service providers. Although there are many conceptual types of intelligent network interfaces, only those for the most basic call control capabilities have thus far been standardised. Moreover, technical means to ensure essential requirements are not yet developed.

Interconnecting parties need to use interfaces to interconnect even if their networks are otherwise compatible. If there are only two interconnecting parties, standards would not necessarily be required, only case-by-case agreements about technical solutions. However, such agreements are likely to be complicated and subject to change as

technology progresses and networks are upgraded to meet new demands. Once there are many parties that want to interconnect, multilateral agreements are required that naturally would tend towards standards. Such standards lower transactions costs because they reduce the amount of asset specificity. The same asset, "design", can be used in many instances of interconnection. Standards may also be essential to provide interoperability, network security and integrity.

Standards are not always beneficial. There is, for example, an ambiguous relationship between standardisation, interconnection and technical progress. Standardisation may increase the market for interconnection and thereby potentially increase the total telecommunications market. On the one hand, this may make innovations in telecommunications equipment and software more attractive. At the same time standardisation may lock-in a technology and thereby retard technical progress. Also, the resulting increase in competition *in* the market may reduce competition *for* the market. This could decrease the profit potential for radical innovations, such as complete changes in paradigm.

Another ambiguous effect of standards is the need for industry cooperation in order to reach and implement standards. This cooperation can lead to innovative standards by bringing together innovative ideas from different enterprises. Conversely, the cooperation can also result in collusion in the market.

In general, striking an optimal balance between the gains and the costs of standardisation for interconnection will have to be assessed for particular cases. Generally, we can say that a policy of standardisation tends to shift competition from innovation in technology to competition in service innovation and standardised production.

The Commission's policy of leaving most interfaces to be standardised by voluntary efforts strikes the appropriate balance between the gains from standardisation and the gains from innovation. Regulatory oversight of industry collaboration to develop standards will be required to guard against collusive behavior. For a limited set of interfaces - those required for Europe-wide services, emergency and directory services, and numbering - the Commission should actively encourage development of standards and be prepared to mandate their adoption.

There is a potentially rich set of logical points of interconnection to intelligent network interfaces. Access at network control and switching points could pose significant risks to network integrity and security. Technical standards for mediated access have not yet been developed, but licensing of interconnectors could provide an alternative to open interfaces. Nevertheless, the availability of several suppliers of access and network services can be expected to increase the reliability and availability of telecommunications services. The service control and management interfaces to IN services should be opened to interconnection. The Commission should encourage the development of technical standards for mediated interconnection to service control and service switching.

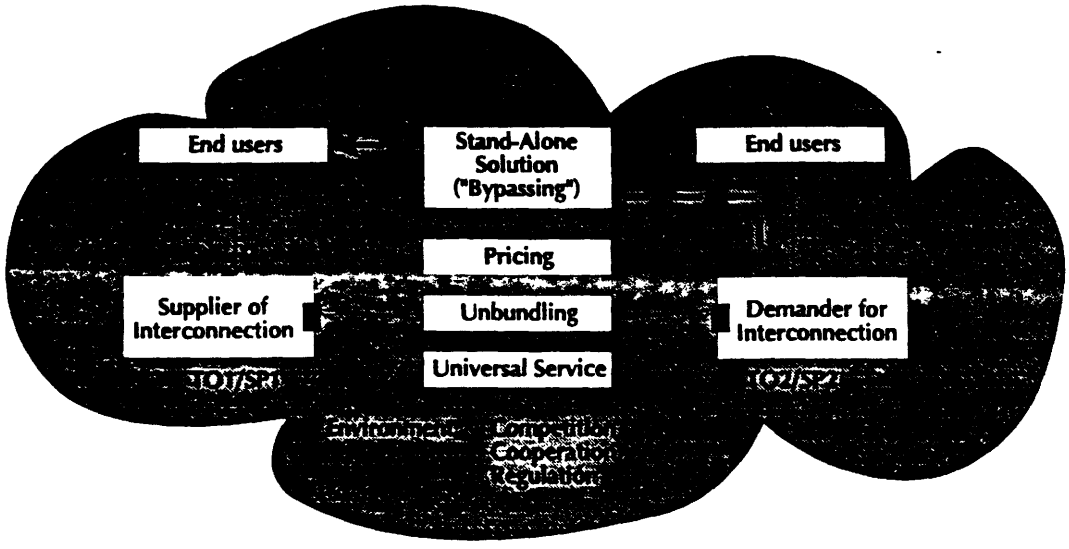
In most instances, physical collocation of an interconnector's equipment in the facilities of the dominant TO is technically achievable and provides more nearly equal access than virtual collocation.

Subscriber number portability is difficult to achieve with current technology, but some alternative measures can reduce the TO's advantages of incumbency. Portability is more readily achieved for freephone and other database-related services.

Because upgrading switching systems to support equal access to multiple operators has high costs when older-technology switches must be retrofitted, a policy of mandatory end-user equal access should be limited to newly-installed switches and software upgrades of existing digital switches.

3 Interconnection as an economic issue

The economic approach towards interconnection can best be presented by the following figure.



An implication of the economic approach to interconnection is that we study the market for interconnection. This is likely to be a fast-growing market. Its size depends on the concentration of the retail markets for telecommunications services and the degree of vertical integration of TOs.

As such, interconnection corresponds precisely to what we observe everyday in the majority of market transactions where a firm buys a product because it needs that product as a raw material or a semi-finished input for the production of its own product. What makes it appear different from goods and services exchanged in other market transactions are essentially four characteristics:

(1) Interconnection is often considered a bottleneck input without which the demander could not produce his own service and, due to technical or legal barriers, he cannot produce this input himself. In addition, the supplier and demander of interconnection often compete with each other in the retail market for telecommunications services.

(2) Interconnection involves a degree of ongoing cooperation and interaction between the contracting parties that surpasses other purchaser-supplier relationships.

(3) Conversely, if the two networks approach equal size, the relationship may be reciprocal, in that the operators mutually demand interconnection with each other's network.

(4) Interconnection effectively internalises network externalities that are created by the availability of access to subscribers of other networks.

All four aspects have implications for the conclusion of interconnection agreements, especially the degree with which the one or the other party benefits from the relationship.

The bottleneck property is of utmost importance because it calls for some kind of government intervention establishing a right to interconnect (by regulatory decree or competition policy). However, the bottleneck property itself does not necessarily hold for all types and aspects of interconnection. It therefore has to be established on a case-by-case basis.

A bottleneck can be identified by the following properties:

- control of a facility by a single firm,
- facility essential for production,
- inability of others to practically duplicate the facility,
- denial of access with substantial harm to competition,
- absence of a valid business reason for not providing access.

The most relevant example of bottlenecks in telecommunications is access to residential customers who have only one line running into their homes. The cost of a second line from a different supplier is usually prohibitive relative to the cost of interconnection. Thus, access to such residential customers is a bottleneck independent of the supplying local operator's market share. In contrast, access to multiline business customers or to trunk transport may not be such a bottleneck. Multiline businesses have access lines that could be distributed between several carriers. And there are many equivalent routes of trunk transport between two points that are far enough away from each other.

A specific feature of interconnection agreements is that they usually involve traffic flows and capacity provision on both ends. Thus, both parties are at the same time buyers and sellers. Depending on the degree of symmetry of this relationship, it can be a source of commonality of interest. In the case of full symmetry, for example, interconnection charges would totally net out between the two parties and therefore be no source of contention, as was exemplified by international accounting tariffs over many years. Usually, the degree of asymmetry is a function of the vertical integration and relative size of the parties involved. The degree of symmetry and reciprocity in interconnection relationships should be taken as an important indicator for regulatory policy. The more asymmetric the relationship between interconnecting parties the more need there is for direct regulatory intervention. The more symmetric and reciprocal the relationship is, the greater is the need for monitoring the danger of collusion.

The relationship between the demander for and the supplier of interconnection depends to a large degree on the types of firms interconnecting with each other. If both are operating in totally separate markets, the relationship is simply one of vertical market power. This would, for example, approximately hold for the US until now. Interconnection is further complicated through the fact that the interconnecting parties often find themselves in a competitive relationship, in that both compete for the business of the same enduser. Thus, control over the bottleneck facility may not only tempt the supplier to engage in simple monopolistic pricing but also to shut out competition by refusing to deal (or by raising rival's cost). As a general rule one can expect that, in the case of competitive or substitutive relationships between the final outputs, interconnection and the final outputs will be substitutes as well. Conversely, in the case of complementary relationships between the final outputs, the relationships between interconnection and the final outputs is likely to be complementary. As a result, a party with bottleneck power over interconnection facilities will want to receive a markup above cost for interconnection services in the former case and may be willing to grant charges below cost in the latter case.

Interconnection is called for by certain combinations of economies of scale, economies of scope and externalities. If there are strong economies of scale and scope and strong positive network externalities, the traditional concept of an integrated monopoly provider would be superior to several interconnected providers. At the other extreme, if there are no economies of scale and scope and no externalities at all, then many independent suppliers would coexist totally without interconnection. The global network externality that is realised when formerly not connected networks become interconnected is highly important. Together with the bottleneck property it provides the strongest case for policy intervention in interconnection and for a duty of operators to offer interconnection.

Economic aspects of specific types of interconnection

This study concentrates on four major types of interconnection, namely interconnection of fixed networks, interconnection of fixed and mobile networks, interconnection of

mobile networks and interconnection in an intelligent network environment. These cases are characterised by some economic differences. The benchmark case to which these differences are related is the interconnection between fixed networks.

The framework for interconnection between two or more fixed networks needs to be able to deal with a large variability of cases. This should be done by keeping the framework sufficiently open.

Under the same general interconnection framework there are no economic reasons to treat fixed-mobile interconnection agreements differently from fixed-fixed interconnections. The differences, if any, concern specifics, such as the naturally asymmetric positions of the two parties, the potentially complementary nature of the two retail products and implications for access charges.

There are good economic reasons to allow and encourage direct mobile-mobile interconnection. The same holds for undistorted transit interconnections, which can provide an alternative and a yardstick for direct mobile-mobile interconnections.

There are no economic reasons to treat interconnection agreements in an intelligent network environment differently than under the same general interconnection framework as for fixed-fixed interconnections. The differences concern specifics. In particular,

(a) the intelligent network environment is likely to prevent stable and standardised interconnection agreements from emerging in the near future. Interconnection agreements will have to continue to change over time and to become adapted to new circumstances. This is important because of the nature of specific investments. It means that long-term contracts for interconnection have to remain open to change although the accompanying investments are largely sunk and therefore cannot be undone. The necessary adaptation may provide for a continuing role of the regulator.

(b) To the extent that IN features embody innovations by the interconnecting TO (rather than innovations by equipment manufacturers) licence fees incorporating the value of these innovations need to be considered as part of interconnection charges.

Pricing for interconnection

Price regulation of interconnection needs to do better than the unregulated interconnection market would perform. The effects of laissez faire on prices for interconnection services depend, to a large extent, on the prior structure of the telecommunications (end-user) market. Thus, we have to consider the interaction between these two markets and have to differentiate between laissez faire in the end-user market for telecommunications and laissez faire in the market for interconnection.

The conclusions on pricing under a regime of laissez faire are: If left to themselves, markets for interconnection services are likely to reflect either collusive arrangements or monopoly power of incumbent TOs. In either case, interconnection prices are likely to be high relative to prices that would emerge under competitive conditions. If there is a danger of collusion, low regulated interconnection prices may be advisable. However, they may be hard to achieve against industry interests, and their likely uniformity may spur collusion in the retail market. It may then be better to leave the market to itself and only intervene through the tools of competition policy. The lower interconnection charges are kept, the less harmful are the effects of any collusion in the end-user market, because collusive markups are then based on lower marginal costs. The more likely case is that of monopoly power in the market for interconnection. At the same time, prices in telecommunications retail markets are likely to reflect both the effects of partial competition and regulatory preferences (including cross subsidies, USOs and the like). As a consequence, interconnection prices cannot simply be left to the market, nor are they easily regulated. This necessitates a methodology for interconnection pricing under regulation.

A number of pricing rules have been proposed in the literature, based on theoretical models. These models make various assumptions, upon which the relevance and range of their results depends. Because of the wide range of possible outcomes and because of the complicated interaction of variables that regulators find difficult to observe, the theoretical models are likely to provide insight but little practical applicability for the regulator.

We believe that a fair summary of the theoretical models is as follows:

- The pricing prescriptions depend crucially on the assumptions made. The ranges for possible pricing outcomes in the Ramsey (i.e., Laffont-Tirole) and the efficient component pricing rule (ECPR) (Baumol-Willig) frameworks are large and can extend above and below all reasonable cost measures.

- The results themselves are derived under a number of restrictive assumptions. In particular, the ECPR assumes price-taking behavior, an absence of sunk costs on the part of the interconnectors, and efficient pricing on the part of the TO. It is not a priori clear what the effects of lifting the assumptions are.

- The models, in particular ECPR, have little to say if prices in other markets served by the TO are not optimal.

- The more general Ramsey-pricing models for interconnection provided by Laffont and Tirole are extremely hard to interpret and even harder to implement.

In summary, the guidance from the theoretical models is limited. The models do agree on some outcomes for special cases. We may therefore be able to narrow the outcomes by observing certain market features and desiderata in the form of constraints not imposed in these models. These observations include the following:

- The main basis for allowing and promoting network entry is that economies of scale and scope are not so pronounced that they will make network competition infeasible or inefficient.

- A second basis for allowing network competition is that entrants are likely to be more efficient than the incumbent. This would compensate for entrants' smaller size, should economies of scale continue to play some role.

- The results desired from network competition are lower resource costs to the economy and lower prices to customers. Changes in the incumbent TO's retail price structure as a consequence of network competition are inevitable.

- Even with interconnection charges set as low as marginal or average incremental costs the incumbent is unlikely to lose its market quickly. Usually, there are sunk costs (that entrants have to expend), switching costs by customers, name recognition, brand loyalty and other advantages of the TO over entrants that prevent consumers from switching to entrants even at substantially lower prices. For example, in the UK Mercury only gained about a 10% market share in its first ten years.

- Pricing distortions (unbalanced tariffs) in other markets served by the TO are desirable only in exceptional cases and therefore deserve special scrutiny. Since the individual outputs should generally contribute different amounts to common and overhead costs of the TO, the existence of a valid "local access loss" cannot be established by simply using fully-distributed costing rules.

- Making it hard to add access charges to interconnection charges sets the right incentives to rebalance retail tariffs in an economically efficient way.

- Interconnection charges under a Ramsey rule or ECPR are extremely hard to calculate. This problem is compounded if interconnection services are unbundled (as we believe they should be). Such explicit calculations should therefore be the exception rather than the rule.

- Interconnectors offer services that are differentiated from the incumbent TO's services and from each other. Differentiation can occur physically by delivery (wire or wireless) or through pricing policies (at a high price wireless services may be complementary to fixed-link services, while at a low price wireless services may be substitutes to fixed-link services). Using Ramsey models or the ECPR would lead to individualised interconnection charges, depending on the competitive relationship of each interconnector to the TO and other factors. Such severe price discrimination in the market for interconnection is likely to be inequitable, invite arbitrage, become arbitrary and interfere with sound competition policy.

- A mature telecommunications market is likely to be characterised by price and service competition in retail markets. However, bottlenecks in reaching individual

customers are likely to persist and with them the necessity to interfere in the market for interconnection through regulation or competition policy. Because of the diversity of uses to which interconnection services will be put, the principles for interconnection charges should be independent of the specific service created with interconnection.

Concluding from these observations we call for cost-based interconnection charges (based on average incremental costs). We believe that cost-based charges should form the base-line case but that markups on top of average incremental costs may be justified depending on the incumbent's legitimate revenue requirements. The burden of proof for determining these markups must be on the incumbent.

In order to base interconnection charges on the costs of interconnection, one has to know what the costs are and how they are related to interconnection as a service. The incumbent incurs five types of costs for interconnection:

(1) costs of conditioning the system of the incumbent TO for competition, in particular measures to ensure network security and integrity, particular standardisation, introduction of equal access, changes in the numbering system;

(2) costs of establishing the physical interconnection between specific networks, such as one-time costs of compatibility testing and making routing arrangements;

(3) costs of providing sufficient capacity for switching, transmission and related network components to accommodate traffic from the interconnecting network at the TO's peak period;

(4) variable costs of call recording, directory enquiries, billing, etc.;

(5) overhead costs for accounting, management, legal expenses and those overhead costs associated with the four other cost types.

How do these types of costs relate to interconnection services? The first type of costs is related to interconnection in general and not to a particular interconnection arrangement. The second type of costs, in constrast, occurs each time a new interconnection arrangement is made. The third type of costs is due to the use of facilities that are usually shared with other interconnectors and final users. Types of costs (1) to (3) are essentially one-time capital costs. The fourth type of costs varies directly with usage and it contains little or no capital costs. The fifth type again is shared and has only a small capital component.

Of the five types of costs associated with interconnection, three are fairly easy to relate to interconnection. They are the costs of conditioning the system of the incumbent TO for competition, the costs of establishing and maintaining the interconnection of the particular interconnector, and the variable costs associated with interconnection services. The more difficult costs to deal with concern costs for network capacity that are shared with other users and the overhead and common costs.

One of the most important questions of interconnect pricing is capacity pricing versus usage pricing and the relationship of this issue to peak-load pricing. We suggest a flexible and optional approach to the type of charging. If possible, capacity-based charges should be offered, and they could be applied either ex ante or ex post. (a) Ex-ante application would mean that the interconnector and TO would agree on the busy hour and the busy hour contribution(s) to be paid by the interconnector. This might require both parties to make point estimates, and there could be penalties for exceeding limits and bonuses for staying below. (b) Ex-post application of capacity-based charging would be very similar to peak-load pricing, except that it would apply to the TO's actual systems peak hour rather than to a predefined schedule. As an alternative or option, sophisticated peak-load pricing of interconnection services would be offered. This would be based on the expected system peak. Uncertainty could be taken care of by spreading the capacity charges according to the probability with which the system peak occurs at different hours of the week. As a further option the interconnector could choose to be charged according to the time-of-day schedules offered to retail customers. These schedules are likely to be unsophisticated and driven by concerns other than the system peak (e.g., regular business hours).

The share of the costs of conditioning the system of the incumbent TO for competition to be paid by the interconnector should reflect to what extent his customers (through his prices) are to pay for the introduction of competition. In deciding this, consideration must be given to the beneficial effect that competition will have on all customers, also those who are customers of the incumbent. Costs of types (2) to (4) are costs caused by a specific interconnector and should be borne in full by him. Prices for interconnect services should contribute to overhead costs through an appropriate margin. Costs of USOs are not directly related to interconnection and will be treated below.

Some concluding observations as regards pricing for interconnection: Costs depend heavily on investment decisions and these decisions in turn are strongly influenced by expectations. Thus, costs are not something objective and independent of the actions of the major players. In a market with vigorous competition, one can trust that management normally makes here the right decisions, both with regard to investment and the costing of long-lived capital goods. In a regulated industry, it is the regulator, who by strongly influencing expectations, determines to a large extent what the costs are. The regulator then also has to decide on tariffs and charges. In these circumstances, management may not have the incentive to determine costs as accurately as possible, with the result that reported costs are often not at all reflective of the actual cost causation. Given this, it appears less shocking if the regulator also proceeds to determine how the costs should be measured. The regulator should shy away from trying to determine costs in actual detail, however.

Another important aspect is that questions of costing of interconnection services and questions connected with their pricing must be considered as distinct issues. The regulator's role with respect to costing is to define the methodology by which costs are to be determined but not to get involved in their actual calculation. Once costs are

known, the question of how they are included in charges must be a separate decision in which the regulator may also be involved to the extent that he determines actual values. In this decision a number of policy considerations (efficiency, equity, market conditions, property rights, etc.) may play a role.

Over time, as the market for interconnection develops, regulation of interconnection should decline and give way to competition policy as a safety net. How can one gradually deregulate interconnection charges? In our view, the path toward deregulation goes via flexibility and the establishment of competition policy standards for interconnection charges. Flexibility would first be introduced in the form of price caps which, over time, would be increasingly freed from rebalancing and restructuring constraints. Furthermore, optional tariffs could be introduced as alternatives to capped tariffs. Then the scope of price caps would be changed. Paradoxically, both an increase and a decrease of their scope can increase the flexibility of a TO's pricing policy. An increase in the scope of price caps allows the firm more restructuring because now more different prices can be traded off against each other. A decrease in the scope of price caps can increase pricing flexibility because those prices outside the cap are constrained only by the market. Thus, the question is if the regulator wants to deregulate by reducing the number of services constrained or by constraining all services less. At the same time that pricing flexibility is increased, standards should be imposed for prices that are not considered compatible with competition. Such prices would normally be those below incremental costs or above stand-alone costs. Exceptions would need special justification in case prices were challenged under competition law.

Unbundling

Unbundling of interconnect services is one of the most controversial issues. On the one hand, unbundling has the potential to make the telecommunications markets and the market for interconnection more competitive. On the other hand, unbundling may sacrifise economies of scope that are achieved by bundling services, or unbundling may be costly to achieve, due to high transaction costs or regulation. Since the economic literature has discovered many motives for bundling of services, some of which are anticompetitive, the case for economies of scope and low transactions costs of bundling has to be made specifically before the call for unbundling is rejected.

The desirability of unbundling depends on the administrative and construction costs of offering unbundled elements. The benefits of unbundling consist of increased flexibility in combining network elements, resulting in cost savings and increased competition. The process of unbundling should be industry driven, with some regulatory guidance that unbundling should occur if its benefits exceed its costs. In principle, customers of unbundled elements should pay for the costs of unbundling (because they also derive the benefits). Such payments also establish a prima-facie case that unbundling is desirable. Since unbundling costs (like costs of equal access) are largely one-time costs, they may have to be recovered over a longer period of time. A regulatory

determination may be required to establish the appropriate costs per unit of unbundled element sold. The more unbundling occurs the less opportunity exists to assign overhead and common costs. Thus, the fully-distributed cost pricing approach becomes less and less feasible the more unbundling progresses.

4 Interconnection as a regulatory issue

The main reason why market solutions for interconnection will not meet the general public interest must be seen in the market structure of the telecommunications sector still prevalent in most countries. In such an environment, the incentives to the incumbent to offer interconnection to other network operators, in particular new market entrants, on a fair and efficient basis are not too strong if the services the other networks offer are substitutive and competitive to its own. There are only a few cases where in actual practice market entrants have negotiated the interconnection of their networks with that of the incumbent completely on their own without any regulatory involvement.

Competition policy versus regulation

Even in countries with no authority to explicitly regulate the telecommunications sector there always exists an oversight over market players as regards their adherence to prescribed market rules. In other words there is at least a competition policy and an authority taking care that the relevant codes are being observed. The question that needs to be addressed is whether a sector-specific regulation of the telecommunications sector is in fact needed or whether a competition policy, applied in the same way as to all other segments of the economy, could be considered sufficient to deal with its structural and institutional problems, in particular those posed by interconnection.

Competition policy can approach interconnection issues either by influencing the behavior of market participants or by influencing market structure. The property of interconnection of providing access to bottleneck facilities leads to several types of behavior that can be forbidden under competition law. These types of behavior, known as abuse of a dominant firm's market power, include exclusion of competitors from the bottleneck facility, squeezing (charging a price for the bottleneck facility that is high relative to the price to end users), predatory pricing, price discrimination (raising rival's costs), bundling and vertical restraints (for example, fixing prices that interconnectors can charge end users). Competition policy can help uncover and rectify such abusive behavior by offering (potential) interconnectors actual and punitive damage awards and by penalising offending parties. Structural competition policy steps in when policy measures aimed at controlling behaviour are considered inadequate to deal with problems due to corporations' large size and deep pockets. Structural competition policies consist of forbidding mergers, prescribing separate subsidiaries and, as the most radical measure, forcing the divestiture of parts of a corporation's businesses.

Structural policy measures may intervene to prevent mergers that are due (in part) to a failure to solve interconnection issues between different providers of telecommunications services.

The prevention of collusive behaviour of competing telecommunications suppliers should generally be the task of a cartel office applying general competition law. Structural competition law is best pursued by a cartel office in conjunction with the courts. Assuming that a specific regulatory authority is established, cooperation between it and the cartel office is advisable in those cases that involve issues of interconnection.

The most widespread policy approach to interconnection is proactive regulation by a government appointed Regulatory Authority (RA). Historically, this may have to do with the prevailing regulation of telecommunications markets for end users that made it natural to place competitive issues and therefore interconnection issues with the same agencies. A major difference to competition policy is the more industry-specific, proactive and ongoing nature of regulation. An immediate consequence is that regulation may be more adequate if industry-specific expertise and continuous adjudication are required. In our view, that is likely to be the case as long as telecommunications end-user markets are regulated and as long as the market for interconnection is highly asymmetric (dominated by a single firm) and has not yet matured in its rules. The RA should have the power to impose its decision in all situations in which, according to its evaluation, the normal market process would not lead to acceptable solutions. Legislation should provide that decisions by the RA are subject to judicial review to mitigate any fears of arbitrary regulation. Regulatory attention should primarily be directed to the constellations of network-network and network-service provider interconnection.

Realisation of interconnection

In identifying the conditions for interconnection the RA should clearly designate (a) the networks or network segments that constitute bottleneck facilities and (b), for each declared bottleneck facility, the classes of suppliers of telecommunications services that would be entitled to interconnect with it. The RA should carry out the relevant evaluations balancing global externality effects and the effects of economies of scale and scope against the potential dynamic benefits that may arise when new competitors are denied interconnection and have to search for and find alternative ways of delivering their services. The time period during which the status of bottleneck facility for a network or network segment is to be maintained should be specified. The end of that time period could be defined in terms of the competitive state of the relevant market. For carrying out these evaluations, specific technical, economic and legal expertise will be required which should be at the disposal of the RA.

Once particular segments or the whole of a telecommunications network have been declared bottleneck facilities, service providers and other network operators should be granted adequate rights to interconnect with them. Conversely, the operator controlling

these bottleneck facilities should be under an obligation to grant interconnection. Rights to obtain and duties to provide interconnection should be formulated in secondary legislation promulgated by the RA. Licences given to telecommunications network operators and, where relevant, to service providers should specify the conditions relevant to the particular case and provide for specifics according to the particular circumstances.

The right to demand and the duty to provide interconnection should be made contingent on the finding that a network or a network segment has been declared a bottleneck facility for the use intended by the demander. This should be specified in the licence.

If certain providers of telecommunications services are not required to have licences, the RA should specifiy in a regulation treating the case in general what their interconnection rights are and who has the duty to provide interconnection.

Regulation of interconnect pricing

There is a wide range of possibilities of involvement by the RA with respect to charges for interconnection services. This involvement may range, at the one end, from leaving the fixing of charges completely to negotiations between the parties concerned and, at the other, to determining them on the basis of the RA's own evaluation of relevant costs and market conditions.

The RA should allow private party negotiations for the conclusion of interconnection arrangements. It should also specify under what circumstances and in what way it will intervene in private party negotiations. This should be the case when negotiations threaten to fail or they in fact have failed. The approaches could include facilitation of negotiations, arbitration and ex-post determination. The RA should aim at bringing about an understanding with the incumbent TO and smaller demanders (service providers and smaller network operators) regarding a standardised set of interconnection services. Charges for the standardised set of interconnection services should be proposed by the incumbent TO and be subject to the approval of the RA. The RA will have to establish a regime by which charges for standardised interconnection services can be adjusted over time as demand and cost conditions change. The price-cap regime suggests itself as the best approach currently available. The adjustment of charges over time for individually negotiated arrangements should be left to negotiations between the parties concerned.

The RA should not aim to impose interconnection charges that claim to correspond exactly to socially-optimal prices. The RA should define lower and upper limits within which interconnection charges must be set. The standard for setting the lower limit of an interconnection charge should be that of Long-Run Average Incremental Cost (*LRAIC*). The upper limit of an interconnection charge should be a charge calculated by adding to *LRAIC* a markup that when applied to the *LRAIC* of each service would lead to revenues sufficient to cover all revenue requirements (minimum uniform markup). If negotiations fail, the RA should determine charges that fall within the given range using

its assessment of demand conditions and allowing prices in other regulated markets to vary so that the incumbent may meet his overall revenue requirement. Charges for standardised interconnection services should also be fixed within the range given above. They would result from a process in which the incumbent TO submits a proposal, the RA examines it and, if it meets the RA's criteria, the RA approves it, otherwise it would make a determination.

The best cost accounting approach currently available to derive cost measures is Activity-Based Costing (ABC). It appears that, if consistently applied and based on forward-looking cost data, ABC will lead to measures that are close to reflecting efficient *LRAIC*. The RA should require TOs falling under their mandate to use an ABC methodology for the costing of their services. Until an ABC methology can be put in place, efforts should be made to use the available methodology as flexibly as possible with the aim of avoiding grossly misleading cost figures as the basis for interconnection charges.

Tariff rebalancing and universal service obligations

Interconnection pricing is often used to serve as a financing mechanism for local access losses from unbalanced tariff structures and universal service obligations. This need not be, nor is it the best solution. On the basis of our analysis and the evaluation of international experience the following strategy with regard to unbalanced tariff structures and USOs seems to be appropriate to us: Potentially the major competitive burden for a TO might be an unbalanced tariff structure in voice telephony. In line with established EU policy, we recommend not to maintain this situation but to accept or even foster a strategy of tariff rebalancing. Although rebalancing will take some time, we do not recommend that TOs be compensated for remaining access losses via access charges in the transition period. Otherwise, they might also lose incentives to increase efficiency in access services. The temporary competitive disadvantage can usually be accepted because at least in the initial phase of competition TOs are still enjoying advantages that competitors do not have.

The NRAs should also rationalise their USO policy, develop solutions and remove non-telecommunications related burdens from TOs. In general, our position is that USO burdens placed on TOs be compensated out of a general Universal Service Fund (USF). In principle, the USF could be funded from any source. However, the realistic approach would be to require all telecommunications network operators and service providers to pay into it on the basis of their volume of activity in the retail telecommunications market. This approach would have the important advantage of de-coupling the issue of interconnection charges from the issue of financing USOs, which would already be a substantial advantage.

After a period of 3 to 5 years from the introduction of competition, the NRAs should review the situation. In particular they should reconsider the decision not to introduce access charges. To our mind the initial decision might be revised if competition has become effective, the financial burden of unbalanced tariff structures and USOs still is

significant, a USF solution is not feasible and the TO is competitively disadvantaged by the situation. These prerequisites for introducing access charges might be different from Member State to Member State and have to be made operational for regulatory purposes. Developing common operational criteria could be done at the European level. NRAs then have to verify and to apply these criteria to come to a final conclusion. Effectiveness of competition can be measured by the market share of competitors and by movements in market shares and in prices. Local access losses and the financial burden of USOs can be identified by proper cost accounting methodology. Whether or not a USF solution for financing USOs is feasible mainly is a question of political or regulatory decision making. The identification of a competitive disadvantage of the TO caused by the resulting situation seems to be more complicated. If the corresponding TO is financially in good shape and earns an appropriate rate of return on capital, then there is some indication that the asymmetric regulatory burden from unbalanced tariffs and USOs are outweighed by other competitive advantages compared to competitors. Then no (urgent) need for access charges arises. If the TO is in a bad financial situation and earns an insufficient return on capital, the situation is more difficult to evaluate for the regulator. Such an outcome might result from the regulatory asymmetry. However, it might also be caused by poor competitive performance, less customer responsiveness or inefficiency in production.

Network integrity

There is no question that the interconnection of different networks and service providers requires careful attention to maintaining the integrity of networks, in particular that of the PSTN. At the beginning of the process of introducing competition into the sector, it will be the incumbent TO that must assume the responsibility of assuring the integrity of its network. The cost for this will then have to be included in the charges for network services that it charges its own business units downstream as well as its competitors through interconnection charges. As a corollary, network operators and service providers should be charged with the cost of network integrity in proportion of their shares in volume of business in the relevant markets. As competition develops and competing networks gain in size, the operators of the latter will have an interest of their own in assuring the integrity of networks, not only of their own networks but overall, and be interested in finding common least-cost solutions.

Collocation

The collocation of an interconnecting operator's equipment accomplishing the physical interconnection, or, as regards service providers, the collocation of their computers and switches on the premises of the interconnection granting network operator, brings advantages both in terms of quality and costs. If there are no reasons with opposite effects of comparable importance, it should be granted in order to minimise the cost of providing services in a competitive environment. The RA should require that the incumbent TO offer competitors physical collocation of their interconnecting equipment. Virtual collocation should be accepted as an alternative to physical collocation. Lower

levels of the quality of interconnection due to virtual collocation should be compensated through lower charges.

Points of interconnection

The issue of points of interconnection is essentially a special aspect of the issue of unbundling. If there is a sufficient degree of unbundling of interconnection services, and if demanders for these services can freely select from the available set according to their needs, then there are also sufficient points of interconnection for demanders of interconnection services to select from.

The RA is not well positioned to determine on an ex-ante basis the proper interconnection points for the various demanders of interconnection services. The determination of points of interconnection should be left to private party negotiations with a role for the RA if negotiations fail. Solutions for the standardised points of interconnection should be the task of the industry committee entrusted with finding solutions for the proper degree of the unbundling of services in general.

End-to-end quality

The provision of services by new competitors is not infrequently associated with the notion of inferior quality. From this one concludes that the RA should assure that the introduction of competition be accompanied by requirements placed on new competitors regarding end-to-end quality. The relevant point is that interconnectors do not get a quality of service that they do not want or that they have to pay a price for high quality services while actually getting a lower grade. Conversely, the legitimate concern of the incumbent operator may be that, independent of what quality of interconnection he offers, he might be identified with the quality the new market entrant brings to market which, if of a low grade, could reflect on his reputation with end users. Issues of quality should in general be left to negotiations between the parties concerned. If an agreement cannot be reached during negotiations, the RA should be ready to intervene to bring about a solution. For this it should preferably proceed by facilitation of negotiaitions, mediation or expert arbitration, and only in the last resort to ex-post determination. The fallback solution of the RA should be that the interconnector be supplied with the same quality that the incumbent TO provides itself. An industry-wide committee should be charged with the setting of performance parameters for standardised interconnection services in a way to assure appropriate goals of end-to-end quality.

A framework for negotiation

Interconnection arrangements should in principle be the outcome of commercial negotiations. Given the reality of imperfections in the market for interconnection services, a regulatory involvement will be inevitable and needed with respect to at least a number of issues. There should be clear ex-ante determinations on some major interconnection issues from which private party negotiations would have to start.

Whatever issues that need to be resolved for an operative interconnection arrangement and not determined ex ante by the RA should be resolved in negotiations between the parties to such an arrangement. The RA may facilitate these negotiations by arbitration activities if they are in danger of failing. The RA should also, depending on the given situation, place particular restrictions on the negotiating process and on the range of expected results and impose minimum standards to be met.

Interconnection and the international settlement process

Interconnection between incumbent telecommunications network operators of different countries is currently following the international settlements process, which is based on the presumption that these operators do not compete with each other on their domestic territory. Once a unified interconnection regime is established for the Member States of the EU, whereby new market entrants will be able to compete across international borders, the question arises how this will impact on the international settlement system and what the policy of the RA should be. There are basically two options: either bring the settlement system within the ambit of the interconnection regime or to allow it to co-exist with it. We will argue that the second option should be preferred provided that certain precautions are taken.

The regulatory authorities should for the time being not interfere with the current international settlement system. It can be expected that this system will rapidly adjust and with time become part of the interconnection regime in those countries covered by the regime. The regulatory authorities should be aware of the potential for anticompetitive elements in future (settlement or interconnection) agreements between the former monopoly suppliers of international telecommunications services. A policy may have to be developed vis-à-vis countries not covered by the prospective interconnection regime, in particular countries with a restrictive telecommunciations policy whose suppliers might exploit the liberal regime in the EU to their advantage.

5 European and worldwide experience with interconnection

To our knowledge this study brings together the most comprehensive description and evaluation of interconnection experience in the world. The study analyses how all the 12 Member States have dealt with interconnection issues in their national environment so far. To make use of the rich experience with interconnection in countries which have liberalised telecommunications earlier than the European Union, some additional countries are also analysed (namely the US, Japan, New Zealand and Australia).

In all countries that have introduced network competition in telecommunications, interconnection has been among the most pressing issues. As experienced in the US from the early parts of this century onward, incumbent TOs may simply want to refuse interconnection with competing network operators. Later experiences in the UK, Germany and Australia show that incumbent TOs, even if forced to interconnect by

licence or statute, do not voluntarily grant interconnection to competing network operators at terms and conditions that would be acceptable to regulators. Without regulatory interference negotiations often reach an impasse. This experience suggests:

(a) that a right or duty to interconnect is necessary to ensure network entry;

(b) that some form of regulatory interference with private negotiations on interconnection agreements is helpful in reaching outcomes that regulators desire.

The experience also suggests that network interconnection is too complicated and possibly too individualised an issue to be regulated in all its aspects. Thus, a balance between regulation and commercial agreements needs to be reached. Since most interconnection regimes start out with a highly asymmetric market position between the incumbent TO and the interconnector, ex-post regulation has proven to be an effective tool in helping the interconnector's negotiating position. In order to create reasonable expectations about the outcome of ex-post regulatory interference, ex-ante regulation has to establish a set of basic guidelines for the issues that can be treated through ex-post regulatory determination and the criteria to be used by the regulator. The UK framework has created such rules in great detail. It is questionable if the UK level of detail is needed or whether more general rules suffice. The trade-off is between constraining the regulator and requiring frequent changes in the ex-ante regulation on the one hand and regulatory discretion and vagueness on the other.

Many countries use their interconnection regime as an active regulatory tool for promoting competition in the telecommunications sector. The objectives of interconnection regulation as revealed by regulators in our country studies include entry help and the viability of the incumbent. Entry help is provided to the interconnector via low interconnection charges (and/or high prices for retail telecom services) that improve their competitive position via the incumbent TO. Entry help is also provided via rules that equalise interconnection charges across interconnectors and thereby improve the competitive position of small interconnectors relative to large interconnectors (US "equal charge" rule). As appropriate, entry help is most pronounced at the beginning of the interconnection regime (US, UK and Japan). While the question of the viability of the incumbent TO is raised at the outset, it becomes a more pressing issue over time, as "bypass" occurs and the incumbent loses market share. A major reason given for this problem by incumbents is the slow speed allowed to rebalance retail tariffs.

The viability of the incumbent is taken care of through fully-distributed cost pricing of interconnection and through (implicit or explicit) access charges or access loss contributions. We have not found any satisfactory regime of access charges among the countries we studied. The US is actively searching for a replacement for the status-quo approach currently used (which was derived largely from a formula for separating interstate and intrastate costs). The UK approach is much more explicit and rational than the US approach but it requires superhuman objectivity in making waiver decisions as well as complicated and questionable calculations. Access charges have been justified in some countries by constraints on tariff rebalancing and/or by USOs. While

constraints on tariff rebalancing should be lifted to accommodate competition and to promote cost-based pricing, USOs may actually become more desirable under competition. So far, only Australia has a method for establishing and financing the costs of USOs in place. Experience in this area is needed.

The interaction between regulatory bodies and official competition policy in the area of interconnection varies among the countries studied. In New Zealand, competition policy fully dominates; there is no regulation. In the US the two types of policy often compete with each other. Major parts of the US interconnection regime are the result of competition policy, for example, the vertical separation into local and long-distance carriers, the equal-access stipulations and the "equal charge" rule. In the UK interconnection regime, the regulator seems to actively pursue competition policy, without facing strong constraints from other instruments of competition policy. Our expectation is that active regulation of interconnection will eventually disappear as the market for interconnection matures. Competition policy will then have to take over as the main policy tool for dealing with problems arising in this market. It is therefore imperative that the role of competition policy be established early on.

Most countries have gained their first experience with interconnection agreements through fixed-mobile interconnections. For full-fledged network competition, fixed-fixed interconnections are currently more important. The question is, to what extent countries can learn from their fixed-mobile interconnection experience for the upcoming fixed-fixed case and to what extent they are locked in by their decisions on fixed-mobile interconnections. For several countries a particular emphasis of fixed-mobile interconnection agreements is on low tariffs for private circuits. In the UK, the only European country in our study with fixed-fixed interconnections, preferential tariffs for private circuits have not been provided under fixed-fixed interconnection agreements. The ostensible reason for this asymmetry has been to encourage facilities investments by competing fixed-network operators and to discourage similar investments by mobile operators. That there can be ample room for private circuits in fixed-fixed interconnection agreements has been demonstrated by the importance of the US special-access regime.

Over time, interconnection moves from something infeasible or difficult to something resembling business as usual. At the beginning of interconnection regimes, there is usually a single entrant that wants to be interconnected to the incumbent TO. The pace of introducing interconnection along with interconnection charges appears to be the most pressing issue. While timing to realise interconnection remains important for the newcomers, the feasibility of interconnection has long been established, and most parties face other issues. Countries with long experience in network competition (US, UK) are confronted with a diversity of parties that want to interconnect and that have different interests. An interconnection regime that individually takes care of these interests is likely to become cumbersome and complex. Rather, standardisation of agreements on many issues appears possible, leaving fewer issues that have to be solved for individual cases. As the market for interconnection matures, non-

discrimination between interconnectors becomes pressing, and the case is made that all potential interconnectors should be treated similarly (as in US expanded interconnection).

How can countries at the beginning of their interconnection regimes learn from the countries that have more experience with interconnection in a competitive environment? Clearly, the more advanced countries have gone through stages in their interconnection regimes that might be skipped or shortened by the followers. For example, the technical feasibility of interconnection has by now been demonstrated under various network configurations. There is ample experience with location of interconnection points and with compatibility between different types of networks and line capacities. Similarly, there are many issues relating to interconnection agreements for which solutions could be adapted from UK interconnection agreements or US interconnection tariffs, both of which are in the public domain. Some issues are not so clear-cut but nevertheless learning is likely to be helpful. For example, the costs and benefits of equal access, while possibly different in magnitude across countries, are unlikely to differ much in kind. Methods for cost-benefit analysis of equal access may therefore be transferable.

In the US and the UK the publicity of the contents of interconnection agreements goes along with an involvement of the whole telecommunications sector in the process that shapes the interconnection regime. Such an involvement and public discussion may slow down the speed of decision making but it is likely to improve the understanding of the issues and trust in the outcome of regulatory decisions.

The US country case study is the only one that could be relevant for the relationship between the European Commission and the Member States in terms of regulatory division of labour and responsibility. The US experience suggests that dual regulation causes problems of jurisdictional cost separation and of conflicts between rules that govern intrastate and interstate transactions. The US has generated reasonable uniformity of approaches throughout the country where either the federal regulator has preempted state regulation or where competing interstate/intrastate regulation exists and operators can arbitrage between jurisdictions. Translated to the case of the European Union, this suggests that the European Commission could either prescribe binding rules on interconnection or establish European standard rules that can be followed on a voluntary basis. Voluntary rules could lead to a unified approach to the extent that arbitrage possibilities for telecommunications services between countries can be realised through facilities-based competition through interconnection.

6 Towards a European interconnect policy - recommendations of the study

All experience with competition in the European Union and in the rest of the world proves that interconnection is the key for transforming the former monopolistic market structure in telecommunications into a competitive one. Viable competition is unthinkable without interconnection between mainly (but not exclusively) the incumbent's and the new competitors' networks. Economic analysis can show and can give the answer why that is the case. Technical analysis gives evidence that interconnection is feasible and more cost-effective than stand-alone solutions. It is not only competition in public voice telephony that requires interconnection of networks. The status of service competition in the EU proves that viable service competition in other service fields benefits from interconnection to existing networks. The case for policy and regulatory involvement can be made quite easily. This holds on the national as well as on the European level. In the following we will focus our findings on the necessity for and the best approach to a consistent and coherent European interconnect policy.

Need for a comprehensive European interconnect policy

We see four major arguments in favour of the need for a comprehensive European interconnect policy. First, the European Union has taken the lead in the transformation of the telecommunications sector from a monopolistically structured market to a competitive one. Member States therefore expect that major policy frameworks and measures which govern and structure the transition from monopoly to competition will also be developed on the European level. Interconnection is, of course one of them. Second, a European interconnect policy can act to counter divergences in national approaches. Quite different national approaches have already been developed in the case of mobile networks. So far, only the UK has developed an approach toward interconnection between fixed networks. A European policy thus could take the lead in establishing a uniform and innovative approach in this area, as well as with regard to interconnection in an intelligent network environment. Third, similar conditions of access to networks and network functions under equal terms and conditions in each Member State favour the development of European-wide networks and services. Interconnection can be a bottleneck for such services if it is not provided everywhere. Fourth, the European policy framework for interconnection developed so far is consistent with a variety of very different interconnect policies in the Member States and does not lead to a harmonised development.

Current European interconnect policy

Our evaluation of the current European interconnect policy leads to the following conclusions:

The fundamental principles for open network provision which have been developed within the legislative ONP framework, including the voice telephony Directive rejected

by the European Parliament in the summer of 1994, are a sound basis for a comprehensive European interconnect policy. Although developed for and within an environment of monopolistic provision of voice telephony and network infrastructure harmonised conditions, basic principles and essential requirements are also fundamental regulatory conditions in an environment of competitive provision of voice telephony and network infrastructure.

As compared to the regulatory framework and the regulatory rules concerning interconnection in countries which have introduced competition in the core business of telecommunications, however, the current elements of a European interconnect policy are too broadly defined and do not address all relevant regulatory challenges and problems. They are consistent with quite divergent national approaches in the European Union and therefore neither lead to harmonised conditions for interconnection nor facilitate or foster the development of European-wide networks and services.

Major policy decisions on the transition to a fully-liberalised telecommunications market environment are to be expected soon in Europe. This progress increases time pressure to develop a more comprehensive and detailed European policy approach towards interconnection and its regulatory implementation. Efficient competition requires the appropriate interconnection regime to be available in advance. This analysis leads to our first recommendation:

Recommendation 1:

Binding European legislation dealing with all the major interconnection issues should be available and effective before full-scale competition is introduced in 1998.

Any European interconnection legislation includes an element of harmonising national approaches and at the same time any interconnection legislation sets conditions or regulates competition. We thus recommend:

Recommendation 2:

European legislation on interconnection could be based upon both Art. 100 (a) and the competition rules of the Treaty. There is no a-priori reason why one or the other legal basis should be excluded or preferred.

<u>European and national responsibility</u>

One of the objectives of the study is to identify regulatory issues concerning interconnection which are dealt with most properly at the European level and those which are best performed at the Member States' level. This division of labour has to be found in the current constitutional order of the EU. This mainly implies that European

policy can predominantly provide the legislative framework and provisions. The administrative control and implementation remains with the Member States' institutions. The European legislative process, however, exhibits shortcomings and weaknesses for dealing with dynamic market and competition developments like interconnection. Therefore, concerning the upcoming discussion on a regulatory authority on the European level we recommend:

Recommendation 3:

If the upcoming discussion on the organisation of regulation in Europe leads to the creation of a European regulatory authority for telecommunications, then this authority should predominantly deal with all regulatory aspects of interconnection.

Interconnection and the competition rules

Although the Commission cannot at this time directly regulate telecommunications operators, it can directly apply the competition rules of the Treaty. The competition rules of the EC Treaty directly apply to most interconnection problems. The advantage of "regulation" through competition rules is their unified application throughout the Union by the Commission. However, their effect is limited by their scope of application and by the fact that their primary objective is to provide for fair competition. They are not designed to achieve other objectives and are no substitute for a comprehensive set of rules for interconnection equally applicable to all players. As a matter of fact, most interconnection agreements have to meet the criteria of the competition rules of the EC Treaty. This also means these provisions empower the Commission to enforce these rules with regard to interconnection if it comes to the conclusion that specific interconnection agreements violate the competition rules.

We thus recommend:

Recommendation 4:

4.1 The Commission should enforce the competition rules if it comes to the conclusion that specific provisions in particular interconnection agreements violate these rules.

4.2 Enforcement activities should be concentrated on interconnection cases with direct relevance for European-wide networks and services.

4.3 Applying the European competition rules might also be regarded as a European policy instrument in case a Member State has not yet (properly) implemented a European legislation on interconnection.

4.4 Competition policy should act against collusive behaviour of interconnecting parties, the refusal of a dominant network operator to interconnect, discrimination, unfair pricing for interconnection and the refusal to unbundle network services.

Policy options

We see two major policy options the Commission may choose:

(1) Rely on the proposed voice telephony Directive.

(2) Develop a comprehensive interconnect policy in the ONP framework.

The first option would regard the interconnect policy model included in the proposed voice telephony Directive as sufficient for developing a fully-competitive telecommunications market in Europe. In our view, the voice telephony Directive is compatible with quite different national interconnect approaches and it does not include all relevant interconnection cases. We therefore recommend:

Recommendation 5:

5.1 European policy should develop comprehensive legislation towards interconnection which does not only deal with interconnection to the TOs' voice telephony networks.

5.2 Concerning voice telephony, this legislation should include the following interconnection cases not yet covered by the voice telephony Directive:

(a) Interconnection between two mobile telephony networks within the same Member State;

(b) interconnection between two fixed public telephone networks within the same Member State;

(c) interconnection between mobile networks from different Member States.

Right and obligation to interconnect

The following recommendations mainly deal with a comprehensive legislative European framework on interconnection. The most important legislative provisions should deal with the right to interconnect and the obligation to provide interconnection. In this context we recommend:

Recommendation 6:

6.1 European legislation should require the right to interconnect and the obligation to provide interconnection in all relevant cases.

6.2 This legislation should be implemented in Member States, preferably in the national telecommunications laws.

6.3 The right to interconnect should be specified by regulatory rules set by NRAs and/or by the licences which are granted to network operators.

Recommendation 7:

7.1 There should be no general regulatory barrier preventing network operators and service providers from entering into interconnection agreements with each other.

7.2 Network operators endowed with a special or exclusive right creating bottleneck facilities, or having a dominant market position due to actual control over bottleneck facilities, should be obliged to provide interconnection for these bottleneck facilities to other network operators and service providers.

7.3 If service providers in future gain dominant market positions due to actual control over bottleneck facilities, these service providers should be obliged to provide interconnection for these bottleneck facilities to network operators and other service providers.

7.4 These principles should be set by European legislation, and specified case by case by the NRAs in granting licences to network operators.

Recommendation 8:

8.1 European legislation should permit communities of interest in cases in which there is little or no demand by others for interconnection or in which there is sufficient public interest in not interconnecting to justify an exemption from the general interconnection requirement.

8.2 NRAs should make case-by-case decisions on such requests based on published decision criteria, in particular those based on competition law.

Recommendation 9:

9.1 European legislation should require that network operators who must provide interconnection should offer points of interconnection that maximise the benefits to telecommunications users and thereby optimise opportunities for competition.

9.2 The Commission should study whether the introduction of a common structure for network interconnection based on sub-national geographical units is a feasible and useful approach.

Regulatory intervention and negotiations

At least in the initial stages of network competition, interconnection has to be regarded as a customer-specific service and has to be arranged for not on general terms and conditions but on case-by-case outcomes. The regulator is not best equipped to deal with the complex issues of interconnection by himself. He should as far as possible rely on the market mechanism which means relying on commercial negotiations between the interested parties. However, he has to involve himself to make the negotiations approach successful. According to our regulatory model, the RA should set some ex-ante conditions for negotiations on interconnection agreements between interested parties, leave major issues for negotiation, facilitate negotiations, arbitrate if negotiations are in danger of failing, and be prepared to make a determination if negotiations have totally failed. Most of these regulatory actions are case-by-case interventions which therefore typically fall into the responsibility of the NRA. However, it makes sense to harmonise those interconnection issues which should be determined ex ante by the NRA and which function as a framework for negotiation. The following recommendations define this regulatory model:

Recommendation 10:

10.1 European legislation on interconnection should identify those issues which should be determined ex ante by the NRA.

10.2 Ex-ante determinations should deal with the following interconnection issues:

- The right to interconnection of network operators and service providers to designated telecommunications networks.
- Principles that the NRA applies for the determination of interconnection charges as well as of access charges if they are used.
- The cost accounting methodology to be used by the TO so that the relevant cost standard can be applied.
- Provision of equal access and collocation.
- Conditions of numbering.
- Rules regarding publication of all or a selected range of the terms in interconnection agreements.
- Technical standards for interconnection if applicable.

Recommendation 11:

11.1 To harmonise the structure and content of interconnection agreements, European legislation on interconnection should give some guidance on issues upon which negotiating parties should agree without being legally binding to them.

11.2 Agenda items for negotiations and agreements should be the following ones:

- Concrete structure and level of interconnection charges.
- Changes of interconnection charges over time.
- Locations of the points of interconnection.
- Concrete technical realisation of interconnection.
- Quality of interconnection services.
- Access to ancillary and supplementary services.
- The precise set of signalling functionalities to be provided by the interconnection providing carrier.
- Network management, forecasting of traffic flow, provisioning.
- Measures for meeting essential requirements (network security, network integrity, interoperability of services, protection of data).
- Intellectual property rights.
- Liability and indemnity.
- The method of dispute resolution procedure to be used before a determination by the regulator could be requested.
- Dates and time periods for carrying out agreement, duration and renegotiation of agreement.

Recommendation 12:

European legislation should require that NRAs have the right and the responsibility to make ex-post determinations on major interconnection issues if negotiations between interested parties fail.

Recommendation 13:

13.1 European legislation should require that NRAs, before they become effective, approve all interconnection agreements involving network operators that are under the obligation to provide interconnection. Other interconnection agreements would only be subject to ex-post oversight according to competition law.

13.2 Approval of interconnection agreements should be made dependent on their compliance with requirements set ex ante by the NRA and their consistency with general competition policy standards.

13.3 In case it refuses to approve an interconnection agreement, the NRA should provide for a mechanism (renegotiation, determination by the NRA) for the elimination or modification of the objectionable clauses.

Recommendation 14:

NRAs should facilitate negotiations by using these means and instruments:

(a) The NRA should set maximum time periods for negotiations in advance.

(b) Ex-post determinations should only be made after unsuccessful attempts to arbitrate.

(c) Arbitration should aim at avoiding determinations. The NRA should arbitrate upon request of either party.

Recommendation 15:

An arbitration mechanism at the European level should be introduced to solve interconnection disputes

(a) between operators from different Member States,

(b) concerning European-wide network operations, and

(c) concerning national cases with significant European-wide implications.

Standardisation

The availability of standards for interconnection interfaces makes it easier for interconnecting parties to agree on technical issues of interconnection. On the other hand, developing (common) standards is a time-consuming process and can reduce the incentives for competitive innovations. If interconnection of competing operators would only be feasible on the basis of European standards, then standards would have to be regarded as real bottlenecks to interconnection and competition. However, we have seen in our country studies that access to interconnection interfaces can be agreed upon by negotiation. In most cases these access problems could be dealt with without regulatory intervention. We thus regard the current European approach towards standardisation as appropriate also in the interconnection context.

Recommendation 16:

16.1 The Commission's policy of leaving most interfaces to be standardised by voluntary efforts strikes the appropriate balance between the gains from standardisation and the gains from innovation. We recommend this policy approach also for standards for interconnection interfaces.

16.2 Regulatory oversight of industry collaboration to develop standards will be required to guard against collusive behavior at the national and the European level.

16.3 For a limited set of interfaces - in principle, those required for Europe-wide services, emergency and directory services - the Commission should encourage development of standards and be prepared to make their implementation mandatory.

Pricing and access charges

We have pointed out theoretically, and our empirical analysis strongly supports this, that interconnect pricing is a key factor to determine the structure and the intensity of competition in the transformation process from a monopolistic market structure to effective competition. Interconnection charges can not only determine 50% and more of the new entrant's costs, it also to a significant degree determines his network structure and therefore overall competitive strategy. What might or should be done at the European level of regulation to reach an efficient outcome? Incumbents and new entrants often fail to reach an agreement in particular on interconnect pricing. At least for the initial phase of the transition to effective competition, where the market positions are very asymmetric, we recommend a strong role of the regulator.

In our view the regulator should set upper and lower limits for interconnection charges and let the interested parties negotiate structure and level of charges in detail.

Before interconnect charges can be determined successfully a proper approach on tariff rebalancing and financing USOs has to be developed. We clearly favour economically efficient rebalancing of retail tariffs and financing USOs outside the interconnection charging regime. The following set of recommendations develops our pricing and access charge model in detail.

Recommendation 17:

17.1 The Commission and Member States should accelerate a strategy of tariff rebalancing and not accept permanent major local access losses.

17.2 Instead of generally subsidising local access, if regarded necessary, NRAs should arrange for social tariffs that provide targeted subsidies to marginal consumer groups. Preferably, social tariffs should be arranged within the framework of an optional tariff structure.

Recommendation 18:

18.1 European legislation should set the following principles with regard to interconnect pricing: Interconnection charges should be based on objective criteria, be cost-based, be transparent and non-discriminatory, and be sufficiently unbundled and economically efficient.

18.2 To facilitate negotiations NRAs should set upper and lower limits for interconnection charges.

18.3 The lower limit should be the long-run incremental cost of providing services used for interconnection. The upper limit should be the long-run incremental cost plus a markup that, when applied to each service, would lead to revenues sufficient to cover all revenue requirements of a TO.

18.4 If NRAs have to determine interconnection charges they should also set charges within these bounds, with neither the upper nor the lower limit being excluded from consideration.

18.5 Costs due to conditioning the incumbent TO's network for competition in a multi-carrier environment (measures to ensure network security and integrity, particular standardisation, introduction of equal access, changes in the numbering system) should be treated as common costs of all networks/services which are interconnected, including services offered by the incumbent.

Recommendation 19:

19.1 The relevant cost standard for regulatory purpose of interconnection pricing should be forward-looking long-run incremental costs.

19.2 This standard can be supported using information from Activity-Based Costing. If the existing costing system does not provide the proper cost information and its adaption requires time, information from engineering cost models (which should routinely be available in TOs) should be used.

Recommendation 20:

If the NRA has determined (initial) interconnection charges or if interconnection is offered by a TO as a standardised service offering, interconnection charges should be regulated by using a price-cap mechanism to give sufficient price setting flexibility.

Recommendation 21:

Telecommunications-related public service obligations should be treated as USOs in voice telephony.

Recommendation 22:

In any interconnection legislation the European Union should give preference to financing USOs via a Universal Service Fund system instead of access charges. The burden of proof should be on individual Member States that in their particular environment a USF system is not viable or feasible and other approaches might be necessary.

Recommendation 23:

23.1 If the European Union and/or individual Member States follow the policy of financing USOs via access charges, some common access charge principles should be set at the European level.

23.2 Access charges for financing USOs should be set in a fair, efficient and non-discriminatory way. They should be fully justified and meet the criterion of proportionality.

Recommendation 24:

24.1 An imbalanced tariff structure should not be considered as part of USOs.

24.2 Access charges designed to compensate the incumbent TO for the costs of imbalanced tariffs should not be included in interconnection charges initially, as rebalancing eliminates them over time.

24.3 Three to five years after the introduction of competition NRAs should review the situation and reconsider the decision not to provide for compensation for costs due to remaining imbalances of tariffs. Access charges should be introduced if competition has become effective, the corresponding financial burden of a TO still is significant, and the TO is competitively disadvantaged by the situation.

Recommendation 25:

A European interconnect policy should not allow non-telecommunications-related financial burdens to be compensated by access charges.

Recommendation 26:

Access charges should not be used to compensate TOs for restrictions which are imposed on them to control or regulate their dominant market position.

Equal access and collocation

Equal access will intensify competition and in our view is an essential prerequisite for fair and efficient competition between network operators. On the other hand, there are significant network set-up costs related to the introduction of equal-access capabilities. These costs should be kept as low as possible by choosing an appropriate time path for its implementation. Whether and to what extent a harmonised approach of introducing equal access European-wide is feasible needs further study.

Recommendation 27:

27.1 The Commission should study the Europe-wide implementation of equal access. In this context, the standardisation for equal-access arrangements should be considered.

27.2 On the basis of these results a strategy of introducing equal access should be made mandatory for Member States as soon as possible. This strategy might imply different time paths depending on the status of network development in the Member States.

For operators that physically interconnect their facilities to another operator, physical collocation of terminating equipment is usually technically superior to virtual collocation at some distance from the switching point. From the regulatory point of view physical collocation should therefore be the benchmark. If only virtual collocation is provided interconnectors should be compensated for any loss in quality by a lower interconnection charge.

Recommendation 28:

28.1 European legislation should require that the incumbent TOs offer competitors physical collocation of their interconnecting equipment.

28.2 NRAs should accept equivalent virtual collocation as an alternative to physical collocation.

Public access to interconnection agreements

The principle of transparency requires public access to interconnection agreements which are in the regulatory domain. There may be items in the commercial agreements where confidentiality is justified. Therefore we recommend:

Recommendation 29:

29.1 NRAs should have mandatory access to the full text of interconnection agreements.

29.2 Interested parties generally should have access to those agreements.

29.3 Parties of interconnection agreements should have the right to petition for confidentiality concerning specific documents before the NRA. The NRA should decide on such requests on the basis of published criteria.

Our recommendations show that the European Union still has a major task to accomplish before a comprehensive European interconnection policy is in place.

Contents

1 Introduction

1.1 The topics

1.1.1 Interconnection and competition

From some discussions on interconnection with regard to competing network operators and service providers one might get the impression that interconnection is a relative new issue in telecommunications. That is really not true. The history of interconnection is as old as the history of telecommunications itself. From the old days of telecommunications the predominant pattern of interconnection has been the interconnection of networks from operators which were active in locally, regionally or nationally separated markets. The main purpose of interconnection was to enable users in one region to reach users in another region. The new dimension of interconnection in the modern history of telecommunications results from the intention of operators to be interconnected to another operator's network in the same region or market.

Many people have difficulties to understand how competition in telecommunications can be introduced and can work when in the initial situation an incumbent operator dominates the market on the basis of a nation-wide universal network where he has invested tens of billions of ECUs. The key to understand the opportunities and the structure of competition in such an environment is interconnection. By using the bottleneck facilities of the incumbent's network new competitors can concentrate their activities on market segments where competition is viable, need not set up fully-separated stand-alone network solutions and, nevertheless, are able to offer end-to-end services to their customers on a nation-wide basis. Although there remain economies of scale in some parts of the telecommunications network interconnection is desirable because it enables competition to work efficiently in areas where there are less economies of scale. Pure stand-alone solutions would limit the scope of competition in telecommunications significantly. The barriers to entry would be much higher as compared to a solution where interconnection of competing operators is possible.

Interconnection is not only essential from the competitor's point of view. It is of equal importance from the user's point of view. With interconnection they get all the benefits of the integrated monopolistic system and in addition the benefits of competition. Without interconnection the benefits of competition to users would be less obvious. They would have to compare advantages of competition with disadvantages.

1.1.2 Interconnection as a regulatory challenge

The interconnection of networks is economically beneficial and therefore should be a predominant objective of any telecommunications policy. Because of its competition supporting nature new market entrants generally require interconnection at fair and equal conditions as compared to incumbent TOs. Because of the same relationship and, in addition, because of the positive network externality implication interconnection of networks is in the interest of telecommunications users.

Given the necessity of interconnection for effective competition in telecommunications, there are some reasons to assume that the dominant (if not monopoly) integrated network operator having bottleneck control over access to most customers will regard that access as his major competitive advantage and will be less willing to provide the public interest solution for interconnection. We will show in the following chapters that the incentives of the incumbent to offer interconnection on a fair and efficient basis are mixed. These incentives may be positive if the services other operators offer are complementary to its own. The contrary is true, however, if the services are substitutive and competitive. Then the incumbent may expect disadvantages from interconnection and might attempt to refuse it altogether, offer it at too high a price or at a too low quality. This incentive structure leads to our presumption that pure market solutions based on commercial negotiations for interconnection will not lead to socially efficient outcomes. This evaluation defines the regulatory challenge with regard to interconnection. Regulatory intervention should aim at compensating the market failure aspects of the commercial relationship between different network operators. Like any regulatory intervention it should be as market conform as possible and should make maximum use of the market mechanism.

1.1.3 ONP and a European interconnect policy

The European Union is on the way to fully opening up the telecommunications markets for competition. In June 1993 the Council decided to definitively end the voice telephony monopoly in the Member States by the end of 1997. A decision to set a similar date for the infrastructure monopoly of the TOs is in preparation. As an interim step the unrestricted provision of network infrastructure for services which are already liberalised is under discussion. Each of these liberalisation measures will require the interconnection of new networks with existing ones to develop viable and efficient competition.

At the same time the whole regulatory approach of open network provision will be under review in the next few years. Although developed for and within an environment of monopolistic provision of voice telephony and network infrastructure harmonised conditions, basic principles and essential requirements of the ONP concept are also fundamental regulatory conditions in an environment of competitive provision of voice telephony and network infrastructure. What seems to be necessary is to apply the

general regulatory rules of ONP to interconnection and to develop a comprehensive interconnect policy.

1.2 Introduction to the study

1.2.1 Background and objectives

The European concept of Open Network Provision was developed to support the regulatory strategy of service liberalisation and the provision of transborder service offerings. At the same time TOs were maintaining their network infrastructure monopoly. The basic concept of ONP was to oblige TOs to open their network under fair competitive conditions to competing service providers and to interconnect with them.

The scope of competition is changing in Europe from service competition in data and value-added non-voice services to the core telecommunications business of voice telephony and network infrastructure provision. This process has started with mobile communications in most Member States where for the first time TOs are challenged by operators who compete against them on the basis of their own physical network infrastructure. This process will continue when service providers get the right to freely choose on their infrastructure provision. At the final point of this development integrated network operators compete against the TOs on all service levels including voice telephony on their own network infrastructure.

In this development more and more network operators want to be interconnected to each other and to the TOs' networks in particular. The basic nature of ONP will not change in that environment. The intention of ONP to promote fair competition between vertically-integrated TOs and new competitors which have to rely on services and resources of the TOs to produce and offer their own services is of equal importance in that environment as all experience with network competition proves.

Given these developments, it is obvious that the Commission has to identify what the relevant policy issues for the interconnection of networks are and how to identify potential barriers to interconnection which could inhibit the interoperability of services at a European level. The study on network interconnection should be seen in this context.

Given the policy decisions towards a fully-liberalised telecommunications market within the European Union by the end of the decade (or earlier?), interconnection is essential and necessary to develop a viable competitive environment. For that reason any successful telecommunications policy has to provide a proper framework for interconnection of networks and services to reach that goal. Interconnection is the key of the future European telecommunications policy.

Against this background, the substantive objectives of the study may be summarised as follows:

- Develop a thorough understanding of the different forms of interconnection of telecommunications networks and services at a conceptual level.
- Assess the practice of interconnection in countries with relevant experiences, in Europe as well as overseas.
- Identify and investigate the issues that arise at all levels and interfaces where interconnection may be demanded.
- Investigate mechanisms by which potential barriers to interconnection may be avoided or overcome to assure free and unimpeded Europe-wide services.
- Develop recommendations for the Commission regarding the further development of a European interconnect policy.

Besides providing an analytical framework of dealing with all relevant policy issues of interconnection, the study should in particular examine the interconnection framework of the proposed voice telephony Directive and make recommendations on further developments.

1.2.2 Approach and work programme

Our approach to the study is conceptual and empirical. Conceptually, we derive frameworks for interconnection including problems which have to be solved by the interested parties and/or the regulatory authorities. We derive options for solutions and performance criteria for evaluating arrangements and interconnect policy measures. This conceptual part of the work is based on our previous work on interconnection issues, a careful reading of the relevant literature and results of previous reports carried out by the Commission.

To keep the project manageable and to concentrate activities and resources on the most relevant policy issues it was first of all necessary to identify the most relevant interconnection scenarios in the broad range of actual and potential interconnection cases. After intensive discussion with the Commission's staff the following interconnection cases have been jointly identified as most relevant for the purpose of the study:

(1) Interconnection of fixed networks.

(2) Interconnection of fixed and mobile networks.

(3) Interconnection among mobile networks concentrating on GSM to GSM network interconnection.

(4) Interconnection in an intelligent network environment.

First of all we identified the specifics and differences in these cases. Although some interconnection issues and problems in these various scenarios look quite different, our attempt was to develop an interconnection (policy) framework which can deal with these cases in an uniform way. In our mind we succeeded with this approach.

In the empirical part of the study we examined experience with interconnect policies in all Member States and in the US, Australia, Japan and New Zealand. We also identified plans and policies in those Member States which have not yet had any relevant experience. The dominant approach to gathering and evaluating information in these countries has been personal interviews with TOs, new network operators, NRAs, manufacturers, service providers and independent experts. For a limited number of countries information gathering was based on a questionnaire sent out to the same group of organisations.

The result of the country studies, our cross country comparison and first tentative conclusions on a European interconnect policy have been presented in a workshop early June in Brussels. About 100 representatives coming from NRAs, TOs, user organisations, new operators from most Member States and in addition from Sweden, Finland and Norway attended this workshop. Many helpful comments and suggestions have been made to us at the workshop and afterwards which we used to reassess our findings and to complete our knowledge.

1.2.3 Interrelationship of this study with concurrent studies

During the study timetable there was a concurrent study undertaken by Arthur Andersen entitled "Cost Allocation and the General Accounting Principles to be used in the Establishment of Interconnection/Access Charges". The Arthur Andersen study examines the practical questions associated with the establishment of appropriate cost allocation and accounting systems and assesses the way in which interconnect charges should be established in preparation for full service liberalisation.

1.3 Structure of the report

Our report consists basically of three parts. In the more analytical part of the study we examine the interconnection issue from three different perspectives and deal with three different aspects. We take a technical, economic and regulatory view to identify and analyse problems and their solutions concerning the interconnection of networks. These contributions form Chapters 2, 3, and 4. Chapter 5 contains, in a summarised form, the second part of the study. Here we present the empirical basis of the study. This basis consists of country-by-country case studies in which we describe and analyse the experience with interconnection, the way in which the regulatory institutions have dealt with interconnection and, of course, the solutions developed in these countries. Although not all Member States have any experience with network interconnection we have analysed the situation in all Member States of the European

Union. We do not only report on actual experience with interconnection in the Member States; we also report on plans and concepts which have been developed or are being discussed in the Member States. Because there is more experience with network competition in other parts of the world than in the European Union, the Commission was interested in the interconnection experience and solutions in such countries. For that purpose we carried out in-depth case studies on Japan, the US, Australia and New Zealand. All these case studies are presented in Chapter 5 in a summarised form. The full-length country studies are presented in the Annex to this report.

The third part of the study develops recommendations concerning a comprehensive European interconnect policy. These are developed on the basis of the analytical results in Chapters 2 through 4 and the world-wide experience and practice with interconnection. To come to a comprehensive policy model we also examine and evaluate the current approaches and elements of a European interconnect policy in Chapter 6.

2 Interconnection as a Technical Issue

2.1 General approach and scope

2.1.1 Overview

The scope of this chapter is the technical aspects of interconnection that relate directly to conditions of competition among two or more suppliers of telecommunications services. We focus on general principles and seek to identify fundamental technical conditions that characterise interconnection in most types of networks and raise important issues for regulatory policy.

Our analysis is based on the empirical information gathered in the series of country studies for this project. In addition, it draws on the findings and problems identified in recent specialised studies that have examined particular technical aspects of ONP and on issues identified by telecommunications standards bodies.

Interconnection of networks divides broadly into two categories - approximately *symmetric* relationships of two networks, and *asymmetric* relationships in which the two parties are substantially unequal in size or technical conditions. These categories are useful not only in examining interconnection as a technical issue, but also as an economic issue in Chapter 3.

- Symmetric relationships typically exist between TOs that interconnect for international service at national frontiers, and between two mobile operators who are directly interconnected.

- More frequently, interconnection relationships between TOs and other operators and service suppliers are asymmetric. In these cases, technically dissimilar facilities must often be joined together, and the directional flows of traffic and services between the two networks may be quite disproportionate. Moreover, the incumbent network operator is often the dominant supplier whereas interconnection is often demanded for technologically advanced services by an entrant. In many cases, if it is to be viable a competitor requires access to the incumbent's network facilities or services.

Therefore, we give particular attention to:

- interfaces that provide access to bottlenecks - points at which the incumbent, by controlling the technical arrangements of interconnection, can affect the competitor's viability, product or costs.

- technical requirements that are necessary to achieve equal access and thus contribute to conditions necessary for fair competition, both between two or more competitors, and between new network operators and an incumbent operator.

Limits on open access are permitted under ONP to the extent they may be required to achieve essential requirements. Our analysis will focus on:

- the nature of technical risks (to network security, integrity, service interoperability, and data protection) that may exist at major points of interconnection
- technical measures that can reduce or resolve these risks
- the possibility of offsetting benefits to essential requirements from multiple suppliers.

We conclude that:

1. Asymmetric relationships between incumbent TOs and competitors will be frequent.
2. Regulatory attention will be required to ensure that (1) competitors obtain access to bottlenecks, and (2) TOs make the technical changes needed to ensure equal access to achieve fair competition.

2.1.2 Analytic framework

A single telecommunications network contains a large number of interfaces at which components are interconnected. The network operator internally manages these connections by coordinating its staff, and by establishing specifications to its external suppliers of components. The operator and the suppliers sometimes rely on international technical standards to define portions or all aspects of an interface. More often a national TO has modified these standards or has developed proprietary interface requirements to be met by (all of its) suppliers.

The focus of this study is the *external* points of interconnection at boundaries between two telecommunications entities - either two distinct network operators or a network operator and a service provider. Only incidentally do we need to touch on the many types of interconnection within a single network.

Conceptually, network relationships may be represented in a series of service provision layers (Figure 2.1.2-1).

1. The bottom layer - infrastructure - provides capacity (bandwidth). It is built up from way leaves (rights-of-way) and transport facilities (cables, radio links, and satellite facilities). This layer includes the transport facilities of different entities such as TOs; cable television distribution companies, and television broadcasters.

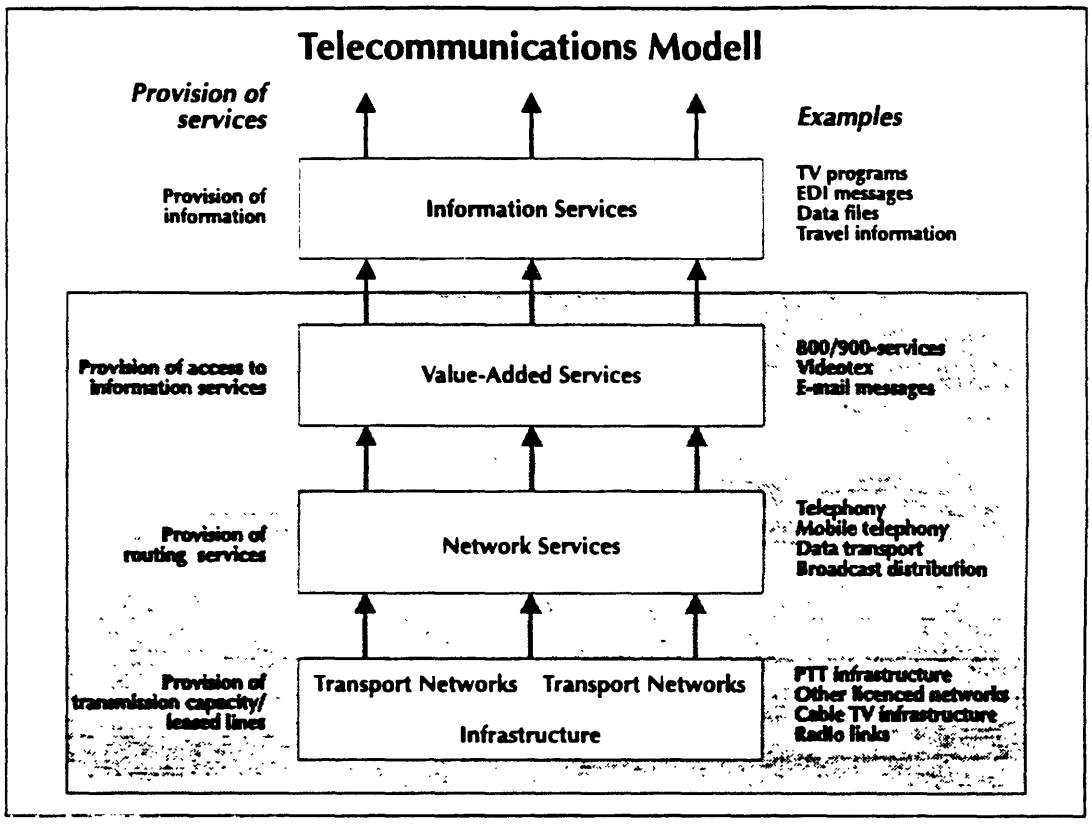
2. The technology at the second layer provides routing of signals and messages through the infrastructure. It consists of network switches and control facilities. The network services at this level include voice telephone service, X.25 data service, and television distribution.

3. At the third level, networks provide access to information or communication services which can be selected by the individual user, e.g. cashless calling; freephone; videotex; e-mail messages.

4. Finally, the top layer provides information content, e.g., data files; travel information; television programmes.

The two lower levels shown in Figure 2.1.2-1 comprise the so-called 'basic services', while 'enhanced' or 'value-added' services require higher-layer features as well. This distinction is found in the regulatory regimes of some countries, generally to separate monopolistic provision from competitive provision of services.

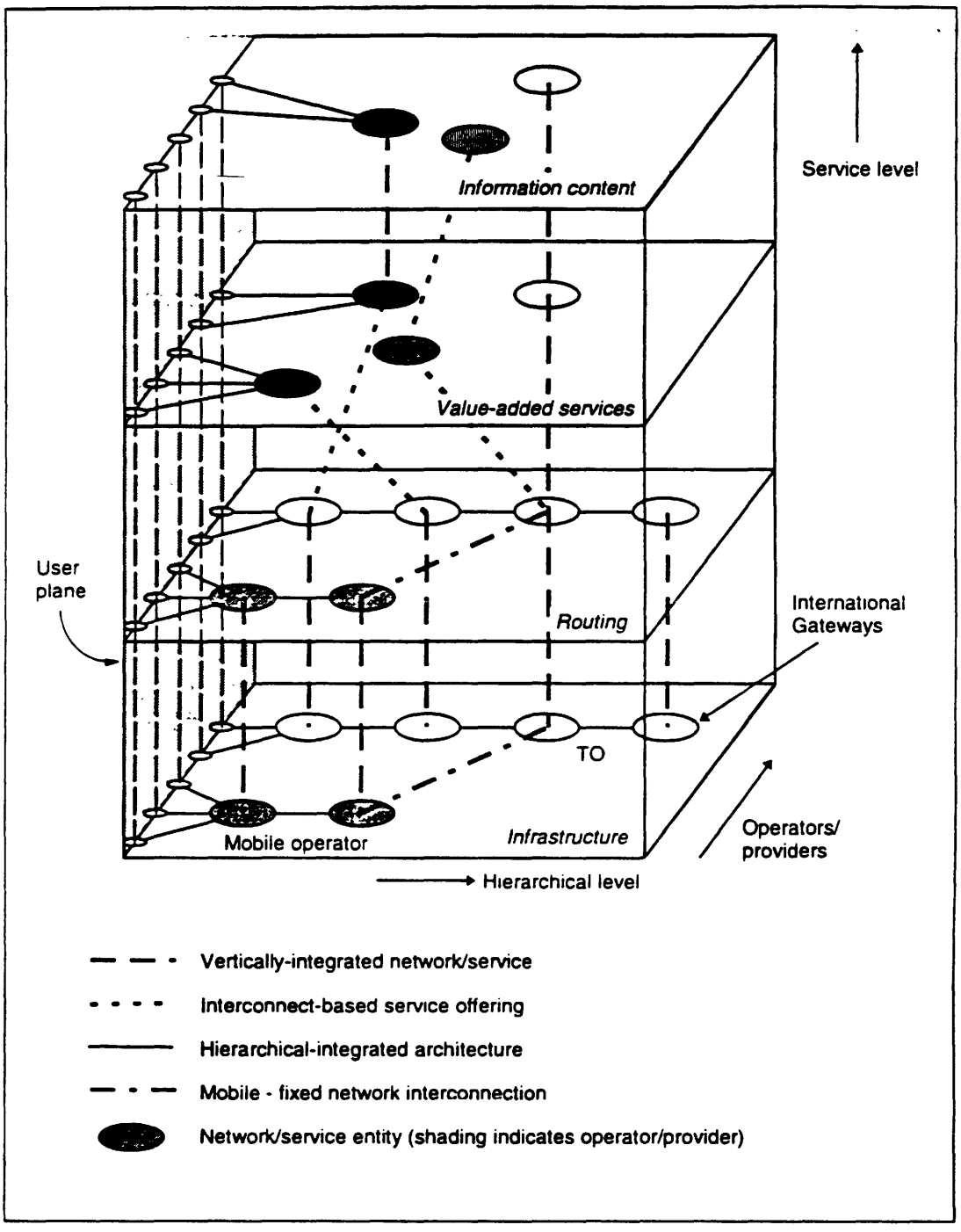
Figure 2.1.2-1: The layered model for telecommunications and tele-information service provision



The layered network model of Figure 2.1.2-1 can be expanded into three dimensions in order to show more explicitly the possibility of competitive provision of resources. Graphically, competitive facilities or services offered at a given layer by different telecommunication entities can be shown as duplicated symbols in that layer. To be able to distinguish the different competing providers at each layer, the four layers can

be extended horizontally into four service planes. In each service plane, the (potential or real) competitors are spaced apart in one direction, while the perpendicular direction in the plane indicates the hierarchical distance to the end user in the delivery chain of network components. Figure 2.1.2-2 shows this resulting three-dimensional "interconnection space" with four service planes.

Figure 2.1.2-2: Interconnection space for competitive telecommunications and telematic service provision



Obviously, this interconnection space contains an abundance of internal interfaces where network components belonging to a single telecommunications firm might be interconnected. Selecting the best path of internal interconnections is a classical economic problem faced by all telecommunication firms in their ongoing engineering processes of procuring equipment from the best manufacturers and optimally reconfiguring the network in response to market needs.

With the classical monopolistic supply of telecommunications resources, the perimeters of telecommunication organisations encompassed much of the interconnection space of Figure 2.1.2-2. The TO supplied all of the infrastructure components between the international gateways, at the far right of the bottom level, up to and often including the end user's terminal equipment at the far left. Initially only a few external interconnection interfaces existed - the international gateways (transit switches at the highest hierarchichal level), and later also interfaces for user access, as the terminal markets gradually become liberalised. In Figure 2.1.2-2, these external interfaces appear to the extreme right and left, respectively. As a result of this history, these "extreme" interfaces have become the most widely standardised. In similar fashion, the TO was also vertically integrated, and supplied not only routing capability but also value-added services (such as operator services and cashless calling) and information-content services (such as directory assistance, weather, etc.) in the higher service planes of the figure.

However, as elaborated upon in the following, this study is mainly concerned with new interconnections between different telecommunication firms. The corresponding external interfaces are laid open by strong new technological and economic forces, which are creating new relationships between the various providers of telecommunications. For example, in the infrastructure plane of the figure an independent mobile operator (indicated by shaded ovals) is interconnected to the TO's infrastructure at an intermediate or higher level in the switching hierarchy. That operator may also supply some of the routing services needed for mobile calls, interconnecting its signalling facilities with the TO's signalling network in the second plane. The figure also shows independent service providers in the value-added services and information content levels, which are interconnected to the TO for routing and infrastructure services.

2.1.3 Vertical and horizontal relationships

Telecommunications firms make use of many types of communications technology to supply markets. They are driven by (perceptions of) market demands and customer needs, and are not necessarily constrained by the hierarchy of the technical relationships.

- Typically, a firm will integrate two or more service layers within its own organisation in order to serve market needs more effectively and to realise

economies of scope by reducing costs that may otherwise occur from using separate suppliers or technologies at each layer. The PTT organisation is the leading example of such vertical integration. A PTT integrates three or four layers to provide voice telephone service and information services. Other telecommunications suppliers, including cable television and broadcast services, have traditionally also been organised along vertical lines.

- Network components can be conceived in a second hierarchy of relationships, one determined by the proximity to the final user. In this hierarchy, the delivery chain consists of: user terminal, access network, local network, trunk network, and international network. At one time European PTTs integrated all elements of the chain from the terminal up to international services. User terminal equipment has subsequently been unbundled, and in some countries access, local switching, and trunk services are already supplied by separate firms.

- Finally, users themselves may be multi-level entities. Users demand access to the network. In addition, they may self-supply some services (PBX switching, private network), and may be offering value-added services and intelligent network services to others.

Fundamental changes in the basic technologies that support telecommunications are now altering the long-standing vertically-integrated organisation of production. Economies of specialisation are giving some suppliers advantages in producing at a single layer of the hierarchy. At the same time, developments in transport capacity, switching and computer control are enabling suppliers to integrate horizontally and to supply formerly separate networks or services by using common infrastructure and software facilities.

We conclude that:

1. Technology makes possible a wide variety of ways to supply telecommunications services. There are many potential interfaces and points of interconnection between operators.
2. Economic factors - including economies of scale, economies of scope, and product differentiation - rather than strictly technical factors determine where operators and service providers will seek to interconnect.
3. Telecommunications technology is compatible with vertically-integrated, horizontally-integrated, and specialised operators.

The net effect of these changes is to redraw the perimeters of many telecommunications organisations. Firms are vertically dis-integrating, and new firms are supplying single components within the vertical chain. At the same time some firms are horizontally integrating across distinct types of networks. The implications of these

new organisational relationships for network interconnection are that some key interfaces that were formerly managed within the firm or network are now points at which two firms meet in both technical and commercial relationships.

In the "interconnection space" in Figure 2.1.2-2 changing organisational relationships between firms may correspond to entirely new paths through this space between two end users, or between an information service provider and an end user. Generally, such new paths represent innovative technical relationships in terms of external interface standards, management of security and integrity, allocation of service quality levels, etc. Moreover, new interconnection paths also involve entirely new economic transactions between organisations, with costs and benefits yet to be determined. The policy issues facing the European Union are to decide to what extent costs and benefits of a particular path through the interconnection space can be discovered - and allocated - by a free market, and to what extent regulations are required to enforce desirable interconnection paths. For instance, regulatory interventions might be deemed necessary to open appropriate paths by removing bottlenecks (Section 2.1.4) or by suitable open standardisation of crucial interfaces along certain paths (Section 2.4). On the other hand, paths which depart from overriding public-policy objectives, such as universal service obligations, may be subjected to appropriate financial charges, or perhaps even be completely barred. These regulatory aspects will be further discussed in relation to the economic interconnect model (Chapter 3.1).

We conclude:

1. Changes in vertical and horizontal relationships are redrawing the boundaries of telecommunications entities.

2. Key interfaces, formerly managed within the firm or network, are now points of technical and commercial interconnection.

2.1.4 Bottlenecks

A bottleneck exists when a competitor, in order to produce its own service, absolutely requires as an input a resource that is produced by the dominant operator and the competitor is unable to produce this input itself. Interconnection to the operator's network then becomes necessary to obtain access to the essential resource necessary to achieve actual competition. Despite the technical possibilities for multiple paths in the interconnection space, the dominant TOs control several resources that may be essential to a competitor. Competitors differ in the inputs they require from TOs. For at least one type of competitor, there is no technical alternative to obtaining the following bottleneck resources from the TO:

- Access to small end users. The traffic volumes of most residential subscribers and many small business users are too small to require multiple access lines. To terminate calls that originate on a competing network, a second line that is supplied by a second operator is prohibitively costly relative to the costs of interconnection.

- End-office switching. For an operator that competes in providing local distribution to end users (such as a cable television network), the costs of supplying local switching may greatly exceed the costs of interconnection to TO switching.

- Numbering. Telephone numbers are an essential resource to providing end-user access. In most networks, numbers provide network routing information as well as subscriber addressing. New carriers are better able to compete for customers if subscribers can retain their telephone numbers when changing carriers.

- Access to trunk network. For a competing trunk operator (e.g., Mercury in the UK or MCI in the US) access to the dominant TO's trunk network is needed during the period its network is being established, in order to deliver calls to areas in which it has not yet constructed facilities. For all service providers seeking to market services beyond a local exchange access to the trunk network is necessary to reach their customers.

- Intelligent network (IN) services. Creation and management of new services will require access to IN functionalities. To obtain comparable quality of service to that enjoyed by the TO, competitors will require interconnection to IN control and database facilities. However, in the second plane of the "interconnection space" the IN concept is closely bound up with the signalling systems required to provide routing through the dominant network(s). Carriers are inclined to invoke this relationship and to deny or restrict interconnection to their IN by citing their own obligation to meet essential requirements (Section 2.6). This gives them a competitive advantage on the third and fourth planes in the "interconnection space", where modern value-added telematic services are located.

- Intellectual property rights. Important internal interconnection interfaces employed by national TOs, e.g., the national side of international transit exchanges, have been designed and developed by equipment manufacturers, who are seldom entitled to offer equipment based on the same national interfaces to third parties. The lack of shared rights to such national interfaces impedes access by service providers and competitive facilities operators, primarily in the analog PSTN. However, country experience, especially in the US, suggests that with strong regulatory encouragement industry committees and standards groups can establish workable arrangements for standardised interfaces. Less difficulty occurs in the interfaces in the ISDN and GSM networks, and also the versions of the IN developed by Bellcore for US local exchange carriers. These efforts by standards and industry organisations envision from the outset procurement from multiple suppliers, although not necessarily access for competing operators.

We conclude that:

1. The dominant TO has bottleneck control of resources essential to a competitor. Bottlenecks range from access to end users to intellectual property rights in software and equipment design. Until technical alternatives to these resources are developed, regulatory action will be necessary to ensure fair competition.

2. With respect to intellectual property rights, regulators can improve prospects for access to resources in the analog PSTN by encouraging industry participants to establish voluntary workable standards (see Section 2.4).

2.2 Major interconnection scenarios

In the interconnection space of Figure 2.1.2-2 interconnection relationships may be classified by:

- type of player (TO, service provider, end user)
- type of facilities (fixed, mobile, satellite)
- type of services (basic, enhanced, intelligent)
- type of users (private user groups, users of public networks).

Of the many possible combinations that can occur, our analysis concentrates on four major scenarios. They are the ones that, in discussions with the Commission staff, we have identified as having leading importance for interconnection: fixed-to-fixed network interconnection, fixed-to-mobile, mobile-to-mobile, and interconnection to intelligent network infrastructure and to intelligent network-based services on the levels three and four in the "interconnection space".

2.2.1 Fixed-to-fixed

Interconnection between two operators of fixed network facilities includes a wide variety of relationships, of which the following are typical:

- TO to TO. Interconnection via international gateways connects symmetrically situated operators. Technical arrangements follow international standards supplemented by bilateral agreements.

- Incumbent to a second national TO. Such interconnection today connects a dominant national operator with a much smaller entrant (e.g., BT and Mercury

in the UK). Both operators seek to provide a full range of services. Key technical issues include points of interconnection in the dominant network's architecture, collocation of equipment, and numbering.

- Access TO to long-distance operator. In national markets where operators do not necessarily provide end-to-end service, access networks which directly supply end users must be interconnected with trunk (interexchange) carriers in order to complete long-distance calls (e.g., local exchange carriers to interexchange carriers in the US).

- Broadband distribution network to TO. Broadband service distributors that supply end-user access interconnect to local or regional TO networks (e.g., cable television networks to BT in the UK).

- Service provider to TO. Information service providers need both physical interfaces (lineside access, trunkside access, signalling, and data interfaces) and administrative relationships (numbering, billing service creation) with a TO.

2.2.2 Mobile-to-fixed

Mobile operators require interconnection to fixed operators to exchange traffic and complete calls. In addition they need fixed transmission facilities to link their base stations and mobile switching centers, links which they frequently (have to) lease from the TO. A major issue for the cost and design of the mobile network is the number and location of interface points with the fixed network.

- GSM operator to TO. Mobile systems seek interconnection directly into the trunk side of the PSTN. Technical aspects of the mobile/fixed interface encompass specifications for physical interconnection, transmission and signalling standards to be used, circuit capacity, and advanced/intelligent services to be provided.

- Cellular operator to trunk TO. In markets such as the US in which access and trunk carriers are no longer vertically-integrated mobile operators may interconnect directly with both the local exchange TO and with one or more trunk (interexchange) operators.

2.2.3 Mobile-to-mobile

Because only a small percentage of mobile calls connect the subscribers of two different mobile operators, these calls are usually supplied via the interconnection of each of the mobile operators with the fixed TO. However, direct interconnection

between mobile operators does enable mobile operators to improve the quality and customised management of their service.

- GSM to GSM. GSM systems access specialised equipment and user location register databases by using the Mobile Application Part (MAP) on top of the SS7 signalling system protocol stack. However, few TOs have as yet fully implemented the TCAP portion of the SS7 protocol, which is required by the MAP. Within their own networks, mobile operators supply this capability over leased lines or their own facilities. When two mobile operators are able to interconnect their systems directly they are able to query each other's location registers and provide roaming between the two systems. If they are not directly interconnected, roaming requires that the fixed TOs' signalling systems support the MAP. Direct mobile-to-mobile links would also enable operators to transport voice traffic and thus bypass the TO network and its access fees.

- Dissimilar mobile interconnection. An operator licensed for both analog and digital mobile systems may accelerate the uptake of its digital service by offering dual-mode terminals and portable numbers.

2.2.4 Intelligent network interconnection

As it becomes possible to separate the control of network resources from basic telecommunications services, TOs, service providers and end users are seeking to interconnect to other operators' network intelligence and data. Interconnection to intelligent network services and resources is thus an additional dimension of interconnection for the fixed-to-fixed, fixed-to-mobile, and mobile-to-mobile scenarios. The technical potential exists for a rich variety of interconnections between intelligent network services of different operators. However, as yet there is quite limited experience with IN interconnection. Moreover, standards for interfaces are in very early stages of development (Section 2.4.3.4.).

- Service provider to intelligent network. In many instances the IN interface provided by network operators to date involve administrative and management relationships, supported by computer-system access to data bases of a limited set of parameters for services designed by the TO. Enhanced service providers are seeking much more extensive access to IN capabilities at three levels of IN structure:

  1. service creation environment pointability to design, code and test service logic programmes and to customise service parameters

  2. service control point - ability to process IN service logic and to read and write network-embedded databases for service-specific data (destination numbers, call-forwarding instructions, etc.)

3. service switching point - ability to control call processing in real time and geographically.

- User to intelligent network. End users, for example those with SS7-controlled private corporate networks, seek to interconnect their private databases over TO signalling networks.

- TO to intelligent network. TOs that are interconnected for delivery of voice telephone services usually supply related value-added services, such as cashless calling, free-phone services, call forwarding and other services. In order to offer these services to customers of other operators, TOs must provide signalling, database access, and call-control capabilities to interconnecting operators. Other operators, such as cable television operators who provide end user access, may seek to use a TO's intelligent network service to supplement its own voice-circuit facilities.

2.2.5 Summary

There are a large number of interconnection relationships, according to the type of player, facility, service, and end user. The scenarios of most immediate importance for regulatory policy are fixed-to-fixed, fixed-to-mobile, mobile-to-mobile, and intelligent network interconnection.

We conclude that:

1. The principal technical issues affecting competition among interconnected fixed operators are equal access to network components and services, collocation of equipment, and numbering.
2. Europe-wide operation of GSM service is technically limited where TOs have not implemented advanced signalling capabilities needed to support roaming by mobile subscribers. Direct interconnection of mobile operators can overcome this limitation and should not be restricted by regulatory action.
3. Interconnection to intelligent network services and resources will be of interest to many fixed and mobile network operators and service providers. Conversely, denial of IN access can prevent offering of new telematic services by value-added providers or put these providers at a considerable disadvantage. Development of standards for interconnection to IN functionalities is at an early stage and technical means to ensure essential requirements have not yet been agreed. Regulators should encourage further development of voluntary standards (see Section 2.6.1).

2.3 Network architecture

The technical opportunities for interconnection between two operators are determined by their network architecture, i.e., the logical and physical arrangement of transport links, switching, and control facilities. The purpose of this section is to identify the relevant points of network interconnection in fixed networks, mobile networks and the intelligent network.

2.3.1 Reference configuration for network interconnection

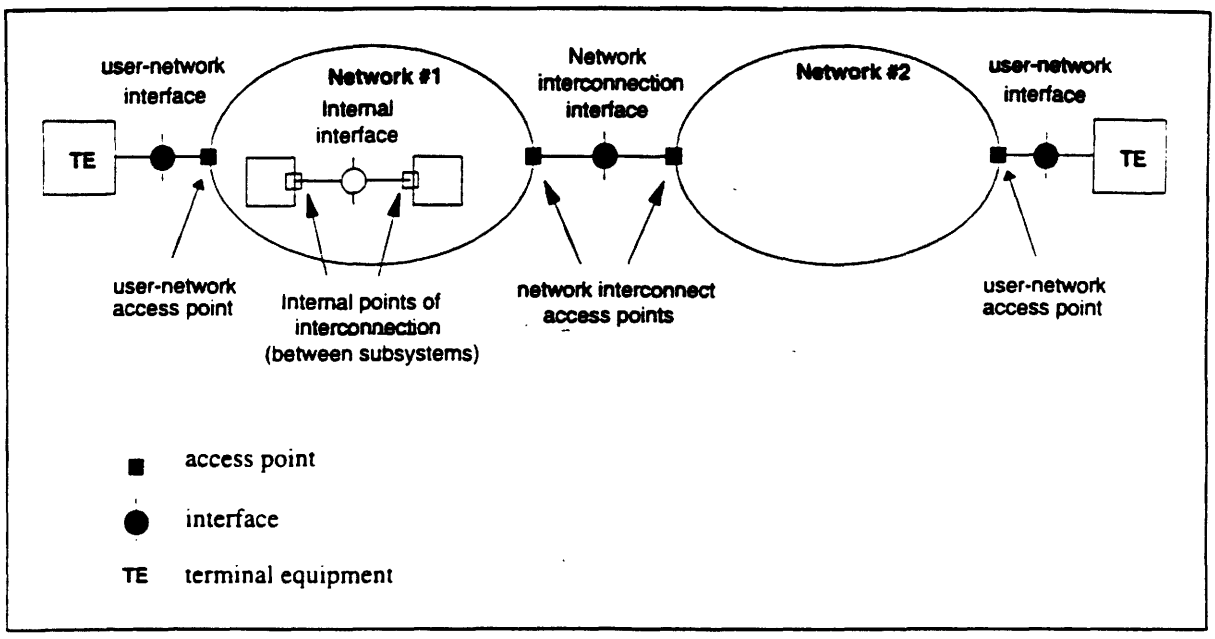
Figure 2.3.1-1 shows the generic reference configuration for the interconnection between two networks (or between parts thereof). Interconnection is realised by connecting network interconnect access points by a transmission facility (which may be either a simple transmission line, or a transit path through another network). Note from the figure that:

- there may be several different network interconnect access points (e.g., at different levels in the network hierarchy, such as national and regional access points of a TO).
- internal points of interconnection between subsystems within one network lie outside the scope of this study (but some internal points may also be suitable external points for interconnect access by third parties).

Relevant technical aspects of the network interconnection interface include:

- choice of location for the interface (e.g., collocated with TO facilities, or not);
- interface specification for physical interconnection;
- specification of transmission and signalling service levels to be supported (e.g., ETSI standards);
- required circuit capacity, quality, and availability of the transmission facility;
- advanced facilities to be supported.

Figure 2.3.1-1: Network interconnection reference configuration



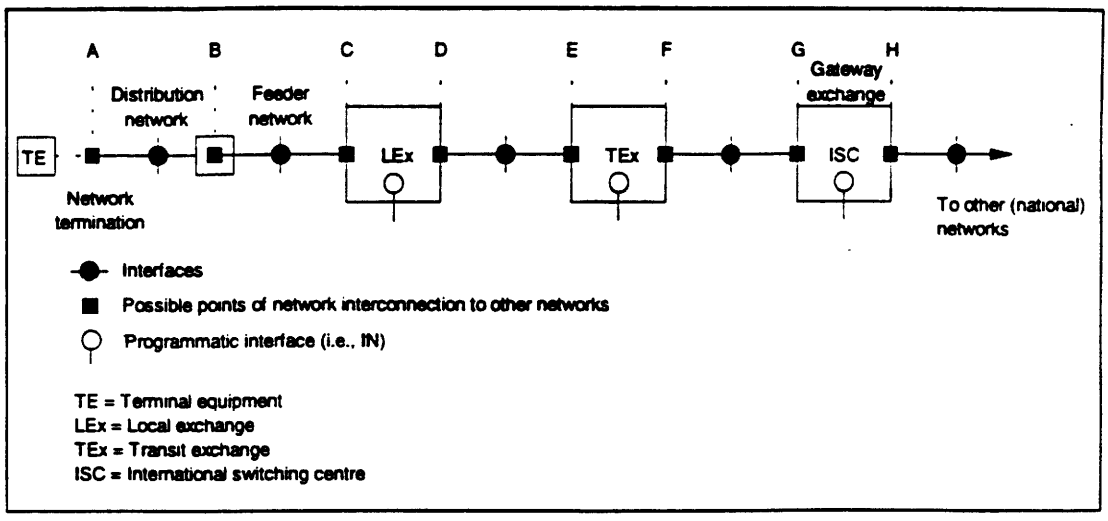
For some detailed examples, the reader is referred to Sections 4.2 and 4.3 of the Dutch country study.

2.3.2 PSTN/ISDN network architecture

The architecture of a national PSTN/ISDN is depicted in simplified form in Figure 2.3.2-1. The main elements of the architecture are:

- the International Switching Centres (ISC) which are the gateways to the national networks in other countries and for which interconnect agreements are a classical business matter
- the Transit Exchanges (TEx)
- the Local Exchanges (LEx)

Figure 2.3.2-1: PSTN/ISDN network architecture



In principle, the national network can provide interconnect access for other networks at several points of the hierarchy:

- National Access Points (NAP - point H)
- Regional Access Points (RAP - point F)
- Local Access Points (LAP - point D)

In addition to these three different "trunk-side" access points for other networks, the "line-side" access points (A, B, and C) are of importance for two groups of competitors - competitive access providers who offer facilities that bypass some or all of the local distribution network, and some service providers and resellers, particularly in those countries with developed value-added service competition which do not (yet) permit infrastructure competition (see e.g., the Danish country study). The interconnect point 'B' has received little attention in Europe, but may become of importance in the future if public telephone service can be offered locally by non-TOs using different local-loop technologies, such as cable television or wireless access (e.g., by DECT).

The initial interconnect access points to a TO network tend to be chosen high in the network hierarchy, typically as a National Access Point (H). As the interconnect traffic grows and the new interconnector's marketing knowledge of the geographical demand distribution increases, Regional or even Local Access Points (F and D, respectively) become more important. The actual choice will be strongly influenced by the regulatory terms granted to the new operator for establishing favourable transmission facilities from his Points of Presence (PoP) to the corresponding TO's Access Points, or for collocating these (see Section 2.5.2). Each PoP is a physical location, where the interconnector has established facilities for the purpose of obtaining interconnect access to the TO. Generally, the number of PoPs will increase as the interconnect traffic grows.

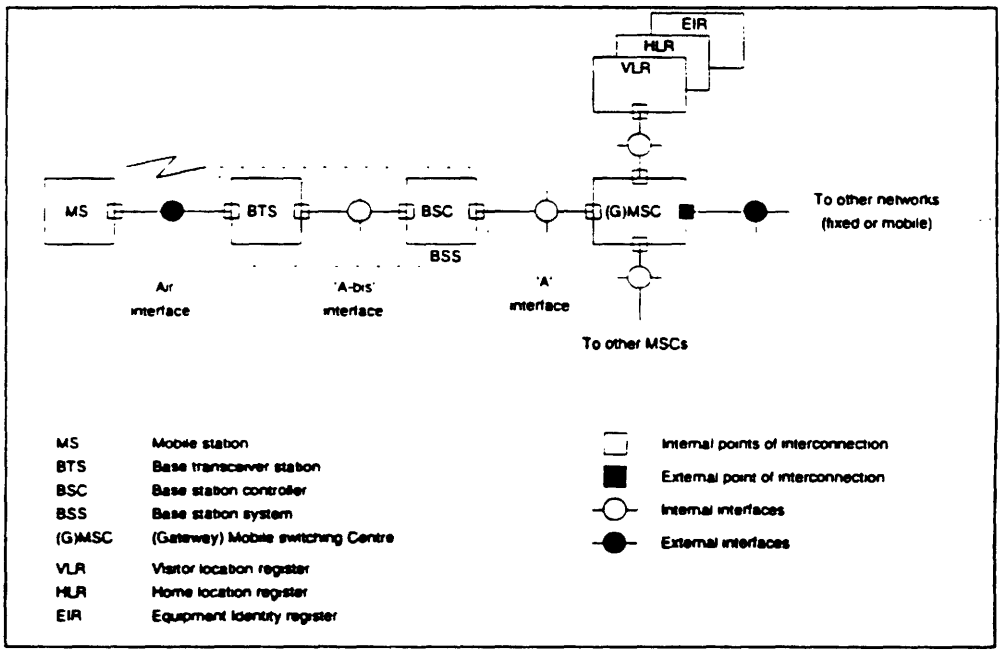
2.3.3 PLMN/GSM network architecture

Figure 2.3.3-1 shows the basic architecture of a mobile (GSM) network. A mobile network contains the following elements:[1]

- the Mobile Switching Centre (MSC), which supports switching and call management, including the handover of calls,
- the Base Station System (BSS), consisting of a Base Station Controller (BSC) and one or more Base Transceiver Stations (BTS), which support mobile management and control of the radio network,
- registers (Visitor Location Register, Home Location Register, Equipment Identity Register), which hold the parameters applicable to each subscriber and the location of the subscriber,
- the Mobile Station (MS), which is the mobile terminal equipment used by the subscriber.

The MSC (or Gateway MSC) supports the interfacing to other (fixed or mobile) networks, such as the PSTN/ISDN discussed in the previous section.

Figure 2.3.3-1: PLMN/GSM network architecture



1 PA Consulting Group (1992).

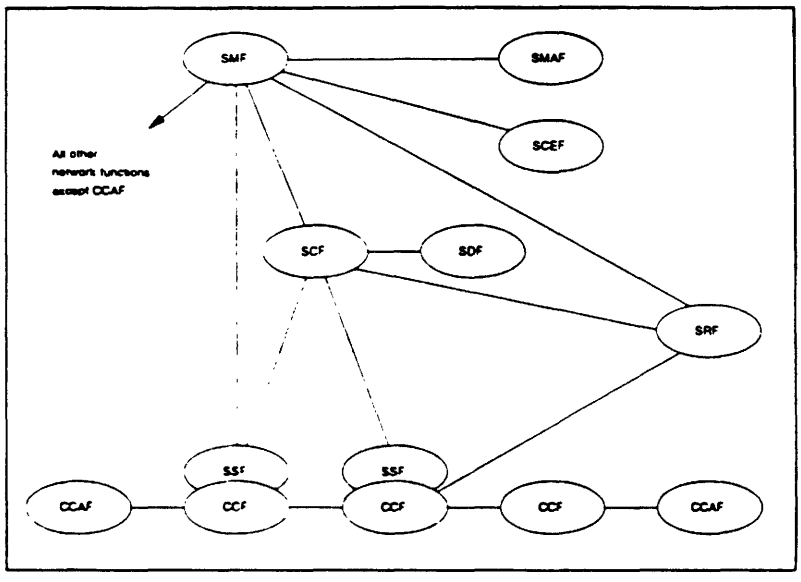
2.3.4 IN architecture

The IN conceptual model consists of four planes:

- service plane,
- global functional plane,
- distributed functional plane,
- physical plane

where each plane represents a different abstract view of the capabilities provided by an IN-structured network. Each plane interacts with adjacent planes. Within each plane entities are defined, and between pairs of entities relationships may exist. Figure 2.3.4-1 shows the entities and their functional relationships for the IN-distributed functional plane model.[2]

Figure 2.3.4-1: IN distributed functional plane model (ITU-T Recs. Q. 1204 and Q. 1211), (IN network functions and their functional relationship)



CCAF Call control agent function
CCF Call control function
SCEF Service creation environment function
SCF Service control function
SDF Sevice data function
SMAF Service management access function
SMF Service management function
SRF Specialised resource function
SSF Service switching function

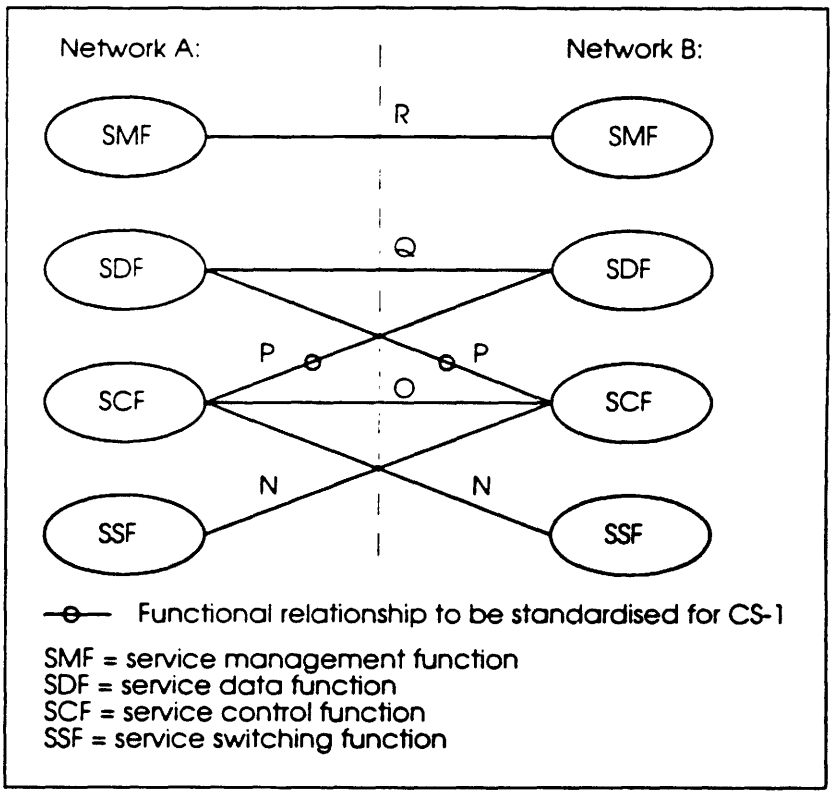
2 ITU-T Rec. Q.1204.

The generic relationships in the distributed functional plane model are the basis for the ongoing specific standardisation activities of ITU-T and ETSI.

The functional entities in the distributed functional plane can be mapped onto physical entities in the physical plane. The physical plane identifies different physical entities, the allocation of functional entities to physical entities, and the interfaces between the physical entities. Between these physical entities reference points may be defined and for these reference point interfaces may be standardised. ITU-T Rec. Q. 1215 describes the physical plane of the IN architecture for Capability Set 1 (CS-1), the first set of call-control elements that have been standardised. The physical plane identifies different physical entities, the allocation of functional entities to physical entities, and the interfaces between the physical entities.

If the physical entities are located in different networks the endpoints at both sides of the interfaces may be considered as access points for network interconnection. Figure 2.3.4-2 depicts the functional relationships and their associated reference point between the IN functions that are located in two different networks. CS-1 transactions encompass service control using translation and validation via exchange of information with a data function in a second network. Thus a reference point P is within the scope of CS-1.[3] The other reference points (O, N, Q, R) lie beyond the scope of this initial set of standardised call-control functions.

Figure 2.3.4-2: Possible network interworking functional relationships



3 ITU-T Rec. Q. 1211.

2.3.5 Summary

We conclude that:

1. Fixed networks have well-defined external interfaces at several levels of the network hierarchy, located primarily at switches but also in the distribution system and local loop that extends to the end user. The choice between the corresponding access points is largely determined by economic considerations and by any regulatory constraints limiting the freedom of choice by the party seeking interconnection.

2. Open access to points of interconnection at all levels will enable competitors who pay at least the incremental costs of interconnection to combine their own and incumbent network operator's services and facilities to produce services at minimum costs. However, in most markets incumbent operators are dominant and have incentives to minimise rivals' opportunities to interconnect and to raise their costs. Regulatory authorities should require incumbent operators to provide interconnection at multiple network levels absent a demonstration of high costs that are unlikely to be recovered from interconnecting operators.

3. Mobile networks have a single type of external interface for service providers and other operators, located at the mobile switching centre.

4. The transmission facility connecting the access points of two different networks can be a single line or a transit path through a third party's network. The economic and regulatory conditions for establishing such a facility are important technical design constraints.

5. Although there are many conceptual types of intelligent network interfaces, only those for the most basic call control capabilities have thus far been standardised.

2.4 Interfaces and standards

2.4.1 Relationship of standards and interconnection

There is a range of possibilities for the use of standards to govern interconnection and network access relationships. Interconnection encompasses network interfaces within a single organisation and access to interfaces by second organisations.

Interconnect access at a given interface may be unavailable. Alternatively, it may be required (in pursuance of the EU's ONP policy or by national regulatory policy). A third

possibility is voluntary interconnection - thus, some networks offer interconnection without a regulatory requirement. With regard to standards, they may not exist for the point of access. Or, standards may be available, but it is not required that they be used. Finally, a single standard may be required at the point of interface.

Table 2.4.1-1: Relationship of interconnection and technical standards

	Standards		
Interconnection Required	**None**	**Voluntary**	**Mandatory**
No	1	2	3
Yes	4	5	6

The various possibilities, shown in Table 2.4.1-1, are as follows:

1. Interconnection not required, no standards. Within a TO or other firm the connections between components of one network are internally managed. Access to these interfaces is not required by regulation. As it sees fit, the firm may use its own standards, proprietary standards of equipment vendors, or industry and internationally-agreed standards.

2. Interconnection is not required, but some networks make it available. The regulator may encourage use of standards, but not require them. The ISDN 'U' interface in the U.S. is a possible example.

3. Interconnection is not required by regulation, but the regulator or industry body requires adherence to common technical (ITU-T, formerly CCITT) standard at the interface.

4. Access to the network is required, but there is no standard. The regulator requires unbundling so that a second operator can purchase just those services on the TO's side of the interface, and leaves it to industry to establish technical arrangements. US expanded interconnection is an example. Open access with functional (but not technical) standards could be placed in this category. For example, a requirement to provide access at a 'U' interface with the functional requirement that emergency powering is guaranteed to a standard of 1 minute outage in 10 years would leave technical arrangements unstandardised.

5. Access is required by one or more NRAs in the EU, and standards are recommended. For example, if the 'U' interface were offered outside of ONP, ETSI could still develop a standard that would then be voluntary for Euro-ISDN.

6. Access is required, and the standard is mandatory.

2.4.2 Economic aspects of standardisation

Viewed in economic terms, standards are a way of lowering individual transactions costs of parties: the individual costs of negotiating and deciding on the arrangements necessary for interconnection. Standards can improve the functioning of markets by:

- reducing equipment costs (economies of scale, increased number of suppliers),
- reducing transaction costs of negotiating interconnection agreements,
- increasing compatibility of offerings from multiple suppliers, thus harmonising services across Member States,
- increasing the availibility of service and thus promoting universal service.

Interconnecting parties need to use interfaces to interconnect even if their networks are otherwise compatible. If there are only two interconnecting parties, standards would not necessarily be required, only case-by-case agreements about technical solutions. However, such agreements are likely to be complicated and subject to change as technology progresses and networks are upgraded to meet new demands. Once there are many parties that want to interconnect, multilateral agreements are required that naturally would tend towards standards. The reason why such standards lower transactions costs is that they reduce the amount of asset specificity. The same asset, "design", can be used in many instances of interconnection. Standards may also be essential to provide interoperability, network security and integrity.

Standards can evolve voluntarily through market dominance of an individual firm, through spontaneous adoption by many firms, or through conscious industry collaboration. The first of these is likely to create market power that would call for government intervention. The second is desirable but too unlikely to be relied upon ex ante. Because of the highly technical nature of standard setting, the third option, industry cooperation, is definitely the preferred option. However, because of the accompanying dangers of (a) collusion or (b) lack of agreement, regulatory oversight remains desirable.

Standards are not always beneficial. There is, for example, an ambiguous relationship between standardisation, interconnection and technical progress. Standardisation may increase the market for interconnection and thereby potentially increase the total telecommunications market. On the one hand, this may make innovations in telecommunications equipment and software more attractive. At the same time standardisation may lock in a technology and thereby retard technical progress. Also, the resulting increase in competition *in* the market may reduce competition *for* the market. This could decrease the profit potential for radical innovations, such as complete changes in paradigm. An example is the choice of a wireless local loop for narrowband (voice) and a wired local loop for broadband (broadcast), the so-called Negroponte switch.

Another ambiguous effect of standards is the need for industry cooperation in order to reach and implement standards. This cooperation can lead to innovative standards by bringing together innovative ideas from different enterprises. Conversely, the cooperation can also result in collusion in the market.

The very activity of establishing and agreeing on standards may itself introduce significant overall costs:

- delay in the introduction of service or interconnect access,
- costs of the operations of standards and regulatory bodies,
- reduced flexibility to adapt to local conditions and satisfy particular market needs.

In general, striking an optimal balance between the gains and the costs of standardisation for interconnection will have to be assessed for particular cases. Generally, we can say that a policy of standardisation tends to shift competition from innovation in technology to competition in service innovation and standardised production.

We conclude:

1. Mandatory standards for interconnection interfaces should be reserved only for services and technical components of networks for which the benefits of Union-wide harmonisation are very high. This would include communication technologies, such as GSM, designed for high geographic portability; network numbering systems; and emergency and directory services.
2. In most other cases, standards reached through voluntary coordination are more likely to balance the gains from rapid innovation with the widest use of common interfaces.

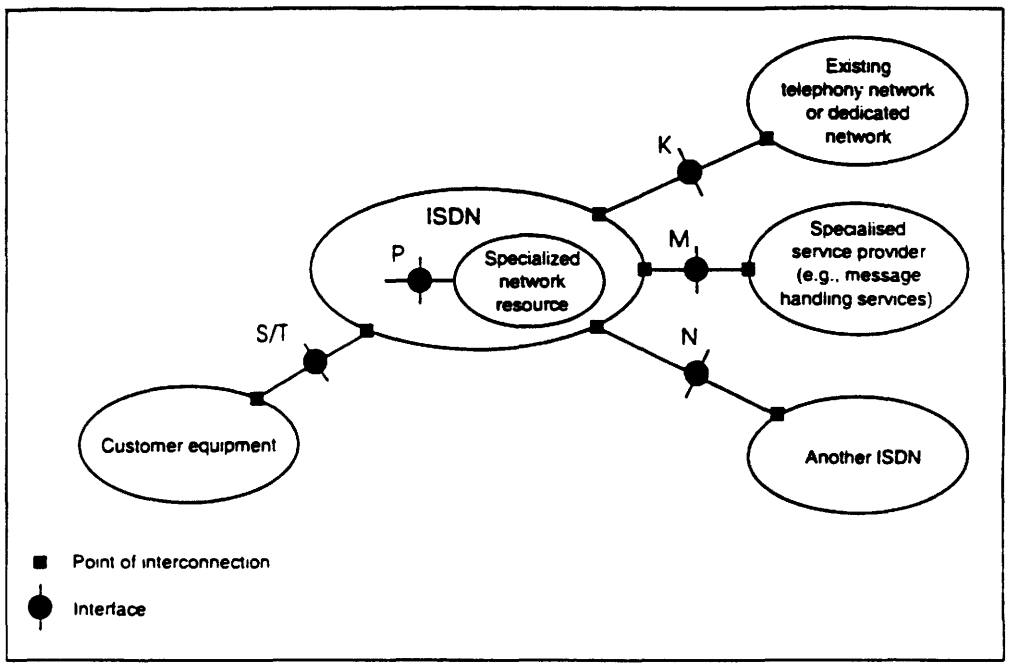
2.4.3 Interfaces and standards

The purpose of this section is to identify both existing and desired interface definitions for the major network interconnection scenarios.

2.4.3.1 Fixed - to - Fixed

Figure 2.4.3.1-1 shows the reference points (K, M, N, P and S/T) for network interconnection defined in ITU-T Rec. I. 324.

Figure 2.4.3.1-1: Architectural relationships between the ISDN and other networks including ISDN (From: CCITT Rec. I. 324)



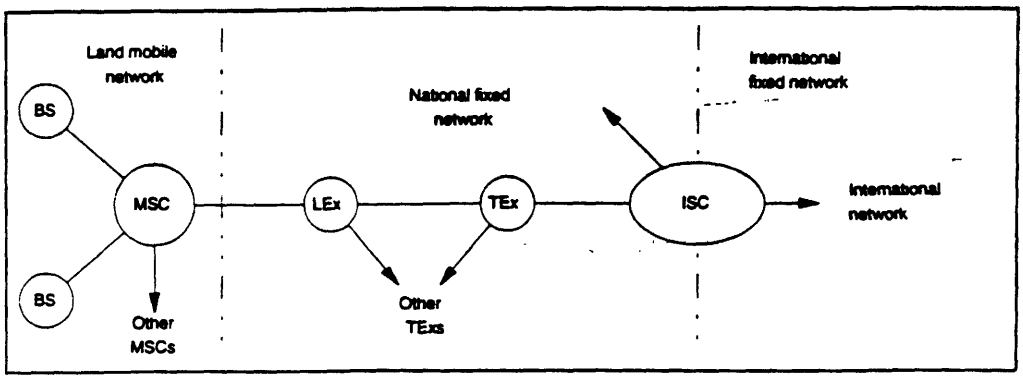
General arrangements for network interworking between ISDNs (N reference point) are described in ITU-T Recommendation I. 520. The interworking functions and requirements to support interworking between an ISDN and a PSTN (K reference point) are described in ITU-T Recommendation I. 530. The I. 400-series of Recommendations describe the characteristics of user-network interfaces (S/T reference point). The internetwork interfaces at the reference points M and P are not yet defined by ITU-T.

2.4.3.2 Mobile - to - Fixed

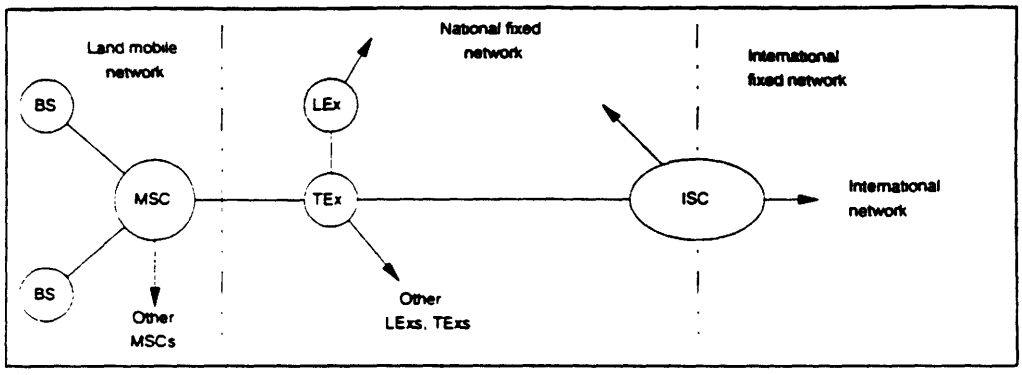
In principle, the interconnection between a mobile network and a fixed network can be at any level in the fixed network hierarchy, e.g., at the local exchange (LEx), transit exchange (TEx), international switching centre/exchange (ISC), or a combination of these. The network scenarios in Figure 2.4.3.1-1 are some examples (CCITT Rec. E. 220).

Figure 2.4.3.2-1: Examples of mobile-fixed network interconnection

a) All mobile traffic via interconnect at local exchange



b) All mobile traffic via interconnect at transit exchange



c) Mixed case: Interconnect national mobile access via transit exchange and international traffic via international switching centre.

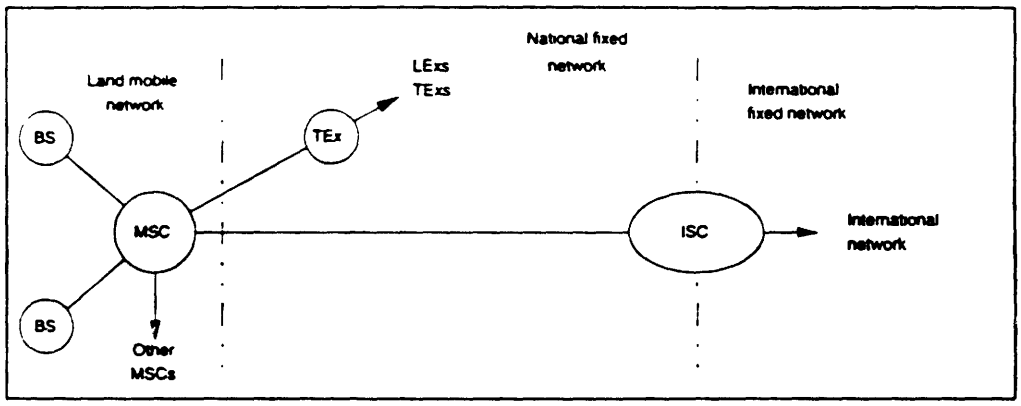


Figure 2.4.3.2-2: Interconnection between a mobile network and other networks (from PA Consulting Group, page 61)

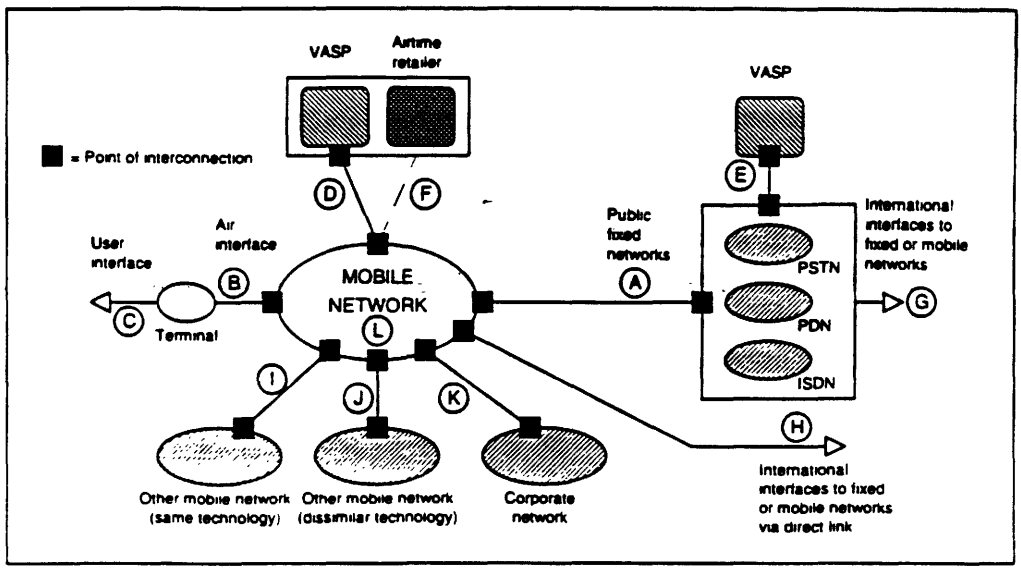


Figure 2.4.3.2-2 shows the general model of mobile network interfaces drawn up in a recent consulting study for the Commission.[4]

The following interfaces are identified:

A Fixed network interface - to PSTN, ISDN, or PSPDN (mobile-to-fixed network interconnection)

B Air interface

C User interface

D Interface to value-added service provider directly connected to the mobile network

E Interface to value-added service provider connected to the fixed network

F Interface to airtime retailer (or similar organisation)

G International PSTN gateway interface

H International link to fixed or mobile network over a leased line

I Direct link to mobile network using same technology (mobile-to-mobile network interconnection)

J Direct link to mobile network using dissimilar technology

K Direct link to corporate network

L Internal interfaces within leased lines and switches of the mobile core network

For each of the interfaces identified technical standards have already been developed by CCITT/ITU-T, ETSI, ISO, and other international bodies. In the PA Consulting group

4 PA Consulting Group (1992).

study extensive overviews of existing technical standards are given for several types of mobile networks: GSM, analog cellular, paging PAMR, mobile data, and telepoint networks.

2.4.3.3 IN interconnection

Network interworking is a process in which two or more networks (IN to IN, or IN to non-IN) cooperate to provide a service. The term *interworking* is used to express interactions between networks, between end systems, or between parts thereof, with the aim of providing a functional entity capable of supporting an end-to-end communication. The interactions required to provide a functional entity rely on functions and on the means to select these functions. Network interworking requirements exist at different levels:

- service processing;
- service management;
- service creation

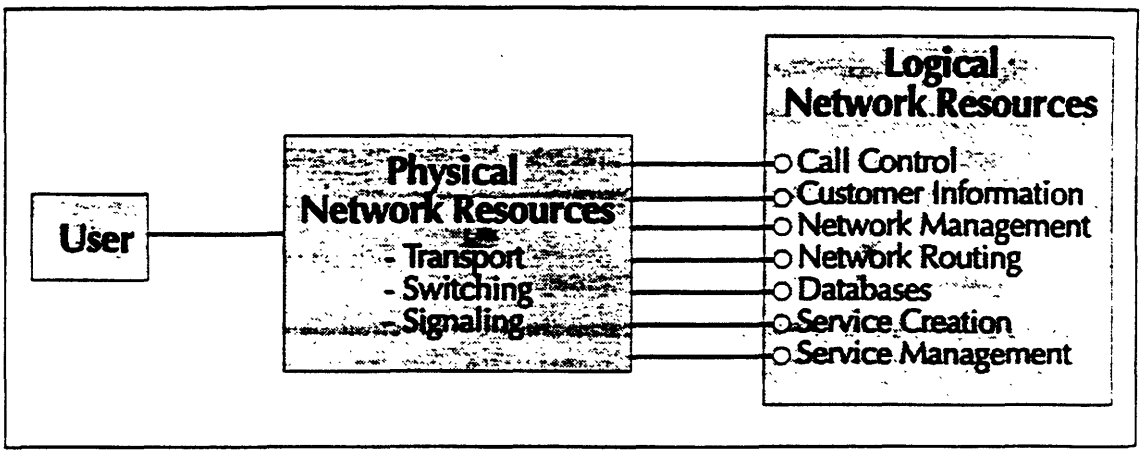
At each level, some network interworking gateway functions need to be defined. These functions include the conversion of physical and electrical states and the mapping of protocols. An interworking function may be implemented in the ISDN, in the other network(s), at the user's premises, through a third-party service provider, or in some combination of these. However, current IN standards do not adequately address the need for interworking between INs under separate ownership. This is an inhibitor to the successful and rapid deployment of pan-European services.[5]

One perspective on network interconnection flows from the view of networks and service providers as suppliers of functions that control communications pathways and access to information arranged in a logical architecture. In Figure 2.4.3.3-1 these logical functions are schematically related to the physical telecommunications resources. Points of logical interface are shown with dots.

Two networks are logically interconnected at one or more interface points when one network's logical resources provide control or information to the other. For example, one network may provide a second network with access to its customer information for directory inquiries and call routing. Service suppliers and end users may also logically interconnect their own information and management resources at these interfaces, for example, to route terminating green-number calls over an interconnected private network.

5 KPMG Peat Marwick (1993).

Figure 2.4.3.3-1: Logical interconnect model



Control of calls and access to essential data within the TO network depend on the network signalling system. The conversion by TOs from in-band signalling to the common-channel signalling system (SS7) will make possible standardised interfaces for logical or programmatic (in contrast to physical) interconnection with the TO network. For example, an independent information services provider could provide a database that would interconnect through a service control point. Another enhanced service provider could access a TO database, using defined SS7 messages, independently of a telephone call.

Information industry participants have requested access to software, databases, and control logic of the TO network. These demands amount to several types of logical interconnection to the network. In the US a "high-level description" of various types of logical requests has been developed, for preliminary discussion, by a task group of the Information Industry Liason Committee (IILC).[6] Interconnection is described with reference to several types of logical network objects:

- Switch, including functionality to communicate with service platforms and respond to their instructions. A call-control capability is included within the switch's connection to end-user lines, to recognise that action by a service platform is needed to handle a call at points throughout a call attempt,

- Service platform, a point external to a switch that receives and responds to queries from switches on how to handle calls,

- Database, a point external to a switch where service-related data are stored and are accessed in real time during call processing,

- Resource element, functionality that includes announcements, tones, and input collection (by voice or keypresses),

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6 IILC Issue 026 Task Group (1993), Draft Presentation, 9.2.93.

- Service creation, the functionality for designing, coding and testing service logic programmes.

Figure 2.4.3.3-2 shows 11 possible types of logical requests (labeled A through K) that could arise when two networks are interconnected. A number of these requests for access to service creation, data bases, and service platforms also arise when a service provider interconnects with a network operator.

Figure 2.4.3.3-2: High-level logical requests

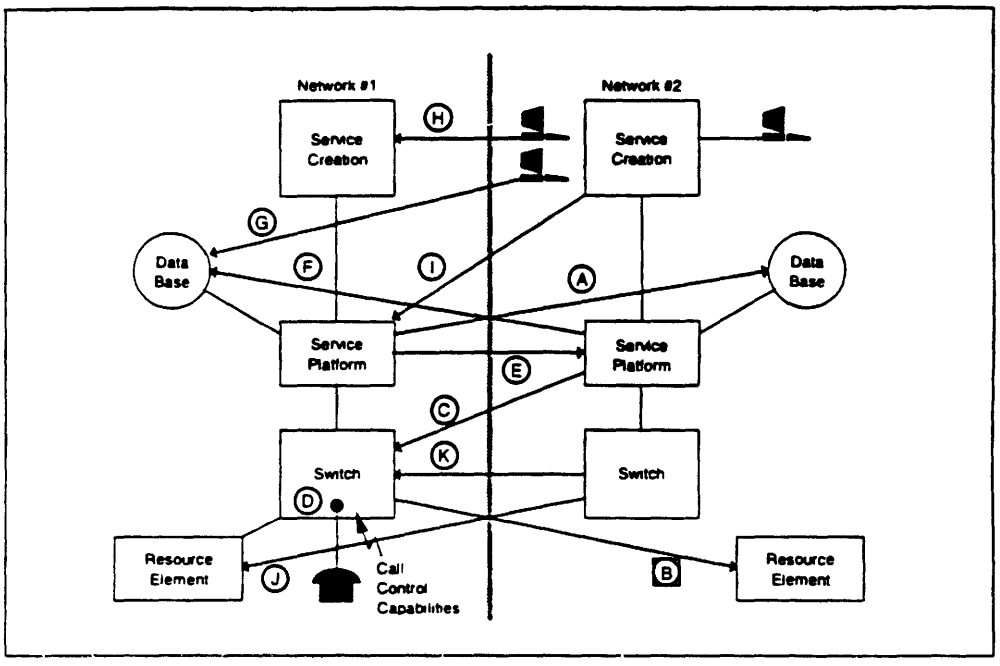


Table 2.4.3.3-1: Types of Logical Requests between Interconnected Networks

Key	Logical Request
A	Net 1 service platform retrieves data from Net 2 data base
B	Net 1 switch accesses Net 2 resource element
C	Net 2 service platform uses Net 1 switch to access resource elements
D	Net 2 directs end-user call-control capabilities via Net 1 switch to access service platforms
E	Net 1 service platform obtains call-processing instructions from Net 2 service platform
F	Net 2 service platform retrieves data from Net 1 data base
G	Net 2 stores end-user data in Net 1 data base for call processing
H	Net 2 uses Net 1 service-creation tools to write programmes and store them in Net 1
I	Net 2 uses own service-creation tools to mm Net 1
J	Net 2 switch accesses Net 1 resource element
K	Net 2 switch accesses Net 1 resource element via Net 1 switch

We conclude that:

1. There is a potentially rich set of logical points of interconnection to intelligent network interfaces.
2. Access at control and switching points could pose significant risks to network integrity and security.
3. Technical standards to protect network integrity and security in the presence of interconnection have not yet been developed, but establishing interconnectors' liability for breakdowns in network integrity and security, by licensing or other means, could provide an alternative to open interfaces.

2.4.4 Recommendations from other studies concerning interconnection standards

Several recent technical working groups and consultancy studies for the Commission have conducted in-depth examinations of the present state of standardisation in the areas of intelligent network functions, broadband, local loop, mobile networks, satellite, and network management. The principal findings and recommendations that concern network interconnection from these studies are summarised in the Annex. They include:

- Additional user interfaces in the local loop (e.g., a U interface) are likely to evolve in some markets in response to user needs and the cost savings (and cost reallocation) possible from integrating functions in terminal equipment.
- Barriers to GSM-to-GSM interconnection are not technical, but administrative and economic.
- Interconnection to intelligent network interfaces, especially at control and switching points, could pose significant risks to network integrity and security. It will be several years before technical interface standards can be developed that would protect against these hazards. In the interim, an alternative to open interfaces could be a requirement that operators and service providers be licensed in order to interconnect to IN capabilities. Licencees would be required to assume liability for lapses in network integrity and data protection caused by their interconnected operations.

2.4.5 Evolution of interconnection standards

Compared to the interconnect and interface situation in the US, it is important to understand that the European Union is evolving from precisely the opposite situation: The Member States of the EU each have a NRA and a national TO with its own engineering practices and internally determined interfaces. The only common interfaces

were at the highest hierarchical level in the "interconnection space", namely, the international transit gateways, the international side of which adhered to appropriate CCITT Recommendations or CEPT agreements. For the rest, the national telecommunications networks were internal affairs, with proprietary interfaces often subject to restrictions on publication or reuse by equipment manufacturers. In these fragmented circumstances it is not strange that predominant European successes in interconnection have been achieved (only) in the area of new mobile networks: These could be designed and engineered afresh as separate entities, albeit with the strongest possible incentive to be interconnected to the different national TO's and to provide international roaming/portability capabilities hitherto non-existent in Europe. As confirmed by our country studies, the standardised GSM networks are the emblematic European symbol of the new internal telecommunications market, and of the general interconnection practice in Europe, namely, starting from the highest hierarchical level at National Access Points in a technological environment akin to international gateways, and evolving towards more Regional Access Points in accordance with actual market needs.

Compare the North American situation. Only some ten years ago, the US (with adjacent Canada) had the omnipresent "Bell System" with its widely published engineering practices, and with a dominant equipment manufacturer owned by the operator, AT&T. This ensured an informal, but consistent system of interfaces and an internal market second to none in size. Since divestiture, this impressive body lies amouldering in the grave, but the soul is marching on: Despite the many changes in ownership and regulatory arrangements, most of the basic network plant, standards and interfaces, and American engineering practices are still largely the same as in the heyday of the old AT&T. Accordingly, important key notions for interconnectivity and competitive service provision, notably the IN concept, have come out of Bellcore, the joint research center of the (non-competitive) RBOCs and been picked up by virtually all interconnecting secondary operators and service providers.

The result of these differences is significant. In continental Europe, interconnect arrangements descend slowly from the highest hierarchical level, when operators of entirely new (wireless) standardised services become licensed in the Member States. Accordingly, national bilateral arrangements (plus international agreements for roaming) are evolving downwards in the infrastructure at different paces in each Member State. In the US, on the other hand, more radical interconnect arrangements, including traditional high-volume services, were immediately necessitated by divestiture, and could be based on common network interfaces already existing at several hierarchical levels.

The different starting points at least partly explain why the US policy approach to interconnection in a competitive environment could - and still can - be so different to the EU's. They may also explain why there is remarkably little policy insistence on (standardised) wireless networks for mobility in a country so given to travel as the US. However, it should not escape attention that the marketing expertise in a significant

number of GSM consortia in Europe, especially in respect of new service provision and the related technical experience with the IN, is provided by partners from the more competitive shores of the Atlantic.

These different directions of evolution of interconnect arrangements in the US and EU suggest that some caution is required in adopting each other's regulatory approaches. It should be noted that telecommunication networks have no dominant technological imperative akin to the much faster-developing areas of information technologies such as micro-electronics components and computer hardware: Economic, regulatory and technological network evolutions are all processes with significant memory of past conditions, especially where basic (wired) network infrastructure and public access conditions are involved. In the terms of our study, bottlenecks for interconnection therefore often appear different in the states of Europe and the US: the economies of scale and the allowed number of alternative paths in "interconnection space" were much larger in North America right from the outset of divestiture.

2.5 Equal access

The technical quality of interconnection affects the quality of service to the end user as well as the costs of that service. From a competitive perspective, however, it is not the absolute quality of interconnection that is of concern, but rather quality relative to that of other suppliers in the market. The concept of *equal access* to network facilities and services emphasises:

1. Non-discriminatory treatment of all potential operators and service suppliers seeking interconnection with an incumbent network operator.

2. Conditions of interconnection for a competing supplier that are substantially identical to those for the incumbent operator itself.

Important requirements for equal access arise in provisioning facilities and services, collocation of TO and interconnector facilities, numbering of subscribers' lines, and end-user access to competing operators.

2.5.1 Provisioning of facilities and services

Competitors are disadvantaged if they cannot order and obtain leased lines, circuit rearrangements, and enhanced services on reliable commercial schedules that are equivalent to the service a TO provides to its own departments or subsidiaries. Experience in liberalised markets (US, UK) suggests that regulators need to establish a requirement for equal provisioning and to monitor TO performance to ensure equal access.

2.5.2 Collocation

For operators that physically interconnect their facilities to another operator, *physical* collocation of terminating equipment in the latter's cable or switching facilities is usually technically superior to *virtual collocation* at some distance from the switching point. These interfaces may offer higher-speed control and signalling connection, higher data quality, and greater reliability and availability. At the point of collocation competing operators' transmission equipment (fiber optic cable, metallic trunks, or microwave radio transceivers) is electrically cross-connected at a trunk distributing frame pursuant to standards defined by equipment manufacturers or engineering bodies. Similarly, service providers collocate processors and database equipment in order to obtain higher-speed access to network control and signalling.

Collocation agreements typically cover:

- physical space, either floor space in a switching building, or cage space in a vault or manhole
- electrical power and environmental conditioning for terminating equipment
- access arrangements for technical service personnel

Experience with collocation in the US and the UK suggests that in many cases physical collocation has both technical and economic advantages compared to virtual collocation. Negotiated agreements reached under encouragement or requirement of the regulator demonstrate that physical collocation is achieveable for important interfaces.

We conclude that:

In most instances, physical collocation is technically achievable and provides more nearly equal access than virtual collocation.

2.5.3 Numbering

The numbering of network lines can be a bottleneck to effective competition and interconnection.

A unique telephone number is required for each end-user access line that connects to the PSTN. Most national numbering plans combine within a subscriber's telephone number a set of digits identifying the particular subscriber line and geographic or carrier codes that simultaneously convey some routing information to the networks that transport the call. Switching and routing technology, particularly in analog networks, has been designed to minimise costs in a single-operator environment. Providing carrier-specific codes in analog networks should be based on a study of costs and

benefits. Even-handed treatment of multiple operators can readily be provided for in digital networks and future routing software.

Competitive supply of end-user access requires allocation of blocks of telephone numbers to additional operators and technical arrangements that can route calls dialed to those numbers to the facilities of the appropriate operators. The allocation activity can readily be separated from the other provisioning activities of the incumbent operator, and should be assigned to a neutral party.

Portability of telephone numbers means that a subscriber can change access carriers and retain the same telephone number for both outgoing and incoming calls. Full portability has been implemented for freephone service in the US by using several centralised databases that associate a specific service provider with each freephone telephone number. Consequently, in the US an end user (typically a retail business that publicises its telephone number) can choose a different operator for incoming freephone service without needing to inform his customers of a new number. However, full portability of subscriber numbers at the local exchange awaits further development and installation of intelligent network capabilities in local exchanges. Lacking full portability, new entrants in the end-user access market face a barrier to attracting customers currently subscribed to the TO.

Several technical means are available to reduce the number portability handicap:

- foreign exchange - a leased line connects the local switching office to a foreign (distant) switching office
- call forwarding - calls to a subscriber's original number are intercepted in the original switching office, re-originated and directed to the forwarded number.
- separate exchange (NXX) numbering code - an entire block of 10,000 exchange numbers is reserved for a single subscriber; the NXX code can then be reassigned to a new operator. This approach is applicable only to the largest subscribers.
- DID (Direct Inward Dialing) trunking - Incoming calls are routed through the local exchange, over dedicated DID trunks, directly to a customer or the customer's service provider. The final four or five digits of the called number are delivered to the customer for further processing (e.g., routing to a specific telephone).

We conclude that:

1. Network numbering systems are likely to favour transport and routing of calls via the incumbent operator. Implementing numbering codes for competing operators may be costly in analog networks. Regulators should require even-handed coding and routing for all operators in new software and technology. Extending this requirement to analog network technology should be based on a study of costs and benefits.
2. Allocation of subscriber numbers to operators should be assigned to a neutral party.
3. Subscriber-number portability is difficult to achieve with current technology, but some other measures can reduce the TO's advantages of incumbency. Portability is more readily achieved for freephone and other database-related services.

2.5.4 End-user access to operators

End-user access to multiple operators and service providers is constrained by the need for technical mechanisms by which users can designate suppliers and access networks can route traffic to them. As discussed in Section 2.4.4, all TO networks were initially designed assuming a single national operator, and traditional switching technology does not provide for a choice of carrier routing.

Upgrading switching systems to support access to multiple operators is most easily accomplished in stored-programme control, and especially digital switches. Retrofitting older-technology switches has proved costly. A preliminary recommendation is that newly-installed switches and software upgrades should incorporate choice-of-operator technology such as digit recognition.

- *Symmetric* access to operators can be provided by *pre-subscription* by the subscriber of a preferred operator. The access carrier maintains a record of the choice for each subscriber line and routes calls directly to the designated operator. The equipment to implement equal-access presubscription has normally been installed at tandem switches in the second level of the network hierarchy.

- A *carrier access code*, dialled as a prefix to a telephone number, overrides the choice of the carrier to which the line is pre-subscribed and enables a caller to direct a specific call to any available supplier at the cost of dialing several additional digits. A *carrier access code* can also be the only way of accessing a supplier, i.e., when there is no pre-subscription. This would then also be *symmetric access* as long as all competitors (including the incumbent) have access codes with an equal number of digits.

- Other forms of access to competing operators can be supplied through a local telephone number. Subscribers then dial a local access number, obtain a second dial tone from the alternative operator, and then dial the destination number, or dial a service code for information services.

We conclude that:

Because upgrading switching systems to support equal access to multiple operators has high costs when older-technology switches must be retrofitted, a policy of mandatory end-user equal access should be limited to newly-installed switches and software upgrades of existing digital switches.

2.6 Other technical issues of interconnection

2.6.1 Essential requirements

Limits on open access are permitted under ONP to the extent they may be required to achieve essential requirements. Essential requirements include:

- security of network operations, especially service level in emergency conditions,
- maintenance of network integrity,
- interoperability of services, where justified,
- data protection, where justified.

Security and integrity of telecommunications networks have become more difficult to achieve, even in single-provider networks, as information services and user-configurable features have expanded. For example, direct-inward dialing and voice messaging systems are vulnerable to fraudulent access and use of trunk dialing and other services.

Network integrity and reliability

Network interconnection can contribute to increased reliability of service to the final user by making alternative paths available for routing calls and providing second sources of supply. Using fiber-optic distribution rings, competing access providers have offered larger commercial customers increased reliability against cable outages. In the US, competition among trunk operators has substantially increased total capacity. Mutual aid agreements among operators provide for rerouting of traffic and sharing of supplies, vehicles and personnel in emergency conditions.

Network security and mediated access

The technical aspects of these issues are being addressed in industry discussions of interconnection to intelligent network services. Maintaining essential requirements places the most stringent demands on technical and administrative interconnection arrangements when interconnection provides direct access to network intelligence. An advanced intelligent network will require very generalised types of mediation, with especially strong protection for network elements and the integrity of the IN infrastructure.

The technical architecture of the IN has initially been developed for a single-operator environment. Even in this form, protection of network integrity and reliability has proved more difficult than first anticipated as shown, for example, by the unintended interaction of value-added features (such as call-forwarding and call-waiting) and flooding of the signalling network with shutdown messages when faulty software upgrades were installed.

Three basic levels of access are currently under discussion:

- Service creation and management. Service providers can configure parameters of service offerings and use programming tools to create customised service logic. Interaction is not real time and data entries can be screened before being activated.

- Service control. 'Read access' to databases can be provided with password and authentication controls. 'Write access' poses most of the problems of potential feature interaction and network-data integrity.

- Service switching. Service provider and other-operator access at the switch is sought for performance reasons, to respond in real time to call triggers in order to provide services during call set-up and conversation. Equal access for non-TO operators could be technically very costly to provide, requiring redesign and upgrading of software for all switches where access is sought. Limiting access to SCPs, however, may restrict service providers to offering inferior service quality in comparison with the TO services that are integrated into the switches.

Until standards are developed that can provide a generalised approach to ensuring network integrity, mediation of access to IN capabilities will be based on establishing specific mediation elements and software protocols to protect internetworking procedures. Country study experience indicates that interconnection to service creation and management can be successfully offered to service providers and operators without compromising network integrity.

Data protection

Two categories of data protection issues arise in interconnected networks:

- Caller identification. ISDN and some analog networks enable end users who wish to maintain the privacy of their telephone number when dialing calls to specify that their number not be presented to the called party. To maintain this data protection, interconnecting networks must be required to respect the privacy indicators associated with the call in the signalling messages. Equivalent privacy protection has not been established for calls to freephone and audiotex service providers.

- Customer proprietary network information. The operator who provides end-user access services is in possession of information about the telecommunications requirements and service usage of those customers. This information can provide the operator with a competitive advantage in marketing other network services. Interconnecting and competing operators seek to limit this advantage by demanding access to those databases and by requiring the operator not to disclose the information to its other service divisions.

In summary we conclude:

1. The availability of several suppliers of access and network services can be expected to increase the reliability and availability of telecommunications services.

2. Service control and management interfaces to IN services should be opened to interconnection. The Commission should encourage the development of technical standards for mediated interconnection to service control and service switching.

3. Protection of caller identification privacy should be considered for freephone and audiotex calling. Incumbent network operators possess a competitive advantage from the customer network information they obtain by supplying services to end users. Regulators should require operators to safeguard such information and prevent its use by marketing and other service divisions.

2.6.2 Network management

Network management is concerned with ongoing operation and maintenance of network facilities and services and the ordering and provisioning of new services. Maintenance in interconnected networks requires coordination, sharing of data, and cooperation in testing. Provisioning of network facilities and services requires a similar degree of coordination of order-taking and supply of network service elements.

The concept of a Telecommunications Management Network (TMN) is being developed by network operators and standards bodies. ETSI is in the early stages of developing standards for user-TO and service provider-TO interfaces.

2.6.3 Measuring, charging and billing

Practices for measuring interconnected traffic include enumeration of billing pulses, aggregation of traffic seconds, and erlang measures of busy-hour occupancy of trunks. Current practices used by interconnecting operators are arrived at by commercially negotiated agreements. To support charging arrangements based on capacity utilisation, considered in the economic analysis of interconnection in Chapter 3, network operators could extend measurement systems that they currently use to monitor network utilisation to all of the major points of interconnection.

Methods of measuring and charging for interconnection to IN services are only now beginning to be developed. Database access can be charged on a per-request basis, the method that is used for collect and calling-card calls that reference a line information database maintained by a separate operator. The technical capability to sample and charge for other types of signalling message traffic has not been standardised.

2.7 Conclusions

Technology makes possible a wide variety of ways to supply telecommunications services. There are a large number of potential interfaces and points of interconnection between operators, and telecommunications technology is compatible with vertically-integrated, horizontally-integrated, and specialised operators. Economic factors - including economies of scale, economies of scope, and product differentiation - rather than strictly technical factors determine where operators and service providers will seek to interconnect.

Changes in vertical and horizontal relationships are redrawing the boundaries of telecommunications entities. Key interfaces, formerly managed within the firm or incumbent TO network, are now points of technical and commercial interconnection.

Relationships between an incumbent TO and competitors will frequently be asymmetric. Regulatory attention will be required to ensure that competitors obtain access to interfaces that constitute bottlenecks, and that TOs make the technical changes needed to ensure equal access to achieve fair competition.

Bottlenecks controlled by a dominant TO range from access to end users to intellectual property rights in software and equipment design. The principal technical issues affecting competition among interconnected fixed operators are equal access to network components and services, collocation of equipment, and numbering. Until technical alternatives to these essential resources are developed, regulatory action will be necessary to ensure fair competition.

Fixed networks have well-defined external interfaces at several levels of the network hierarchy, located primarily at switches but also in the distribution system that extends to the end user.

Europe-wide operation of GSM service is technically limited in areas where TOs have not implemented advanced signalling capabilities needed to support roaming by mobile subscribers. Direct interconnection of mobile operators can overcome this limitation and should not be restricted by regulatory action.

Interconnection to intelligent network services and resources will be of interest to many fixed and mobile network operators and to service providers. Although there are many conceptual types of intelligent network interfaces, only those for the most basic call control capabilities have thus far been standardised. Moreover, technical means to ensure essential requirements are not yet developed

The Commission's policy of leaving most interfaces to be standardised by voluntary efforts strikes the appropriate balance between the gains from standardisation and the gains from innovation. Regulatory oversight of industry collaboration to develop standards will be required to guard against collusive behavior. For a limited set of interfaces - those required for Europe-wide services, emergency and directory services, and numbering - the Commission should actively encourage development of standards and be prepared to mandate their adoption.

There is a potentially rich set of logical points of interconnection to intelligent network interfaces. Access at network control and switching points could pose significant risks to network integrity and security. Technical standards for mediated access have not yet been developed, but licensing of interconnectors could provide an alternative to open interfaces. Nevertheless, the availability of several suppliers of access and network services can be expected to increase the reliability and availability of telecommunications services. The service control and management interfaces to IN services should be opened to interconnection. The Commission should encourage the development of technical standards for mediated interconnection to service control and service switching.

In most instances, physical collocation of an interconnector's equipment in the facilities of the dominant TO is technically achievable and provides more nearly equal access than virtual collocation.

Subscriber number portability is difficult to achieve with current technology, but some alternative measures can reduce the TO's advantages of incumbency. Portability is more readily achieved for freephone and other database-related services.

Because upgrading switching systems to support equal access to multiple operators has high costs when older-technology switches must be retrofitted, a policy of mandatory end-user equal access should be limited to newly-installed switches and software upgrades of existing digital switches.

2.8 Annex

A.1 Intelligent network (IN) interconnection

"The Application of ONP to Intelligent Network Functions," KPMG Peat Marwick, March 1993.

- ETSI should create standard definitions of advanced services, by 1996. [19]

Note: The Commission has subsequently mandated ETSI to do this for five key services: freephone, cashless calling, premium rate, virtual private networks, universal personal telephone services. ["Mandate to ETSI on Intelligent Networks - Explanatory Note," 10 Nov. 1993]

- ETSI should develop standards and tests:

  (1) to permit open provision of IN applications to access switching infrastructure based on SS7.

  (2) for essential requirements between key IN elements, to protect network integrity. [20]

The report finds that current technology and standards are inadequate to allow IN interfaces to be identified, let alone be opened through technical specifications. Open interfaces will take many years to be adopted, and SS7 is inherently insecure. Therefore, it recommends:

- National licensing of IN operators, substituting license requirements to achieve essential requirements for the lack of sufficient technical interface safeguards. [152-154]

- ETSI develop a functional model applicable to regulatory interfaces by end 1995.[19]

FCC, Notice of Proposed Rulemaking, Docket 91-346, "In the Matter of Intelligent Networks", Adopted 8/3/93.

The FCC proposes to require that mediated access be available to third parties. Access would be implemented in stages: first at the service management system (SMS), next at the service control point (SCP), and finally at the switch. The comment and reply period for the proposed rules closed December 1; the issues will be examined in the U. S. country study.

Mediated access: the means by which a non-LEC (local exchange carrier) could gain access to the switch for limited purposes, but is prevented from engaging in activities that might compromise network reliability. [para. 22]

Mediated access to the SMS is already in use for some services, such as 800 database service. Two LECs have proposed gateway access to the SCP. FCC suggests that mediated access to each switch would place significant mediation requirements on every switch. [para. 51]

Standards issues raised:

- should a standard set of "triggers" for services be developed for use by all service suppliers? [para. 43]

- should there be industry-wide formats and standards? What should they be? Who should establish them? [para. 55]

FCC proposes to encourage technical and market trials to test different access arrangements.

In this regard, what is the analogous regulatory mechanism in Europe for trials? Action by individual NRAs? How would a European regulatory policy of first promoting trials and subsequently establishing common ONP standards be implemented at the EU level?

A.2 Broadband interconnection

"The Application of ONP to MAN, Frame Relay and Advanced Transmission Networks and their Services", Fischer & Lorenz and Ovum, September 1993.

- Add to the Leased Lines Directive the following higher-speed leased lines: [193]
  - 34 Mbps, unstructured and structured
  - 140 Mbps, unstructured and structured
  - 155 Mbps
- Update the ONP reference list of standards published in the *Official Journal*, to include the added leased lines, and to include Integrated Broadband Services as part of the Packet Switched Data Services. [197]
- Frame Relay: ETSI should establish an Interworking task force to co-ordinate standardisation activity within CCITT, ETSI, and the Frame Relay Forum. [189]
- ATM Cross-Connect: Consider an ETSI mandate to define service offerings and access interface standards. [190]
- Integrated Broadband Services: U.S. markets are rapidly developing frame relay and ATM Cross-connect. ETSI should shift emphasis from connectionless services (e.g., CBDS) to frame relay and ATM. ETSI should be mandated to reinforce work on

definition of throughput classes needed for quality of service and tariffing. ETSI work should occur through an Interworking task force for Broadband-ISDN to co-ordinate standardisation activities now underway in several fora. [191]

- Addressing: ETSI should endorse the addressing scheme adopted by the ATM Forum and should investigate possibilities for Internet address mapping into E.164 addresses. [193]

The report makes these regulatory points:

Frame relay, MAN and other broadband services and networks are fully in the competitive domain, with the exception of voice telephony and provision of infrastructure. Only limited regulatory measures are recommended.

Video conferencing, which includes real time voice, is a TO prerogative in some Member States. It is the report's view that any service with non-trivial elements in addition to voice telephony should be in competitive domain, therefore including video telephony.

Access to high-speed leased lines is limited by very high prices. Cost-based tariffs would yield large welfare gains.

Collocation of equipment on TO premises may be important, for both cost and technical reasons.

A.3 Local loop interconnection

"ONP Applied to the Local Loop", Analysys, Ltd. Nov. 1993.

Local Loop: ETSI Definition:

> The Local Loop (or Access Network) covers any system implemented between the Local Exchange and the user, replacing a part or the whole of the local line distribution network. An Access Network may consist of multiplexing, cross-connect and transmission functions, and may use optical fibre, copper or even radio transmission (or a combination). [79]

Local Loop: Analysys Definition:

> The local loop is that part of the network which provides the customer with access to the core network, and for which it is both feasible and practical to attribute the cost of *dedicated* plant and transmission facilities, in whole or in part, to individual customers. The core network includes all switching and transmission which is not dedicated to a particular customer. [79]

In practical terms, the two definitions are equivalent, except that Analysys includes the local exchange line card in the local loop.

The Analysys report makes these recommendations:

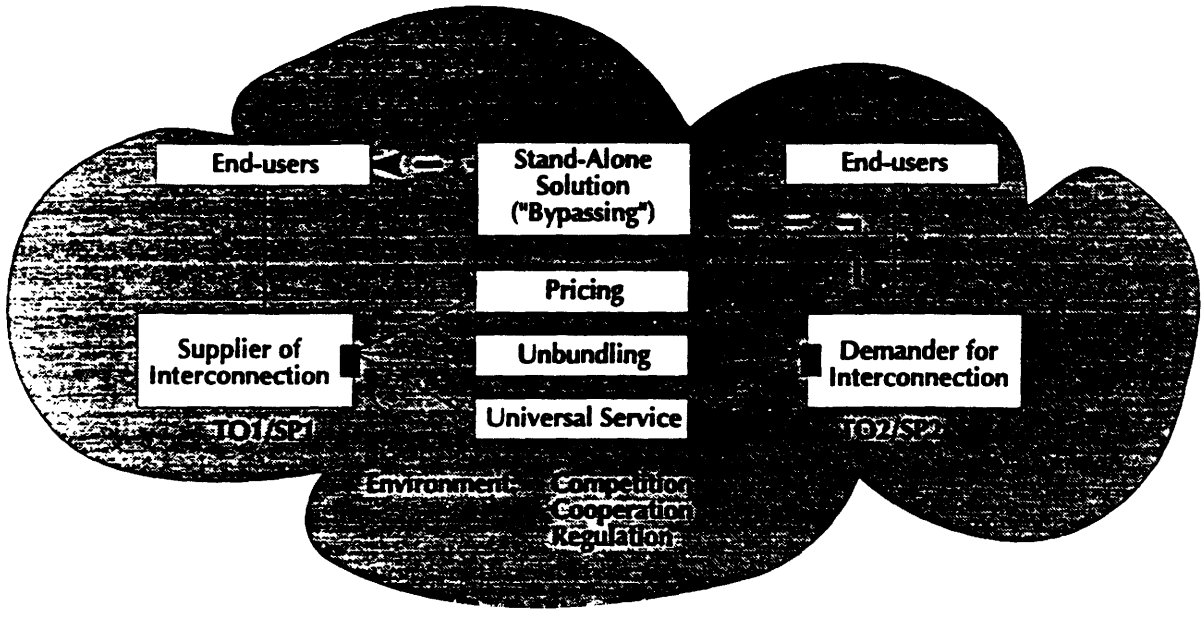
- Modify Voice Telephony Directive by January 1996 to require that TOs publish, by January 1988, a tariff for use of local loop by telephony service providers. Technical and network integrity aspects should be considered in the ONP interconnection study.
- Commission working with NRAs should, by January 1996, produce standard definitions and initial measurements for access deficit charges.
- Commission and ETSI should review progress in standardising network management standards (Q3, others).
- Commission should mandate ETSI to ensure that future standards enable customers to select alternative core networks from the access network. One possibility is digit-recognition to enable call-by-call selection of a core network.
- Reference the ETSI V5.1 and V5.2 standards in the Official Journal
- Add "including video or audio signals where individually selected by the user" to ONP Framework directive, thus providing within definition of a telecommunications service, explicit coverage of access on demand to entertainment.
- Modify the Leased Lines Directive so that where collocation is technically needed in order to offer a service open to competition, then the TO provides non-discriminatory access at a cost-oriented tariff.
- ETSI should standardise ADSL transmission, based on ANSI and Bellcore recommendations.
- Modify the Leased Lines Directive to unbundle into separate charges for each end and for the transmission link.
- The ONP interconnection study should consider technical/commercial aspects of non-discriminatory access to the ISDN D channel by service providers for data transport uses.
- Ensure that customers can request, under general contractual conditions, access to dark fibre.
- Mandate ETSI to investigate definition of a plain copper leased-line standard.

3 Interconnection as an economic issue

3.1 Overview and economic model

In addition to interconnection as a technical telecommunications issue, it is instructive to consider it in a purely economic context. Figure 3.1-1 schematically presents major interconnection issues revealed by the economic approach.

Figure 3.1-1: Economic interconnect model



Independent of how and in which of the many heterogeneous forms interconnection takes place, it always involves a service rendered by a network operator (service provider) to another network operator (service provider). It thereby functions as an input to the product that the second network operator (service provider) wants to place on the market. As such, interconnection corresponds precisely to what we observe every day in the majority of market transactions where a firm buys a product because it needs that product as a raw material or a semi-finished input for the production of its own product.

We have to answer the questions: what are the essential characteristics of these various market transactions? what types among them have obvious similarities with interconnection? and, in what respect is the demand for and provision of interconnection different, so that it warrants special handling on the part of regulatory authorities? Approaching interconnection from this vantage point has the advantage of recognising that it falls within a general class of economic relationships the handling of which by public policy in other contexts may cast light on how to deal with the particular problems posed by interconnection. Such related relationships are to be found, for

example, between adjacant railroads, between gas producers and pipeline companies, and between electricity generation, transmission and distribution companies.

A fundamental observation about market transactions involving inputs needed for further production is that they reflect a division of labour among many different producers of goods and services. In principle, each buyer of such an input could decide to produce the input himself rather than purchase it. In fact, that is what we observe for the so-called vertically integrated producers. In the overwhelming majority of cases, however, firms specialise, so that in the value chain of a firm's product we find a substantial proportion not produced by the firm itself.

Interconnection fits this view of an input provided by a specialised provider to a demander who has not specialised in this particular link in the value chain. What makes it appear different from goods and services exchanged in other market transactions are essentially four characteristics:

(1) Interconnection is often considered a bottleneck input without which the demander could not produce his own service and, due to technical or legal barriers, he cannot produce this input himself. In addition, the supplier and demander of interconnection often compete with each other in the retail market for telecommunications services.

(2) Interconnection involves a degree of ongoing cooperation and interaction between the contracting parties that surpasses other purchaser-supplier relationships.

(3) Conversely, if the two networks approach equal size, the relationship may be reciprocal, in that the operators mutually demand interconnection with each other's network.

(4) Interconnection effectively internalises network externalities that are created by the availability of access to subscribers of other networks.

All four aspects have implications for the conclusion of interconnection agreements, especially the degree with which the one or the other party benefits from the relationship.

As shown in the preceding chapter, physical interconnection usually occurs between different networks or network components. In telecommunications networks, economies of scale and scope are often realised. Telecommunications networks also exhibit externality effects that come about because an increase in the size of a network provides its subscribers with access to a greater number of communication partners. The very fact of interconnection may increase these effects and/or extend the benefits realised in the one network or component to users of the interconnecting part. Against these benefits one should weigh the more dynamic benefits that could be realised if, instead of using interconnection, new ways of reaching out for customers and functionalities were developed and possibly made available for the industry at large. On

balance, because of property (4) interconnection is likely to be highly desirable. However, particularly because of property (1), unregulated markets will generally supply insufficient interconnection.

Once interconnection between two entities has been decided upon (by accord between the parties or by regulatory mandate) two of the crucial questions on which agreements must be reached are the pricing of interconnection services and the unbundling of these services. To a large extent the pricing evolves around the question of proper costing. For many of the elements, a direct costing is impossible due to strong effects of economies of scale and scope in their production. This complicates the price determination in any setting. The issue of unbundling depends in turn on technical feasibility and the willingness of the interconnector to comply with the demander's request. If left to negotiation between the parties, both issues may become largely separated from questions of cost and actual feasibility.

As we have seen, interconnection requires a large degree of cooperation, yet it often takes place in an environment conditioned by competition between the parties. There are two dangers. On the one hand, there is too much cooperation, which is ideal for solving all the technical problems, including unbundling, and which facilitates agreement on prices, but which may lead to less than the desirable degree of competition and even to outright collusion and consequent restriction of trade and thereby too high prices to end users. On the other hand, one may have too little cooperation and too much competitive positioning of the parties involved, so that no pricing agreement is reached at all. Examples for both of these possibilities appear in our country studies, although too much cooperation is harder to detect than too little.

An implication of the economic approach to interconnection is that we study the market for interconnection. This is likely to be a fast-growing market. Its size depends on the concentration of the retail markets for telecommunications services and the degree of vertical integration of TOs.

Assume that all telecommunications operators are vertically integrated. If customers of operator *i* distribute their calls randomly between *i* and other operators, then interconnected traffic as a fraction of total traffic is 1-*H*, where *H* is the Herfindahl index of concentration.[7] Hence, in this case the amount of interconnected traffic is inversely related to market concentration. It (and its value added) is also inversely related to the amount of vertical integration, for example, as entrants substitute their own facilities for interconnect services. An example for this possibility is provided in the UK by NYNEX CableComms which initially depended on Mercury (and, to some extent, on BT) for all its switching but now does 90% of switching itself. An extreme example occurs in the US where, due to vertical separation between local and trunk operators, the market for interconnection has more than $20 billion in annual revenues. Under full vertical

7 As explained below, under the assumptions made, the fraction of outgoing traffic via interconnection is 1-s_i, where s_i is an operator *i*'s market share. Total interconnected traffic as a fraction of all traffic is $\sum s_i(1-s_i) = 1-H$, where $H = \sum s_i^2$.

separation of local and trunk networks the market for interconnection for trunk operators alone equals the size of the trunk retail market (in terms of quantity of calls conveyed rather than in terms of value).[8]

The consequences of these properties of interconnection markets have to be seen in light of the worldwide trends toward (a) increased competition, (b) vertical unbundling and (c) horizontal differentiation of telecommunications services. As a result, the market(s) for interconnection services will quickly gain in importance and will, for some time, be characterised by substantial asymmetries in the size and the characteristics of market participants. Over time the number of market participants and their variety will increase. In a mature situation we can expect that the market dominance of former monopoly providers will subside and that the market for interconnection will offer choice for interconnectors. Nevertheless, we expect that many final subscribers will continue to be reachable only via interconnection through a single TO.

3.2 Special aspects of interconnection

3.2.1 Bottleneck

The aspect of interconnection as a bottleneck input has received most of the attention, and from it the need for mandatory interconnection has been derived.

A bottleneck is also known as an essential facility, which has some tradition in the US antitrust policy. The "essential facility" doctrine originally evolved from a railroad case in 1912. A number of railroads had controlled the only bridge into St.Louis and denied access to this bridge to their competitors. The Supreme Court decreed the bridge a bottleneck and declared denial of access to be a restraint of trade in violation of the Sherman Act. The main elements of a bottleneck are

- control of a facility by a single firm,
- facility essential for production,
- inability of others to practically duplicate the facility,
- denial of access with substantial harm to competition,
- absence of a valid business reason for not providing access.

While we do not question the bottleneck property for a large number of interconnection cases, we nevertheless provide examples demonstrating that it does not apply generally. These examples contribute to answering the question, under what circumstances should interconnection be considered a right and be guaranteed by regulatory rules? and, what are the conditions under which the competitor should be

8 Bypass by use of direct trunk facilities would already be a form of verical integration.

obliged to seek a stand-alone solution, i.e. gain access to end-users by his own devices?

The most relevant example of bottlenecks in telecommunications is access to residential customers who have only one line running into their homes. The cost of a second line from a different supplier is usually prohibitive relative to the cost of interconnection. Thus, access to such residential customers is a bottleneck independent of the supplying local operator's market share. For example, a cable TV company having 5% share of local lines in a city would have a bottleneck over the supply of its 5% of residential subscribers. Such a cable TV company would have the ability, though not an incentive, to exclude others from local access. A vertically separated TO with the remaining 95% market share would have a similar ability but possibly more incentive to exclude others from local access, because its customers could complete 95% of their local calls without interconnection with the cable TV company. A vertically integrated TO with the 95% market share might, in addition, have an incentive not to interconnect with competing trunk operators.

In contrast, access to multiline business customers or to trunk transport may not be such a bottleneck. Multiline businesses have access lines that could be distributed between several carriers. And there are many equivalent routes of trunk transport between two points that are far enough away from each other. In such instances, the bottleneck property would have to be established on a case-by-case basis.

We conclude:

1. The bottleneck property is of utmost importance because it calls for some kind of government intervention establishing a right to interconnect (by regulatory decree or competition policy).

2. However, the bottleneck property itself does not necessarily hold for all types and aspects of interconnection. It therefore has to be established on a case-by-case basis.

3.2.2 Asset specificity

Interconnection usually requires dedicated capital equipment, such as transmission lines and switches that have a long life and are not easily reused if interconnection is ceased ("putty-clay" aspect of investment). There is a cost to changing interconnection partners or going alone, once the arrangements have been made. Asset specificity has received particular attention in the institutional economic literature (Williamson, 1985). Once the assets are sunk, asset specificity gives rise to many kinds of anticompetitive and opportunistic behavior. Correcting or preventing such behavior calls for government

intervention, vertical integration or long-term contracts.[9] Contractual interconnection agreements as contracts are generally long term in nature, either implicitly (by right of interconnection) or by explicit clauses on duration. Also, the assets involved tend to be many, raising the level of complexity of the transactions. Such complexity could be reduced through trade rules that could be embedded in an interconnection framework. In some cases, equipment used for interconnection is more fungible between potential partners (e.g. satellites). In such cases interconnection agreements could be on shorter term and more easily left to the market.

Asset specificity also generates asymmetric information because there are no market prices for all aspects of equipment entering into the costs of interconnection. Even if the interconnecting partner knows these items they may not be verifiable in the courts. This may call for government intervention. However, while asset specificity disturbs the functioning of markets, the accompanying asymmetries of information also burden government intervention. Many aspects of interconnection agreements deal with specific technical, geographic, organisational or customer-specific information that regulators ordinarily cannot assess.

From this we conclude:

1. If there is to be government intervention it has to strike a balance by leaving enough "localised" issues to private party negotiations and by focusing on issues that lend themselves to general rulings.
2. Furthermore, government intervention should put emphasis on methods that make the different parties reveal their private information.

3.2.3 Reciprocity (but asymmetry)

A specific feature of interconnection agreements is that they usually involve traffic flows and capacity provision on both ends. Thus, both parties are at the same time buyers and sellers. Depending on the degree of symmetry of this relationship, it can be a source of commonality of interest. In the case of full symmetry, for example, interconnection charges would totally net out between the two parties and therefore be no source of contention, as was exemplified by international accounting rates over many years. Usually, the degree of asymmetry is a function of the vertical integration and relative size of the parties involved.

9 It may also call for the creation of new property rights, such as joint ownership rights in network facilities, something we expect will happen in the long run.

We conclude:

1. The degree of symmetry and reciprocity in interconnection relationships should be taken as an important indicator for regulatory policy.
2. The more asymmetric the relationship between interconnecting parties the more need there is for direct regulatory intervention.
3. The more symmetric and reciprocal the relationship is, the greater is the need for monitoring the danger of collusion.

3.2.4 Interconnection and final outputs as related goods

The relationship between the demander for and the supplier of interconnection depends to a large degree on the types of firms interconnecting with each other. If both are operating in totally separate markets, the relationship is simply one of vertical market power. This would, for example, approximately hold for the US until now, where local exchange carriers (LECs) interconnect with interexchange carriers (IXCs) and the two types of firms do not compete for final consumers (except for short-distance - intraLATA - trunk calls). Even in this case there are basic substitutional and complementary relationships that complicate the analysis. First, LECs sell access to final consumers, and the demand for this access depends, among others, on the price for trunk calls. As the price for trunk calls decreases, demand for consumer access to the network increases. Since the demand for trunk interconnection is derived from that for trunk calls, trunk interconnection and end-user access are likely to be demand complements. Second, reciprocal calling effects can make incoming and outgoing trunk calls complements (or, less likely, substitutes) for each other. Third, the local loop is used for both local and trunk traffic. They therefore compete for the same facilities, when it comes to peak-load congestion. Thus, they are also substitutes in supply. Similar relationships hold for international calls.

Interconnection is further complicated through the fact that the interconnecting parties often find themselves in a competitive relationship, in that both compete for the business of the same end-user. Thus, control over the bottleneck facility may not only tempt the supplier to engage in simple monopolistic pricing but also to shut out competition by refusing to deal (or by raising rival's cost). Only in the case of completely complementary networks would this tendency vanish. However, what services are competing with those of a TO and what are complementary is not always clear to an outsider and may not be stable. For example, at high prices and low levels of penetration mobile services appear to be complementary to fixed-link services, while at low prices and high levels of penetration the two are likely to compete with each other. As a further example, some information services compete with information services supplied by a TO while others do not. In general, however, information services are complementary to the TO's network services.

As a consequence of this discussion the relationship between interconnection services and the final outputs produced by the interconnecting parties is likely to be complex.

Nevertheless, we conclude:

1. As a general rule one can expect that, in the case of competitive or substitutive relationships between the final outputs, interconnection and the final outputs will be substitutes as well. Conversely, in the case of complementary relationships between the final outputs, the relationships between interconnection and the final outputs is likely to be complementary.
2. As a result, a party with bottleneck power over interconnection facilities will want to receive a markup above cost for interconnection services in the former case and may be willing to grant charges below cost in the latter case.
3. The question is whether such deviations from costs are economically beneficient.

3.2.5 Externalities and economies of scale and scope

Interconnection is called for by certain combinations of economies of scale, economies of scope and externalities. If there are strong economies of scale and scope and strong positive network externalities, the traditional concept of an integrated monopoly provider would be superior to several interconnected providers. At the other extreme, if there are no economies of scale and scope and no externalities at all, then many independent suppliers would coexist totally without interconnection. With technological change, growth and increasing diversity of telecommunications markets, intermediate cases have become optimal that make interconnection attractive. Interconnection between independent firms occurs, for example, if several firms with economies of scale and scope supply different segments of the market, each customer is not buying from all these firms at the same time, and, because of demand externalities, the customer of one firm wants to communicate with the customers of all the other firms to which he does not subscribe. By providing positive network externalities to the interconnected customers interconnection increases social surplus.

We conclude:

1. The global network externality, that is realised when formerly not connected networks become interconnected, is highly important.
2. Together with the bottleneck property it provides the strongest case for policy intervention in interconnection and for a duty of operators to offer interconnection.
3. Interconnection increases social surplus. In its first-round effect, opening the bottleneck helps competitors, while taking care of the externality helps consumers.[10]
4. The duty to interconnect is not unlimited. It faces two types of limits. First, it has to be assured that interconnection can work at reasonable costs. Second, the scope of interconnection and level in the network, at which interconnection occurs, depend on technical and market requirements, including the availability of competitive options and the protection of innovations (as explained for IN services).
5. While the general case for a right to interconnection follows directly from the network externality, one may hold that strong economies of scale and scope could establish a case for vertical integration instead of interconnection. We do not believe that economies of scale or scope should (as it has in the past) interfere with the right to interconnection.

3.2.6 Communities of interest

Network externalities may also be called demand economies and diseconomies of scope. Such economies and diseconomies occur simultaneously when certain consumer groups choose not to interconnect or to do so only in an asymmetric fashion. Internally, these groups want to communicate intensively, while they exclude others from freely communicating with them. A simple example of this is the choice of nearly 60% of residents of Los Angeles to have an unlisted telephone number. More important for the interconnection between telecommunications service providers are communities of interest that build their own networks, for example, banks. In a way, geographic entities can often be treated like communities of interest: countries or states within a country.

Communities of interest may create a desire not to interconnect with others or at least not to interconnect in a reciprocal fashion. This desire may be a legitimate and socially acceptable concern but it may also interfere with a "right-to-interconnect" or an "any-to-any" interconnection policy.

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10 A duty corresponds to a right to interconnect. The duty can be imposed on each operator specifically, while a right cannot be granted without specifying the duty.

We conclude:

1. A specific case for a refusal to interconnect, based on communities of interest, needs to be made.
2. Such a case would have to include a showing that there is (a) no demand by others to interconnect or a demonstrated absence of monopoly power, (b) sufficient public interest in no interconnection (national secrecy, private intrafirm network, protection of innovation).
3. We believe that such a case can either be treated by way of specific exemption from the general requirement to interconnect or by creating a private operator status that is associated with loss of some other privileges (such as wayleaves).

3.2.7 Price rebalancing and universal service obligations (USOs)

In most countries telecommunications retail tariffs are unbalanced in the following sense:

- rental charges for telephone lines and one-time charges for establishing subscriber connections do not cover the corresponding costs,
- local usage charges have lower markups on costs than long-distance charges,
- peak and off-peak prices do not correspond to actual load patterns.

The stated justification for these unbalanced rate structures invariably rests on the objectives to help low income subscribers and to achieve universal service. Since unbalanced rate structures affect all subscribers, they fulfill neither of these objectives well. As income distribution measures they are untargeted and possibly regressive. As a means of increasing subscriber penetration they become less suitable the higher the percentage of subscribers in the population that would continue to subscribe at higher line rental and at higher initial connection charges. Both, for distributional and universal service reasons, targeted price discounts for needy and marginal subscribers are much more effective than a generally unbalanced rate structure. Politicians often fear opposition from subscribers that have to pay more for telecommunications servicies under rebalancing. In fact, rebalancing (at constant aggregate tariff levels) leaves most consumers better off. Only low-usage consumers would be worse off and they can be targeted by special low income and low usage tariffs."

This report is not so much concerned with the justification and scope of universal service obligations placed on TOs.[11] Rather, we concentrate on the effects of

11 This has been done in Cave, Milne and Scanlan (1994).

interconnection on the fulfillment of such obligations and the reciprocal effects of USOs on interconnect pricing.

The pricing of interconnection is tied in with the universal service obligations placed on dominant telecommunications network operators in the following way. The obligations may increase the costs of the operators in question and, more importantly, cause serious distortions in their price/cost margins. If no such obligations are placed on competitors, the latter could gain an advantage by exploiting the imbalances in the incumbents' price structures. Thus, interconnection may effectively increase the burdens of USOs on incumbent TOs. It has then to be decided whether and to what degree competitors should also be burdened with USOs, either directly or by having to pay part of the costs.

In order to simplify understanding and treatment of USOs, it helps to view USOs as special telecommunications services that are demanded by the government (acting as an agent for certain customer groups). As is the case for other services demanded by government, the questions are, who shall provide them, what are their costs, what should be their price and who shall pay (or, how should they be paid)? If they were paid directly by government (financed by taxes or otherwise) this would be a standard government procurement problem. As long as we can separate the procurement task from payment, we may still want to treat USOs as a standard procurement problem and then treat the payment as a separate issue. Starting with the procurement, we may ask what services USOs include. There appear to be two generic types. First, USOs consist of services that are deemed basic and are provided to low income/deserving subscribers (including the handicapped). Such subscribers are distributed randomly over a geographical area and are likely to be low volume users. Second, USOs consist of services that are deemed basic and are provided to high cost/remote subscribers. Such subscribers are restricted to certain geographical areas, usually with low density. In both cases, different types of telecommunications service providers are likely to have advantages in providing USOs. For example, satellites may be the best means of supplying remote areas, and mobile radio may be the best means of providing services to low users (because capital costs are low and spectrum is used sparingly). However, because of its sunk network the incumbent TO may have advantages using fixed-link services in both cases. A potentially third type of USOs is a constraint preventing the incumbent TO from increases in local interconnect and rental charges and from geographic tariff deaveraging. We may interpret such rebalancing constraints as including both of the generic types of USOs.

There are two basic ways of procuring and pricing of USOs in the context of interconnection agreements:

- costing out of obligations for all TOs and interconnectors providing the services. In this case subscribers, by choosing a particular TO, decide who provides the USOs. A refinement of subscriber choice can be achieved by using USO vouchers with prespecified values, that are given to needy and remote subscribers.

- auctions that lead to least-cost procurement. In this case the government decides who provides the USOs.

Both voucher systems and auctioning of USOs should, through the targeting and the competition involved, drive down the costs of providing USOs. The payment for USOs needs to have nothing to do with interconnection. USOs could be paid for

- out of government subsidies. This is likely to be economically most efficient but politically not feasible.

- by a levy on all telecommunications retail services. The allocative distortions and administrative costs of such a levy are likely to stay very small so that this could be economically quite efficient. Such a levy could be of the VAT type or of the consumption tax type. Because of the likely small amount, an ad valorem consumption tax is to be preferred. It should be paid out of the operators' total revenues from telecommunications services and need not be an explicit part of consumer bills. The collected amounts would flow into a USO fund and would be disbursed to operators performing USOs or as targeted subsidies to consumers who receive them, for example, in the form of USO vouchers. Vouchers would have the advantage of not distorting the tariff structure. Also, the administrative costs should stay small.

- through internal subsidies by all service providers. This is historically the most relevant case and the one that leads to the desire to include payment of USOs in interconnection charges. Also, internal subsidies have often been justified with universal service obligations, but the link between the two was rarely if ever made explicit.

- through a component of interconnection charges paid by all interconnectors and imputed to interconnection services provided by a TO to itself. This requires a transparent process of arriving at the charges and becomes cumbersome, once the dominant TO ceases to be the only supplier having USOs.

In our opinion, in most countries the most lacking property of USOs is the proper identification and financial assessment of costs incurred and/or revenues lost because of USOs. If such identification has been achieved, USOs can be treated in various ways as indicated above. Although this is not our preferred method, we discuss financing of USOs through interconnection charges below in Section 3.5.

3.3 Alternatives to interconnection between separate operators

If we were to assume that interconnection between different telecommunications operators were prohibited by law, what would happen? We see two extreme possibilities. The first is complete separation, the second is full integration.

3.3.1 Stand-alone solution

First, as illustrated above in Figure 3.1-1, the stand-alone solution of complete separation means that a customer who has subscribed to a particular network provider and wants to communicate with another customer, can only do so if the other customer is on the same network. In order to communicate with many or all other end users in an economy, a customer therefore may have to subscribe to several network providers. One consequence of this arrangement is duplication which may lead to higher overall costs to society. It will also lead to advantages for larger network providers over smaller ones because of the economies from less duplication. Depending on other economies/diseconomies in the provision of network services and, depending on the type of competition, the result may be market dominance by one firm or full monopoly. M. Mueller (1988) claims that the advantages to be gained by a firm from reaching such market dominance will spur innovation, so that the Schumpeterian gain has to be weighed against the static efficiency loss from market power. There may, however, also be a long-term (innovative) efficiency loss associated with it in that the dominant firm retains first-mover advantages that hinder further innovations by others.

Full separation may also lead to inefficient entry by other firms or bypass by end users if the dominant firm cannot fully price discriminate. In this case, the dominant firm may rather want to lose some consumers than give up on monopoly pricing. The well-known dominant firm price leadership model with a competitive fringe would be applicable here. It shows some erosion of the dominant firm's market power by the fringe. However, as a rule this occurs by increasing total industry costs.

We conclude:

1. A stand-alone solution that results from refusals to interconnect or from excessive interconnect prices charged by TOs should not be tolerated.
2. Stand-alone telecommunications service providers may have their niche for private communities of interest, or they may be the very unlikely result of strong scale and scope economies, but that needs to be demonstrated. The latter would give an ex-post justification for the bygone era of telecommunications monopolies.
3. Stand-alone provision of telecommunications services may also be the result of interconnection charges that lead to inefficient bypass. While inefficient bypass should be avoided, this may not always be possible, due to inability or unwillingness to price discriminate with respect to interconnection charges.

3.3.2 Vertical integration/mergers

Second, if separate firms were not allowed to interconnect they may instead choose to merge with each other. In its end result this case may resemble the previous one in that a dominant vertically integrated firm or a monopoly emerges. Only the path to this outcome is different. In particular, it may be faster and appear more organised. At the same time, consumers are less likely to benefit on the way because competition is excluded from the outset. An in-between case is that of strategic alliances between firms that take equity positions in each other.

We conclude:

> Mergers and alliances should be treated under standard competition policy criteria.

3.4 Economic aspects of specific types of interconnection

3.4.1 Interconnection of fixed networks

The physical and technical differences between different types of interconnection have been treated extensively in Chapter 2. In this section we want to describe and analyse some economic differences between specific types of interconnection. The benchmark case to which the differences are related is the interconnection between fixed networks. That has been the case implicitly described in the previous sections in this chapter and will be the background for the sections to come.

When we distinguish differences between the fixed-fixed and the other cases, it has to be borne in mind that the variation within the fixed-fixed case is substantial and may be just as large as the variation between the fixed-fixed and the other cases. In particular, the relationships between fixed-link operators can be highly asymmetric by size, amount of traffic, dependence, final outputs, and so on.

We conclude:

> The framework for interconnection between fixed networks needs to be able to deal with a large variability of cases. This can either be done by keeping the framework sufficiently open or by anticipating and explicitly dealing with the different cases.

3.4.2 Interconnection of fixed and mobile networks

From an economic perspective the difference between fixed-mobile and fixed-fixed interconnection could lie in the supply conditions and in demand. In fact, it is a combination of the two. From the demand side mobile services are more convenient

than fixed services because they are almost ubiquitous. However, their quality is inferior, in particular when used indoors. From the supply side, mobile services are currently more expensive to provide (due to costly handsets and limited spectrum). Thus, mobile services are an imperfect substitute to fixed services. In particular, at low penetration rates fixed and mobile services may in many countries be complementary to each other. This feature would explain why interconnection agreements with mobile operators have, in several countries, occasioned little regulatory interference. As mobile services penetrate further, they may substitute for fixed services. In particular, they will replace fixed-service usage and 2nd and 3rd fixed lines into homes. New PCN and PCS services may actually even replace 1st fixed lines.

Due to spectrum scarcity and public spectrum management policies, mobile telecommunications has in the past been supplied by narrow oligopolies, with duopolies being the most common case. This is, however, unlikely to be a natural duopoly, and there is no reason why the market should not be able to support 10-15 operators in the same geographical area. A peculiarity of the market so far has been that one of the operators is usually owned by the dominant TO and that the others have to interconnect to this TO. Contrary to entry in fixed-link telecommunications, the non-TO mobile operators are commonly of equal size as the TO's mobile operator.

Mobile operators may have to interconnect with fixed operators for their backbone network and for call completion in either direction. Other than issues raised by their competitive position, demand relationships, or regulatory distortions, we currently see no major economic differences between fixed-mobile and fixed-fixed interconnection.

The framework should, however, be open to different market structures, technologies and demand configurations. For example, the success rate of call attempts is likely to differ between fixed-fixed and fixed-mobile interconnections. If conveyance rates are charged per minute, a different success rate may have to lead to different cost-based charges. However, if call attempts were charged in addition to successful usage, the charge per call attempt and the charge per minute need not differ for the two types of interconnection.

As a consequence, we conclude:

1. There are no economic reasons to treat fixed-mobile interconnection agreements differently under the same general interconnection framework for fixed-fixed interconnections.
2. The differences, if any, concern specifics, such as the naturally asymmetric positions of the two parties, the potentially complementary nature of the two retail products and implications for access charges.

3.4.3 Interconnection of mobile networks

Since mobile-mobile interconnection occurs between competing parties (unless they supply disjoint geographic territories), issues of asymmetric market power and collusion play a major role. An economic demand for mobile-mobile interconnection arises for adjacent or overlapping mobile operators, but this in and of itself would not create new economic issues. Such issues arise largely from inefficient and anticompetitive transit arrangements for indirect interconnection between mobile operators. In principle, mobile operators should make an efficient choice between interconnecting directly or via transit agreements with a fixed-link carrier. This choice will depend among other things on the intensity of usage and availability of interconnection points.

We conclude:

1. There are good economic reasons to allow and encourage direct mobile-mobile interconnection.
2. The same holds for undistorted transit interconnections, which can provide an alternative and a yardstick for direct mobile-mobile interconnections.

3.4.4 Interconnection in an intelligent network environment

As described in Chapter 2, interconnection in an intelligent network environment poses problems on top of those solved for the other environments. In particular, intelligent networks require technical innovations that have to be developed through resources and ingenuity. The incentives for achieving this have to be created and the costs for providing these incentives have to be covered from interconnection agreements. Also, information may have to be shared at a time when intellectual property rights have not yet been fully established. Interconnection policy will therefore have to strike a balance between the legitimate secrecy concerns of those developing the technology and the interests of interconnectors and service providers in influencing and learning about these developments and evolving new industry standards.

As a consequence, we conclude:

1. There are no economic reasons to treat interconnection agreements in an intelligent network environment differently than under the same general interconnection framework as for fixed-fixed interconnections.

2. The differences concern specifics. In particular,

   (a) the intelligent network environment is likely to prevent stable and standardised interconnection agreements from emerging in the near future. Interconnection agreements will have to continue to change over time and to become adapted to new circumstances. This is important because of the nature of specific investments. It means that long-term contracts for interconnection have to remain open to change although the accompanying investments are largely sunk and therefore cannot be made undone. The necessary adaptation may provide for a continuing role of the regulator.

   (b) to the extent that IN features embody innovations by the interconnecting TO (rather than innovations by equipment manufacturers) licence fees incorporating the value of these innovations need to be considered as part of interconnection charges.

3.4.5 Interconnection in a broadband environment

Interconnection in a broadband environment could have been treated under fixed-fixed interconnection. It does, however, pose some of the same issues as interconnection in an IN environment. In particular, broadband investments, due to their high capacity, reintroduce economies of scale and therefore natural monopoly concerns. Broadband has almost only fixed costs, no variable costs, and virtually unlimited capacity. Efficient pricing is therefore going to be very difficult, at least initially. In order to maintain competition in the telecommunications markets in general, the introduction of broadband may have to occur on a joint ownership basis. This could follow patterns already established in other network markets, for example for natural gas pipelines.

3.5 Pricing issues

3.5.1 Pricing under laissez faire without regulatory interference

Price regulation of interconnection needs to do better than the unregulated market would perform. The effects of laissez faire on prices for interconnection services depend, to a large extent, on the prior structure of the telecommunications (end-user) market. Thus, we have to consider the interaction between these two markets and have to differentiate between laissez faire in the end-user market for telecommunications and

laissez faire in the market for interconnection. There are three canonical market structures that can serve to identify policy issues and to evaluate policy solutions. First, a local exchange monopoly may be vertically separated from the trunk market (which may be oligopolistic or competitive). Second, a vertically integrated dominant TO may face a competitive fringe in the trunk market. Third, the vertically integrated dominant TO faces an oligopoly in the trunk or mobile market.

Assume that both interconnection and end-user markets are under total laissez faire, and we start out with a vertically integrated monopoly in the end-user market and therefore no interconnection. Then the monopolist may mimic the outcome of Section 3.3.1 and refuse interconnection. This certainly makes entry by others difficult, because an entrant would first have to find a critical mass of subscribers in order to make subscription worthwhile. An entrant could only hope to gain such a critical mass if he could offer some guaranteed subscriber base. Any guarantee of this type (for example, special rebates if a certain number of subscribers is not met) would be very expensive and would create a substantial barrier to entry.

A second possibility for the incumbent monopolist is to interconnect with potential entrants and try to maximise profits through interconnection prices.[12] In particular, the incumbent firm will have an incentive to use this strategy if the entrant offers a service that does not compete with the incumbent's service. Then interconnection will actually increase the value of the incumbent's offerings and the incumbent will charge a set of multiproduct monopoly prices for all its services (including interconnection) that will take into consideration the demand complementarity and the entrant's options of bypassing the incumbent. The case is different if the entrant offers a substitute to the incumbent's services. Even then it may be optimal for the incumbent not to foreclose interconnection but rather make money from it (Economides and Woroch, 1992). Since interconnectors will charge their own mark-up for their customers, an inefficiency due to double-marginalisation may emerge.[13]

If, by virtue of regulation or competition policy, a mature market for end-user telecommunications services has developed that is horiziontally less concentrated or vertically separated, or both, then the laissez faire market for interconnection may evolve very differently. Assume that all operators have the same amount of vertical integration and that there are several equally-sized operators that compete for end users. Each operator i has market share s_i among end users. If customers of an operator i would want to distribute their calls randomly between i and other operators, then interconnected traffic as a fraction of total traffic originating from operator i is $1-s_i$. The demand for interconnection by an operator is therefore larger the smaller the operator. This does not, however, mean that the marginal willingness to pay per unit of

12 In fact, as an optimisation problem, refusal to interconnect is a special case of pricing.

13 Double-marginalisation means that both the interconnection charge and the retail service have their own markups on marginal costs. In contrast, a vertically integrated monopoly only incurs one markup. As a result, the allocative inefficiency of vertical separation is increased if there is market power on both production stages.

interconnected capacity or traffic conveyed necessarily differs in any way between small and large operators. Such differences would depend, among other things, on the value of the network externality as penetration increases. We would expect that the marginal network externality decreases with penetration. For example, we would expect that a customer, who can currently reach 99% of her acquaintances by phone, values the increase to 100% less than a customer, who can currently reach 1% of her acquaintances, values an increase to 2%. The correctness of this conjecture would imply that the smaller operator *i*'s market share the larger its demand for interconnection. In oligopolistic markets, this situation could lead to unstable competitive relationships and dichotomous market structures, once market shares have become asymmetric.

The fact that telecommunications operators sell each other interconnection and compete with each other for end users is likely to increase their incentives for collusion. While we have not seen much formal modelling of this tendency, it is in line with the economists' folklore outside telecommunications about the behavior of multinational and conglomerate enterprises that often face situations of reciprocal dealings. In particular, certain interconnect pricing practices are likely to facilitate collusion. These pricing practices include the currently used international settlement procedures and revenue sharing. Also, interconnect prices that are based on an operator's retail tariffs may well have collusive effects. The likelihood of collusion is further enhanced by the long-term nature of interconnection agreements (due to asset specificity, as mentioned above). There is some formal modelling confirming the related tendency to use high interconnection prices to implement high end-user prices in the special case of international accounting rates (Lu and Hakim, 1993).[14] Carter and Wright (1994) show that collusion among interconnectors can be used to implement collusive outcomes in end-user markets, but this collusion can be efficient because it reduces the effect of double marginalisation.

To summarise the diverse set of possibilities, there appears to be little hope that an efficient market for interconnection services will develop without policy intervention.

14 Hypothetically, we might want to consider a perfectly competitive end-user market. Under fairly general conditions such a market implies that a competitive market for interconnection services will emerge and have properties similar to those in other competitive markets. Network externalities would, however, only be overcome to the extent possible without subsidising consumers.

The conclusions on pricing under a regime of laissez faire are:

1. If left to themselves, markets for interconnection services are likely to reflect either collusive arrangements or monopoly power of incumbent TOs. In either case, interconnection prices are likely to be too high relative to prices that would emerge under competitive conditions.
2. If there is a danger of collusion, low regulated interconnection prices may be advisable. However, they may be hard to achieve against industry interests, and their likely uniformity may spur collusion in the retail market. It may then be better to leave the market to itself and only intervene through the tools of competition policy. The lower interconnection charges are kept, the less harmful are the effects of any collusion in the end-user market, because collusive markups are then based on lower marginal costs.
3. The more likely case is that of monopoly power in the market for interconnection. At the same time, prices in telecommunications retail markets are likely to reflect both the effects of partial competition and regulatory preferences (including cross-subsidies, USOs and the like). As a consequence, interconnection prices cannot simply be left to the market, nor are they regulated easily. This necessitates a methodology for interconnection pricing under regulation.

3.5.2 Methodology for pricing with regulation

We further develop the case for regulation in Chapter 4. Here we sketch the broad implications of a regulatory pricing regime. The pricing prescriptions would apply to ongoing regulation or to specific regulatory determinations. The special emphasis is on interconnection with a dominant TO.

3.5.2.1 Regulatory objectives

The optimal regulatory pricing policy for interconnection depends on regulatory objectives and the institutional and other constraints that the regulator faces.

The objectives include the following:

- social welfare. This can be viewed as the aggregate overall objective function of the regulator and would include all of the subsequent objectives.
- efficiency. The prime objective considered in the economic literature on regulatory pricing has been efficiency in the sense of Pareto optimality and the maximisation of

social surplus.[15] The use of social surplus is compatible with the partial equilibrium approach commonly used for telecommunications pricing. Social surplus maximisation leads to the famous marginal cost pricing rule (socially optimal prices). Efficiency can be subdivided into

(a) production efficiency (technical efficiency and efficient input prices) and

(b) consumption efficiency (efficient output prices and maximisation of consumer surplus)

- equity and fairness. Distributional equity of pricing can be captured through weights attached to the different groups in society, for example, according to their income and wealth. This is commonly done for the components of social surplus, giving different weights to consumers, firms and government. Fairness is not that easily quantifiable. There are many aspects to fairness. For example, fairness can relate to the process by which regulatory decisions are made; it can relate to property rights in the status quo, to rights of access to telecommunications, to equal treatment in equal situations, to the costs caused by a consumer and other items. These different views of fairness are not all compatible with each other. They have in common that they may only be tractable as constraints in a regulatory objective function. The most important fairness constraints for interconnection prices include the following two:

- non-discrimination. The equal treatment of similar cases is usually viewed as fair, and it is the result of competition even if it is not efficient under all circumstances. Thus, to the extent that competitive outcomes are taken as a benchmark for interconnection pricing, non-discrimination is a desirable constraint.

- cost-orientation. Again, this is a fairness constraint that is usually also called for by competition. Cost-orientation, however, is not unambiguously defined. While marginal cost pricing is definitely cost oriented, views can differ about pricing that takes both costs and demand elasticities into consideration (the inverse elasticity rule or Ramsey pricing).

Cost orientation is of overriding importance for interconnection pricing. Below we will argue that it is long-run costs that should ideally be the cost standard used whenever the cost of providing interconnection services is at issue. For telecommunications, where economies of scale and scope play an important role, two kinds of long-run costs must be distinguished: stand-alone costs and incremental costs.[16]

Stand-alone costs, as the name implies, arise from the provision of a service or a group of services all by itself, that is to say without the benefit of any economies of scale or scope afforded through its provision together with other services. For example, a new

15 Pareto optimality means that no economic agent can be made better off without making at least one economic agent worse off. Social surplus is the sum of consumer surplus, firms' profits and other rents generated in the market.

16 See Baumol (1991) for a full treatment of the ideas sketched below.

competitor would face stand-alone costs for its services if it had to provide end-to-end service without any possibility of interconnection.

Incremental costs, in constrast, are the costs that arise if the provision of the relevant services occurs in the context of the production of other related services and there is the possible advantage of economies of scale and scope. For example, if a new competitor is granted interconnection with the network of an incumbent operator, the cost to the incumbent of providing this interconnection will normally be an incremental cost because it is provided in conjunction with other similar services, which give rise to the said advantages.

Incremental costs play an important role in the discussion surrounding the pricing of interconnection services. They generally constitute a lower limit at which an interconnection service is to be priced. Stand-alone costs in turn serve as a standard for the upper limit of interconnection prices.

We conclude:

1. If the new competitor's stand-alone costs of connecting with its customers are lower than the incremental costs of interconnection with the incumbent's facilities, interconnection would bring no economic advantages.
2. If, however, the new competitor's costs of stand-alone provision are higher than the incumbent's incremental costs of interconnection, interconnection would be economically beneficient. The new competitor would obviously take advantage of interconnection whenever the corresponding price would be below its stand-alone costs.

3.5.2.2 Constraints faced by the regulator

The constraints faced by regulators include:

- informational constraints. Regulators are not fully informed about a firm's cost and demand functions and other aspects of the pricing problems. This creates constraints on their ability to maximise the regulatory objective function. To the extent that the regulated firms possess this information, regulators may be able to extract the information via incentive mechanisms (treated in Laffont and Tirole, 1993a).

- institutional constraints. Regulators do not have unlimited powers. They are constrained in various ways. In particular, (a) they have a limited term of office and therefore cannot commit over time, (b) they have limited powers while in office and are constrained by laws, courts and government, (c) their jurisdiction is constrained

geographically, and (d) the regulator is constrained by staff size and regulatory budget restrictions. Especially important for interconnection charges are:

1. jurisdictional constraints. A regulator may have no control over activities outside its jurisdiction. Interconnection can occur between TOs that are under the same or under different jurisdictions. If the TOs are under different jurisdictions either a regulatory body with jurisdiction over both needs to be created or the two regulators have to cooperate.

2. restrictions to types of regulation. For example, the range of permissible incentive schemes may be restricted by requiring cost-based or rate-of-return regulation. Also, restructuring of regulated prices may be institutionally restricted. Finally, regulation may exclude external subsidies or taxes. Regulation then has to assure that the regulated firm at least breaks even. Under social surplus maximisation by a monopolist facing such a balanced budget constraint and producing at decreasing costs, the famous Ramsey pricing rule emerges. According to this rule, the regulator should set prices such that the price markups over marginal costs of the firm's outputs vary in inverse proportion to the (super-) elasticities of the outputs.[17] The rationale for this rule is that the regulator has to trade off allocative inefficiencies created by higher markups against contributions to finance fixed costs. The lower the demand elasticity, the higher the contribution from a price increase. Thus, a higher markup is justified for outputs with lower demand elasticities.

We conclude:

The objective function and constraints adopted for this study include the following:

- maximisation of social surplus, including profits of TOs and interconnectors
- balanced budget to allow efficient TOs at least to break even
- non-discrimination for interconnection charges paid by different interconnectors. We leave open at this point whether the TO should impute to itself the same charges
- upper and lower bounds on interconnection charges given by stand-alone costs and incremental costs, respectively
- restrictions on retail price rebalancing

17 The super-elasticity gives the total effect of a price change, including cross-effects from related markets.

3.5.3 Theoretical pricing models and their implications

A number of pricing rules have been proposed in the literature, based on theoretical models. These models make various assumptions, upon which the relevance and range of their results depends. Because of the wide range of possible outcomes and because of the complicated interaction of variables that regulators have a hard time to observe the theoretical models are likely to provide insight but little practical applicability for the regulator.

The generic case for interconnection used in most theoretical models has an incumbent TO that produces an intermediate service called "interconnection" or "access" and one or two final outputs (local and trunk services). The incumbent is either a monopolistic (bottleneck) supplier of the intermediate input or can be bypassed at some (higher) cost. An interconnector therefore either needs interconnection as an essential input or has some choice. Interconnectors sell a single final output (trunk services) that can be a perfect or imperfect substitute (or a complement) to the TO's final output(s).[18] Prices that need to be determined in the models include the two or three final output prices and the price for interconnection (and possibly for bypass). The models generally do not treat the case of unconstrained profit maximisation by the TO. Rather, the TO is usually assumed either to maximise social surplus or to be regulated by a surplus-maximising regulator, while interconnectors maximise profits. We now discuss some of the resulting outcomes.

3.5.3.1 Unconstrained socially-optimal interconnection charges

Assume that the regulator sets all the TO's prices optimally but can influence the interconnector's behavior only via the TO's pricing. The pricing outcomes under social surplus maximisation without constraints then depend on the type of competition in the "trunk" market (Armstrong and Doyle, 1993).

If competition in the trunk market is of the Bertrand type and if all types of trunk services are perfect substitutes for each other, then interconnection charges should equal the marginal costs of interconnection services. Under Bertrand competition the outcome in the trunk market is fully efficient. So, interconnection charges should be fully efficient as well. The reason is that under Bertrand competition firms take price as their strategic variable. The regulator will induce the TO to charge a marginal cost price in the long-distance market as long as the TO is at least as efficient as the interconnector. Otherwise, the TO will charge slightly more than the interconnector's marginal costs to assure that the interconnector serves the long-distance market at an efficient price. However, this result is of limited significance because trunk services are

18 With the exception of Willig (1979) the models generally do not treat network consumption externalities in the context of interconnection.

unlikely to be perfect substitutes for each other (and the same holds for other retail services in telecommunications).

If trunk services supplied by the TO and by interconnectors are imperfect substitutes and if interconnectors compete with each other in Cournot fashion then interconnection charges should be set below the marginal costs of interconnection services. Under Cournot competition (with output or capacity as the strategic variable) each firm has some market power and profit-maximising firms will price above marginal costs. The reason for setting the regulated interconnection charge below marginal costs then is that the trunk services supplied by the interconnector have an inefficiently high market price that can be (partially and imperfectly) corrected through lower interconnection charges. Thus, the tendency of firms with market power to price above marginal costs is counteracted by reducing their marginal costs. This counterintuitive result is efficient though not distributionally satisfying.

We conclude:

1. Interconnection pricing at or below marginal costs of providing interconnection services can be optimal.
2. Marginal cost pricing of interconnection is strictly optimal only for very specific cases.
3. Interconnection charges below marginal costs, which have to be financed out of taxes or higher prices elsewhere, are likely to be distributionally unacceptable.

3.5.3.2 Ramsey pricing of interconnection charges

Pricing at or below marginal costs can lead to losses for the incumbent. Thus, a balanced-budget constraint guaranteeing an efficient incumbent TO normal profits may need to be imposed on the regulator's objective function. If the incumbent TO does not itself provide retail telecommunications services (vertical separation), interconnection charges should equal average costs of interconnection services, as long as the balanced-budget constraint is binding.[19]

If the incumbent does produce retail services and faces a balanced budget constraint then both the retail services and interconnection contribute to balance the budget. Under constrained social surplus maximisation, contributions to the TO's profits have to be traded off against contributions to consumer surplus and to the interconnector(s)' profits. This leads to possibly complicated Ramsey pricing formulae. Ordinary Ramsey

19 If the incumbent TO sells several interconnection services the average costs of interconnection are no longer well-defined. In this case markups over marginal costs may optimally differ for the various interconnection services. This may become a problem for unbundling of interconnection services.

prices are already hard to deal with by a regulator because (a) marginal costs and (super-) elasticities have to be measured and (b) consumers with inelastic demands oppose high prices associated with their purchases. In addition to the demand relationship between the final products, the Ramsey pricing formulae with interconnection charges depend (a) on the type and intensity of competition between the TO and the interconnector(s), (b) on relative sizes of the firms, (c) on differences in costs of supplying the final output(s), (d) on the strength of the budget constraint and (e) on the cost of interconnection. Most of these variables are extremely hard to determine even by insiders to the firms, let alone by a regulator.[20] In order to assess the importance of these terms, we briefly go through them:

In the simplest case of a dominant TO and a competitive fringe of other operators in the trunk market, the optimal interconnection charge '*a*' equals $a = MC_{ix} + (p/\eta)(\lambda/(1+\lambda))$, where MC_{ix} is the marginal cost of providing interconnection, λ is the Lagrange multiplyer of the TO's budget constraint, p is the price charged by the interconnector in the trunk market and η is the super-elasticity faced by the interconnector. Reflecting the inverse elasticity rule, the less elastic the interconnector's trunk market segment the higher the interconnection charge should be.

A more elaborate case that is typical for the Ramsey approach to interconnection charges is provided by Masmoudi and Prothais (1994, building on Laffont-Tirole, 1993b). They assume the incumbent is a vertically integrated TO that sells interconnection to an interconnector who competes with it in mobile services in a differentiated Cournot duopoly. In setting the interconnection charge and the incumbent's other prices the regulator acts as a Stackelberg leader, meaning that the regulator acts optimally, knowing that the market participants solve their own optimisation problems (while the market participants take the regulated prices as given). The resulting formula for the interconnection charge is the sum of four components:

- MC_{ix}
- a Ramsey term as above but including market shares and competitive interaction in the trunk market. The more competitive the trunk market, the smaller should be the markup of the interconnection charge over marginal costs of interconnection. Thus, a more competitive trunk market is treated like a market with a higher elasticity.
- a differential efficiency term. This term contains (a) the difference in efficiency between the incumbent and the TO, (b) competitive interaction and (c) λ. The main effect is that the more efficient the interconnector relative to the incumbent, the more the interconnector should produce and therefore the smaller the interconnection

20 Under an informational constraint and for surplus maximisation with welfare weights, Laffont and Tirole (1993b) derive informationally adjusted Ramsey prices. These prices, in addition, contain an incentive adjustment that may be taken care of already by other regulatory tools, such as the use of price caps for the TO's retail services.

charge should be.[21] On the other hand, the larger the concern for the incumbent's profit, the lower the concern for the interconnector's efficiency.

- an interconnection charge revenue effect. This effect is nonnegative and contains the reciprocal of the elasticity of the interconnector's output with respect to the interconnection charge. Thus, the less elastic this output is, the higher the interconnection charge.

Because the different parts of the pricing formula have different signs the cumulative outcome cannot be assessed in general terms but only for specific parameter values. The authors therefore resort to simulation in order to evaluate the sensitivity of the outcome to parameter values. Their judgement suggests that the interconnection charge can exceed MC_{ix} by a substantial margin, but this is not a general result.

We conclude for Ramsey pricing models of interconnection:

1. Interconnection charges should be lower, the more competitive the trunk market, the more efficient the interconnector relative to the incumbent and the less endangered are the incumbent TO's profits.
2. Although the principle of Ramsey pricing models is fairly straightforward, their explicit application to interconnection pricing leads to complicated and opaque results that do not lend themselves to straightforward prescriptions for regulatory action.
3. The Ramsey pricing models can, however, be used to assess whether markups for purposes other than USOs are advisable or not. Criteria suggested by these models include the competitiveness of the trunk market, the relative efficiency of interconnectors in supplying trunk services and the financial condition of the incumbent.

3.5.3.3 Efficient component pricing for interconnection

Baumol and Willig have, for a monopoly provider of interconnection services to be sold to a competitor of the TO's trunk services, developed the efficient component pricing rule (ECPR).[22] Compared to the complicated Ramsey pricing rules for interconnection charges, developed by Laffont-Tirole and others, the ECPR has the attraction of looking simple and, according to its proponents, of being widely applicable and optimal. According to this rule the interconnector should pay to the incumbent monopolist the "opportunity costs" of interconnection. These opportunity costs include the incremental costs of providing the interconnection plus the profit contributions that the monopolist

21 If the final goods market is not regulated it is usually a social welfare improvement to have a competitor enter and provide competition for the final stage even if that competitor is less efficient than the incumbent monopolist.

22 See Willig (1979) and Baumol (1983).

forgoes by selling interconnection rather than retail services. Since the contributions foregone depend on the TO's retail price, efficient component pricing is based on retail prices.

The regulated operator would always prefer to price interconnection charges on the basis of opportunity costs. When the market is opened to competition and the regulator orders interconnection, the regulated operator's whole opportunity set is affected. Expectations regarding volumes and prices in all areas, not only in those where there is now competition, must be revised and in most instances revised downwards. Management would love to include the money equivalent of these lost opportunities in the interconnection charges. This is exactly what the Baumol/Willig rule implies if taken at its face value.

The ECPR is described extensively in Baumol and Sidak (1994), who claim four properties:

- First, it sends the right signal to potential entrants who will only enter if their services are more efficient than those provided by the incumbent.
- Second, it is revenue neutral for the incumbent.
- Third, it does not interfere with (desired?) cross-subsidisation.
- Fourth, it eliminates incentives for incumbents to keep rivals out. In particular, there is no incentive for a price squeeze because competition by interconnectors cannot hurt the incumbent TO.

The ECPR is highly controversial. It has been applied explicitly by US regulators to railroad regulation and, less explicitly, by UK regulations to interconnection with the dominant TO. It is under review as a competition policy standard for interconnection charges in New Zealand. Among economists, it has been backed by A. Kahn, W. Taylor and C.C. von Weizsäcker. It has been vehemently opposed by H. Ergas, Ralph and W. Tye and mildly opposed by Laffont and Tirole. Laffont and Tirole (1993b) argue that the ECPR is irrelevant because, under its assumptions, there would be no sales by the interconnector if the interconnector were less efficient than the incumbent and there would be no sales in the final goods market by the incumbent if the interconnector were more efficient. In the latter case, what would be the meaning of the incumbent's "opportunity costs" of interconnection as defined for the ECPR? The objection against the ECPR is that it bases the opportunity costs on a ceteris paribus condition that has meaning only for the time before interconnection occurs.

The claimed optimality of the ECPR is based on explicit or implicit assumptions, including the following:

- the retail trunk market is homogeneous,
- interconnectors are price takers in the trunk market,
- interconnectors have no fixed costs (only the TO does),
- the incumbent's prices in the local and trunk markets are Ramsey optimal.[23]

How restrictive are these assumptions? In a number of different cases analysed by Armstrong and Doyle (1993) the ECPR survives as a principle, although the actual pricing outcomes may vary substantially by case. For example, if trunk services offered by the TO and by interconnectors are imperfect substitutes, an adjustment to the ECPR needs to be made (a) in order to capture the effects of market power of the interconnectors and (b) in order to capture the fact that the TO will not lose its trunk demand one-for-one when providing interconnection services. While Armstrong and Doyle provide cases that still can be interpreted as the ECPR, Ergas and Ralph (1994) provide cases where the ECPR is dominated by lump-sum interconnection charges. The reason appears to be that, in the Ergas-Ralph cases, interconnection charges are used to raise a specified amount of money for USOs. In contrast, Baumol-Willig have the costs of USOs embedded in efficient final goods prices.

The analysis by Ergas and Ralph also indicates a fundamental problem with the approach behind the ECPR. The ECPR assumes that the only socially beneficial role of interconnectors is to provide trunk services at costs lower than the TO. It otherwise assumes that regulation is perfect. In contrast, most economists would tend to see the social function of competition by interconnectors in its ability to supplement or supplant inherently imperfect regulation. In particular, one function of competition is to determine prices. It is reasonable, under this view, to assume that prices in the markets served by the incumbent TO are inefficient and that competition by interconnectors may help correct this problem. In contrast, the ECPR provides no tool to improve final output pricing. On the contrary, it invites price rigidity and collusion in the final output market.

23 The problem with this assumption is that it recognises that the problem is really one of simultaneous optimisation of pricing in all markets served by the incumbent. Since interconnection charges feed back into trunk charges, one cannot take the latter as given and then optimise with respect to trunk charges. Laffont and Tirole (1993b, p.20) claim that there must also be a general assumption of constant returns to scale. This is not explicitly made, for example, in Baumol and Sidak (1994). Under this assumption the ECPR would coincide with Ramsey prices and marginal cost pricing.

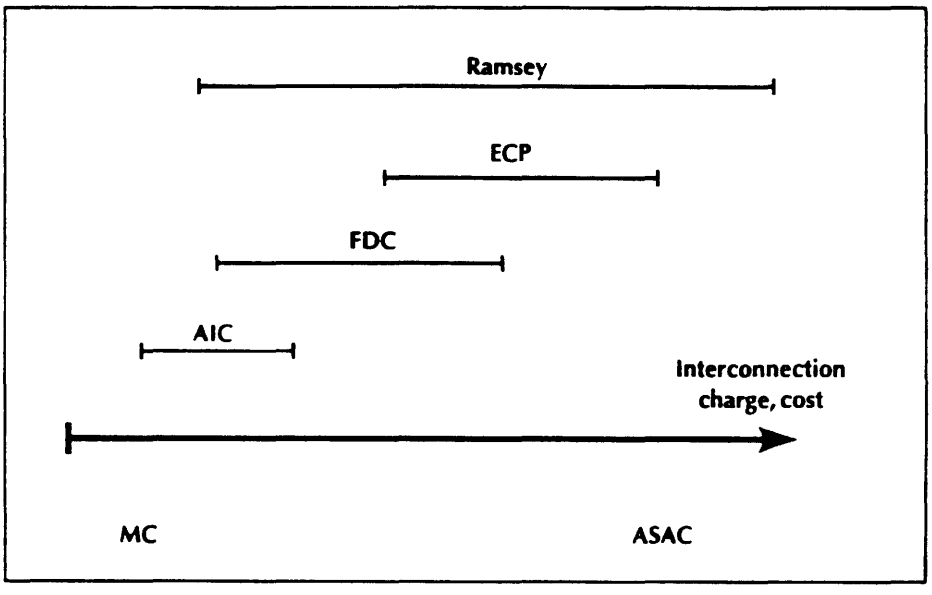
In summary, we conclude:

1. The ECPR has been developed for an almost perfectly regulated monopoly situation that needs some fine tuning. It does not deal with a situation where competition is to be introduced into a market dominated by an inefficient incumbent with heretofore insufficiently regulated monopoly rights.
2. The ECPR evolves around one term, the incumbent's opportunity cost of providing interconnection. This cost is potentially complex and hard-to-measure. The ECPR therefore provides no more guidance for the assessment of access charges than the Ramsey models.

3.5.3.4 Implications of the theoretical pricing models for interconnection

In order to evaluate pricing rules for interconnection, in Figure 3.5.3-1 we compare outcomes under different theoretical rules and the conditions under which they hold. In this figure we have provided the most likely size relationships and ranges. In theory, the ordering may differ and some of the ranges may be wider.

Figure 3.5.3.4-1: Ranges for different pricing rules



Definitions:

- *a*: interconnection charge
- MC_{ix}: marginal costs of interconnection.

  Marginal costs are defined as the cost change resulting from an infinitesimally small change in the quantity of output. The marginal costs of interconnection are therefore

only well-defined if interconnection can be changed in infinitesimally small increments. Realistically, such marginal costs only apply if there are no fixed/sunk costs of interconnection. Thus, marginal costs are more relevant with respect to costs after interconnection has already been established than for the costs of establishing interconnection. It immediately follows that approaches based on marginal costs, such as the Ramsey pricing approach, have to be interpreted correspondingly.

- MC_T^{TO}: marginal costs of trunk services for the TO
- AIC_{IX}: average incremental costs of interconnection
- AIC_T^{TO}: average incremental costs for the TO of providing trunk services.

  Incremental costs are the cost incurred by adding an output increment, where the increment can range from infinitesimal to a whole set of outputs. Thus, incremental costs have wider relevance for interconnection than marginal costs. For a purist, the incremental costs of interconnection would be all the costs incurred by the incumbent TO in addition to the costs of providing its other outputs. The average incremental costs would then be the incremental costs divided by the quantity in which the interconnection service is measured (for example, in minutes, busy hour erlang or in call attempts). As explained in Section 3.5.4, our approach is less pure in that we take as AIC_{IX} the sum of average costs of the incumbent TO's facilities used for interconnection and weighted by the interconnector's share in (busy hour) use of these facilities

- $ASAC_{IX}$: average stand-alone costs of interconnection.

  The stand-alone costs of interconnection are the costs incurred by an interconnector to bypass the incumbent's network. They are only well-defined if interconnection is considered to be a single service and not a vector.

- FDC_{IX}: fully distributed costs of providing interconnection
- ECP: efficient component price
- p_T: price for trunk services
- η_T: elasticity of demand for trunk services

Figure 3.5.3.4-1 conveys the following:

$a = MC_{IX}$ is optimal if there is no budget constraint, competition in the trunk market is contestable and there are no other distortions that could be corrected through interconnection pricing. One such distortion could be that the TO is inefficient in the initial situation. In this case, the marginal costs of an efficient TO would be relevant.

$a < MC_{ix}$ is optimal if there is no budget constraint and if interconnectors hold market power in the trunk market that can be corrected through lower interconnection charges.

$a > MC_{ix}$ is usually optimal if the TO faces a budget constraint and if fixed costs or deficits from other services (local) need to be financed.

$a = AIC_{ix}$ is optimal if $AIC_{ix} > MC_{ix}$ and if interconnection as a service has its own budget constraint. In this case there would be no economies of scale and no necessity to finance losses from other services. Note that *AIC* can be above or below *MC* as *AIC* is decreasing or increasing.

$a = ASAC_{ix}$ is an upper bound for *a* if all interconnectors can bypass TO interconnection at the same average stand-alone cost. At $a > ASAC_{ix}$ all potential interconnectors would bypass, so there would be no interconnection. If $ASAC_{ix}$ differs between interconnectors and the TO cannot perfectly price discriminate between interconnectors the optimal interconnection charge may allow for some bypass and therefore exceed $ASAC_{ix}$ for some interconnectors.

$a = p_T - AIC_T^{TO} + AIC_{ix} = ECP$ is the Baumol-Willig efficient component price. It is optimal if the trunk market is contestable and if all other prices charged by the TO are (Ramsey) optimal. Depending on the net revenue foregone by the TO in the trunk market, *ECP* can range between AIC_{ix} and $(AIC_{ix} + p_T/\eta_T)$, where p_T/η_T is the trunk monopoly markup.

$a = p_T - MC_T^{TO} + MC_{ix}$ is the simplest case of Ramsey pricing if the TO faces a budget constraint and interconnectors form a competitive fringe in the (homogeneous) trunk market. In general, the Ramsey price can range from below MC_{ix} to $(MC_{ix} + p_T/\eta_T)$, where p_T/η_T is the trunk monopoly markup. Thus, the range of Ramsey prices is at least as great as the range of ECPs.

$a > ECP$ can be optimal (a) if interconnectors are more efficient in supplying trunk services than the TO or (b) in a Ramsey framework with a competitive fringe of interconnectors in the trunk market if p_T is a Ramsey price and if $(MC_T^{TO} - MC_{ix}) < (AIC_T^{TO} - AIC_{ix})$. As to case (a), the ECPR does not allow the TO to share in the efficiency rents of the interconnector. Such sharing may be an optimal way to finance the TO's social obligations. However, this is likely to be the exception rather than the rule. Usually, a more efficient interconnector should produce as much as possible, thus saving society's resources. Also, the interconnector(s) may have expended sunk resources to achieve that efficiency, and those need to be recovered. As to case (b), this is only likely to happen with decreasing marginal costs. Thus, *ECP* may still be viewed as a reasonable upper bound for *a*.

$a = FDC_{ix}$ is optimal only by coincidence. FDC_{ix} can, in principle be anywhere on the scale. However, a reasonable lower bound for FDC_{ix} may be AIC_{ix}, assuming that

incremental costs can be directly assigned and that costs have not been increasing over time.[24]

We believe that a fair summary of the theoretical models is as follows:

- The pricing prescriptions depend crucially on the assumptions made. The ranges for possible pricing outcomes in the Ramsey (i.e., Laffont-Tirole) and the ECPR (Baumol-Willig) frameworks are large and can extend above and below all reasonable cost measures.[25]

- The results themselves are derived under a number of restrictive assumptions. In particular, the ECPR assumes price-taking behavior, an absence of sunk costs on the part of the interconnectors, and efficient pricing on the part of the TO. It is not a priori clear what the effects of lifting the assumptions are.

- The models, in particular ECPR, have little to say if prices in other markets served by the TO are not optimal.

- The more general Ramsey pricing models for interconnection provided by Laffont and Tirole are extremely hard to interpret and even harder to implement.

In summary, the guidance from the theoretical models is limited.[26] The models do agree on some outcomes for special cases. We may therefore be able to narrow the outcomes by observing certain market features and desiderata in the form of constraints not imposed in these models. These observations include the following:

- The main basis for allowing and promoting network entry is that economies of scale and scope are not so pronounced that they will make network competition infeasible or inefficient.

- A second basis for allowing network competition is that entrants are likely to be more efficient than the incumbent. This would compensate for entrants' smaller size, should economies of scale continue to play some role.

- The results desired from network competition are lower resource costs to the economy and lower prices to customers. Changes in the incumbent TO's retail price structure as a consequence of network competition are inevitable.

- Even at interconnection charges as low as MC_{ix} or AIC_{ix} the incumbent is unlikely to lose its market quickly. Usually, there are sunk costs (that entrants have to expend),

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24 FDC are based on historic costs while the other cost categories are forward looking.

25 Under competition policy standards, which would apply to cases that are not regulated, AIC_{ix} would form a lower bound and $ASAC_{ix}$ would form an upper bound for competitive interconnection charges.

26 We have not explicitly discussed revenue sharing between interconnecting parties. Such an interconnection arrangement reduces conflicts and therefore moves them toward joint profit maximisation. This may be advantageous if the parties face sufficient competition by others. If not, it is likely to lead to collusion.

switching costs by customers, name recognition, brand loyalty and other advantages of the TO over entrants that prevent consumers from switching to entrants even at substantially lower prices. For example, in the UK Mercury only gained about a 10% market share in its first ten years.

- Pricing distortions (unbalanced tariffs) in other markets served by the TO are desirable only in exceptional cases and therefore deserve special scrutiny. Since the individual outputs should generally contribute different amounts to common and overhead costs of the TO, the existence of a valid "local access loss" cannot simply be established by using fully distributed costing rules. Below, in Section 3.5.9, we describe a method of how local access losses may be calculated.

- Making it hard to add access charges to interconnection charges sets the right incentives to rebalance retail tariffs in an economically efficient way.

- Interconnection charges under a Ramsey rule or ECPR are extremely hard to calculate. This problem is compounded if interconnection services are unbundled (as we believe they should be). Such explicit calculations should therefore be the exception rather than the rule.

- Interconnectors offer services that are differentiated from the incumbent TO's services and from each other.[27] Differentiation can occur physically by delivery (wire or wireless) or through pricing policies (at a high price wireless services may be complementary to fixed-link services, while at a low price wireless services may be substitutes to fixed-link services). Using Ramsey models or the ECPR would lead to individualised interconnection charges, depending on the competitive relationship of interconnectors to the TO and other factors. Such severe price discrimination in the market for interconnection is likely to be inequitable, invite arbitrage, become arbitrary and interfere with sound competition policy.

- A mature telecommunications market is likely to be characterised by price and service competition in retail markets. However, bottlenecks in reaching individual customers are likely to persist and with them the necessity to interfere in the market for interconnection through regulation or competition policy. Because of the diversity of uses to which interconnection services will be put, the principles for interconnection charges should be independent of the specific service created with interconnection.

From above we generally infer that interconnection charges should be cost-based with the basic standard being either MC_{ix} or AIC_{ix}. The issue of contribution to overhead and common costs must be addressed as they affect the viability of the incumbent. While the entrant's viability should, in general, not be increased by forcing the incumbent to provide interconnection below costs, the incumbent's viability may legitimately have to

27 Price differences between incumbent TOs and entrants indicate that retail telecommunications services are virtually always differentiated.

be safeguarded through interconnection charges above costs. Such a markup would be in line with the Ramsey approach described above and would have to depend on the demand relationships, the state of competition and the seriousness of financial shortfalls. The burden of proof for determining these markups must be on the incumbent.

There is also an issue of the quality of interconnection services that needs to be considered in this context. If the incumbent's return from providing interconnection is substantially below that of providing final goods and if the two types of services are substitutes, then the incumbent may resort to hidden quality deterioration of interconnection. Such behavior may need costly regulatory action and monitoring that may be worse than higher interconnection charges.

Concluding from these observations:

1. We call for cost-based interconnection charges (based on MC_{ix} or AIC_{ix}).
2. We believe that cost-based charges should form the base-line case but that markups on top of MC_{ix} or AIC_{ix} may be justified depending on the incumbent's legitimate revenue requirements.
3. The burden of proof for determining these markups must be on the incumbent.

3.5.3.5 Issues of price discrimination

Price discrimination is the practice of a seller to sell related goods or different units of the same good at different relative markups above (or markdowns below) marginal costs. Several price discrimination issues are relevant for interconnection. We may here differentiate between those issues that occur under vertical separation (that is, for a TO that offers only local services) and those issues that come with vertical integration.

Price discrimination in the case of vertical separation is the result of market power and the ability to separate and differently price different units of sale. Such price discrimination can occur through quantity discounts (2nd degree price discrimination) or through dividing market segments (3rd degree price discrimination). If such price discrimination is combined with an overall pricing contraint (in the form of price caps) it may be beneficial because it allows the TO to finance fixed costs and reduce prices for other services offered by the incumbent TO. However, such price discrimination may also distort competition between interconnectors. So, its overall effects are ambiguous. If the incumbent can reap all the benefits from price discrimination directly then the efficiency case for price discrimination worsens. Note, however, that price differences that correspond to cost differences are not considered price discrimination.

Vertical integration of the incumbent TO is the more relevant case for interconnection issues in the EU. This case is substantially more complicated because price

discrimination by the incumbent TO can occur with respect to the market for interconnection and with respect to the final goods markets where the interconnecting operators compete. Contrary to the case of vertical separation the incumbent TO is not just interested in extracting surplus but also in enhancing its competitive position. Now the incumbent will have additional price discrimination incentives in its own favour with respect to those interconnectors with which he competes.

The fear that such discrimination occurs in favour of internal transactions has led to the call for internal charges to the incumbent TO itself equal to charges for interconnecting operators. This practice, which in the US is known as "imputation", looks reasonable, but it has two drawbacks. First, one of the main advantages claimed by economists for vertical integration is that internal transfer pricing can be made more efficient (through internal price discrimination) than outside pricing. In the case of regulated pricing this argument probably needs to be dismissed. Second, it is not clear what the real effect of imputation is, since internal prices are a wash. Imputation can only have real effects in conjunction with a prohibition of cross subsidisation and its detection (treated in Section 3.6.1 under accounting separation).

We conclude:

1. Price discrimination by the incumbent TO for interconnection may be beneficial if the interconnector does not compete with the TO. However, the case is quite ambiguous. We therefore favour a restriction on (external) price discrimination for interconnection.
2. Price discrimination by the incumbent TO in its favour is hard to detect. Requiring the TO not to discriminate in its favour internally is hard to make effective because internal transfer prices are difficult to observe.
3. Cost-based interconnection charges are likely to reduce incentives by the TO to price discriminate internally in its favour because then the TO would internally have to price below costs.[28]

3.5.4 Cost-orientated pricing

In order to base interconnection charges on the costs of interconnection, one has to know what the costs are and how they are related to interconnection as a service. The incumbent incurs five types of costs for interconnection:

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28 A similar advantage is claimed by Baumol and Sidak (1994) for the ECPR. This suggests that there are two ways to prevent a price squeeze. First, by pricing interconnection sufficiently low the incumbent TO may be unable to make any profit by undercutting interconnectors in the end-user market. Second, by following Baumol and Sidak, the incumbent TO may price interconnection so high that it becomes potentially more profitable for him to sell interconnection than to sell to end users.

(1) costs of conditioning the system of the incumbent TO for competition, in particular measures to ensure network security and integrity, particular standardisation, introduction of equal access, changes in the numbering system;

(2) costs of establishing the physical interconnection between specific networks, such as one-time costs of compatibility testing and making routing arrangements;

(3) costs of providing sufficient capacity for switching, transmission and related network components to accommodate traffic from the interconnecting network at the TO's peak period;

(4) variable costs of call recording, directory enquiries, billing etc.;

(5) overhead costs for accounting, management, legal expenses and those overhead costs associated with the four other cost types.

How do these types of costs relate to interconnection services? The first type of costs is related to interconnection in general and not to a particular interconnection arrangement. The second type of costs, in constrast, occurs each time a new interconnection arrangement is made. The third type of costs is due to the use of facilities that are usually shared with other interconnectors and final users. Types of costs (1) to (3) are essentially one-time capital costs. The fourth type of costs varies directly with usage and it contains little or no capital costs. The fifth type again is shared and has only a small capital component.

Different types of interconnection services will incur these five types of costs in different amounts (actually, the first type of cost is not incurred by any particular interconnection service). So, the cost structure will differ between call conveyance, emergency services, directory assistance etc., and there will be aggregation problems for the sum of services purchased by an interconnector.

Basing interconnection charges on costs means that the interconnection services have to be related to the five types of costs. Only the fourth type of costs can be directly related to the quantity of usage conveyed via interconnection, where the quantity is the number of successful or unsuccessful call attempts. The fifth type of costs poses the usual problem of proper inclusion in the price calculation (in terms of determining the proper markup on top of average incremental costs) the handling of which we have discussed at the end of Section 3.5.3.4. The variable and overhead costs are important but they are dominated by the first three types which are all capital costs.

As already indicated, costs of the first type are assignable to the very fact that there is interconnection. They represent identifiable additional costs due to the introduction of competition, which are justified by the beneficial effects that competition brings to consumers. Given that all consumers, especially also the incumbent's customers using services similar to those that the competitors are going to offer, benefit from these effects of competition, there is a good case that all these customers participate in

paying for them. This means that the costs would have to be shared by both the interconnector(s) and the incumbent alike. A possible method of dividing the costs would be in relation to the shares of volume of the relevant businesses, which at the beginning would burden the incumbent with most of them. As competitors gain market shares the burden would decline as the costs would then be divided more and more evenly among all competitors. There are other possible sharing rules. In any case, these costs are very much like common costs of production.

The second type of costs is directly related to the particular interconnection agreement in question and is a one-time capital cost. The costs would have be borne by the interconnector. Only if it is evident that these costs, which are similar to the first type in that they are additional costs of introducing competition, keep new competitors from entering the market should the regulator consider that they be borne by the incumbent. There is also an issue of cost sharing if the facilities can be used for interconnection in both directions and the incumbent TO can benefit from additional traffic generated by interconnection. The share of costs to be included in the charges for the interconnector must then be determined according to the relative weights of the traffic flows in question. Beyond this, this type of costs does not usually cause major pricing problems. In principle, the interconnector could provide the facility itself if that were not interfering with property rights of the incumbent TO.[29] Because of such rights the incumbent TO will normally want to build such facilities and will have the interconnector pay for them through a one-time payment or rental. The type of payment can reflect property rights issues and comparative advantage in financing. In particular, the incumbent TO may want the interconnector to pay lumpsum if the interconnector can readily choose interconnection locations and equipment (virtual collocation). An advantage of rental fees is that they can include follow-up costs of maintenance and can provide incentives for the incumbent to provide high-quality interconnection facilities.

The third type of capital costs is the most problematic, both in its large size and because the facilities are shared with others. Controversies concern the calculation of the costs and the way to charge them. In the following we therefore concentrate on these costs of shared network facilities. In this connection it is important to differentiate between two kinds of network capacity costs, nontraffic sensitive costs (NTS) and traffic sensitive costs (TS). While TS costs vary with (busy hour) interconnected traffic, the NTS costs are unaffected by interconnection. These NTS costs include the lines connecting subscribers to TO local switching offices, parts of the local switches, etc. They are not influenced by interconnection. However, they are used by interconnected traffic and the value of an interconnection agreement to an interconnector clearly depends on them. The question therefore is, to what extent the interconnector should share in paying for these costs. Two views are worth considering. The US practice has been to share the cost according to relative use (although the numbers were distorted in actuality). Contrary to US practice, the costs could be collected as a lump sum from the interconnectors. The second view considers the prime beneficiaries to be the

29 Such property rights have been a major issue in the US for physical collocation.

subscribers. Payment of NTS by interconnectors then becomes an issue of residuals not paid by subscribers.

Relating the discussion of this section to the conclusions of the preceding section, we note the following: Types of costs (2) through (4) would enter in the average incremental cost (AIC_{ix}) of a specific interconnection service or capacity provided a specific interconnector. They would thus always be covered by the lower limit of the corresponding cost-based interconnection charge. In contrast, type (1) is in the nature of an overhead or common cost and, like type (5), would have to be recovered from markups on these incremental cost measures.

We conclude:

1. The share of the costs of conditioning the system of the incumbent TO for competition to be paid by the interconnector should reflect to what extent his customers (through his prices) are to pay for the introduction of competition. In deciding this, consideration must be given to the beneficial effect that competition will have on all consumers, also those who are customers of the incumbent. These costs are to be treated akin to common costs.
2. The costs of establishing and maintaining the interconnection of the particular interconnector, the costs for network capacity that are shared with other users, and the variable costs associated with interconnection services are true input costs for the interconnector and should be borne in full by him.

3.5.5 Cost accounting as the basis for cost-based prices

How can cost-based interconnection charges be calculated in practice?[30] The cost standard for pricing decisions that must generally be satisfied in any enterprise is the one of long-run costs. For an enterprise in a competitive market, this is the relevant standard, since without prices that cover at least all costs in the long run, an entrepreneur will sooner or later have to exit the market. Long-run costs should therefore also be the standard in the telecommunications industry. (In terms of our conclusions of Section 3.5.3.4 this calls for charges based on long-run average incremental costs *(LRAIC).*) Long-run costs are particularly related to capacity, and basing interconnection charges on them is compatible with forward-looking capacity-based pricing and with peak-load pricing. While economic cost concepts are always forward looking, a regulated firm's budget constraint is usually based on its historic costs (for reasons of equity). In order to fulfill such budget constraints, FDC pricing has often been prescribed by regulators. It has two disqualifying drawbacks. First, it is

30 Because of the large role of fixed assets in the costs of TOs, a purely cost-based approach always prominently contains the rate-of-return on investment. We therefore treat cost-oriented and rate-of-return regulation as a joint issue.

arbitrary and thereby likely to be inefficient. Second, it is incompatible with effective competition. Under competition, it leads to additional inefficiencies (by precluding the incumbent from markets where it has advantages and by precluding entrants from markets where they have advantages) and does not guarantee survival of the incumbent.

In normal business practice, costing serves to provide lower bounds for prices. Downward deviations from these bounds are to be avoided in order not to jeopardise the viability of the firm. Which costs have to be included in order to determine such lower bounds? Of what is conventionally considered common costs only those items should be included that - at least in the long run - are causally related to the production of the service. In our view, activity-based costing (ABC) based on forward-looking cost data is the best way currently available to do it. If they are based on FDC, this would be problematic.

It must be recognised that the procedure of determining lower limits for prices is an important management tool. Our evaluation of the efficiency of this management tool would also depend on how the margins to cover overhead and true common costs are determined and the profit margins (if any). In our view, an additional procedure should be used to set these margins. To our knowledge, however, so far no such procedure has been developed.

Since an efficient incumbent TO should be able at least to break even, historic costs do matter for interconnection charges. How then can we avoid FDC pricing? The answer would be to have uncovered sunk costs due to investment decisions in the past included in the overhead costs that may be covered by legitimate markups on *LRAIC*. In this context it may be helpful, however, to refer to Laughhunn (1989). He argues that "FDC is used, almost by default, as an imperfect tool to help solve difficult management and regulatory control problems in an environment where pricing decisions are decentralised", that "(m)anagers ... tend to fill the policy void with FDC because it provides a pricing target", and that "flexible use of FDC along with IC (may be) the preferred route". His suggestion is to apply FDC rules to broad service categories only. Individual services within these categories would not be held to an FDC standard. They could, for example, be evaluated as reasonable if they fall in the range between incremental costs and stand-alone costs. The attractiveness of Laughhunn's approach may depend on how much of total costs would have to be allocated according to flexible FDC instead of ABC (the more by ABC, the better). If Laughhunn's approach makes sense, one needs to develop some ideas as to what "flexible use of FDC" could be.

From the above discussion, it follows that the determining of costs of telecommunications services in general and of interconnection services in particular is by no means a trivial problem. In addition, management has usually considerable discretion in determining how costs are actually measured, with the effect that reported costs are often not at all reflective of the actual cost causation. In the face of this and

similar other problems, if the regulator wants to obtain a close measure of what appears to be "true costs", he has the option of trying to have them determined either by prescribing to the regulated firm best-practice cost accounting procedures, such as ABC, or of having cost studies carried out on his own behalf. When opting for the latter approach, he would be well-advised to commission engineering cost studies, as they promise to give the most objective results.

We conclude:

1. The cost standard for pricing decisions should be long-run costs.
2. In the spirit of ABC, as much direct costing should be achieved as possible.
3. To the extent that FDC is the only practice feasible for a TO, it should (a) be used flexibly, (b) be replaced by better costing methods as soon as possible, and (c) be checked against incremental costs and stand-alone costs, derived through engineering cost studies.

3.5.6 The determination of depreciation charges

In the economics literature on optimal pricing, depreciation usually plays no role. When pricing is done for the services of capital goods, it is usually done in the context of a model of lumpy investment with a joint optimisation over pricing and investment. In practice, however, the costs of capital goods are measured by the sum of depreciation and costs of financing.

The main cost of financing is the rate of return required for financing the assets. Determining this rate of return deviates from the standard cost-of-capital problem faced by ordinary firms in that the prices and supply conditions for telecommunications services are influenced by regulation. This in turn influences firm and industry specific risks. Nevertheless, measuring a regulated firm's cost of capital has been done in many cases so that regulators can receive advice on how to do this from many financial consultants.

Given the high capital intensity of telecommunications, depreciation may then well be the most critical component of the cost of any telecommunications service. Knowing how it should be determined reveals much about the problem of cost-based pricing.[31] While economic depreciation has little to do with capacity utilisation (except for a small amount of wear and tear added through higher utilisation) the cited literature on economic depreciation relates its magnitude during a particular period to the degree of

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31 In the arguments developed in this section, we combine our reading of the literature on economic depreciation, especially Baumol (1971) and Littlechild (1970), with our understanding of both best practice and actual cost accounting. Regarding best practice cost accounting Cooper/Kaplan (1988) is the reference, regarding actual cost accounting it is Laughunn (1989). We also bring in the Boiteux (1956) results on pricing, as treated by Park (1989), when investment is lumpy.

capacity utilisation of the relevant capital asset. In the following, it is assumed that the sum of the discounted revenues equals discounted costs. If the asset is used to its full capacity, depreciation should equal the expected revenue for the period minus operating costs (assuming here that there are no other costs in the form of wear and tear, technical change and change in capital goods prices); if it is unterutilised, depreciation should be set to zero. The relevant values would have to correspond to the revenue and operating cost streams estimated for the periods in question at the time of the investment decision. If evaluation of expected revenue and operating cost streams changes over time, corresponding changes in the value of the asset would have to be made and the depreciation charges adjusted accordingly. Provided that one could price the service in each period in a way to assure full capacity utilisation, the full-use-of-capacity approach would always apply. Thus depreciation charges, and therefore the most important part of costs, depend (a) on the investment decision (when capacity is decided upon) and (b) on changes in the valuation of that capacity by the market over time. At the time of the investment decision, total expected (discounted) depreciation charges should at least be equal the outlay for that asset.

Pricing in a way to assure full use of capacity all the time is not realistic.[32] Optimal pricing prescribes some type of peak-load pricing over the life cycle of the assets: The highest price would hold at highest capacity utilisation shortly before new investment and the lowest price shortly after new capacity comes on stream. This contrasts sharply with FDC pricing over time, according to which the highest price would hold right after new capacity comes on stream. In our view, the Boiteux "uniform" pricing rule discussed by Park (1989) provides for a realistic compromise. It is "uniform" in the sense that while, as in the approaches of Baumol and Littlechild, the total value of productive services rendered by the capital asset over its lifetime must equal the outlay for that asset, service per unit of output is valued the same irrespective of whether there is full use of capacity or not. From this follows that the depreciation charge is always proportional to the volume of output.

In actual accounting practice, depreciation is most often set according to the straight line linear rule. The depreciation of an asset for a given period is set equal to a value obtained by dividing the outlay for the investment by the number of periods during which the asset will be in use. If pricing is established each period and demand varies over time, linear depreciation leads to undesirable fluctuations of capacity utilisation.

While it is typical that historical prices are used for depreciation, the more sophisticated approaches value the asset in each period at the current market price. Depending on the vintage composition of the captial stock and on the degree of utilisation of those capital items put in place most recently, the straight line linear depreciation rule will in the aggregate lead to an overstatement or understatement of the capital costs in relation to those envisaged at the times of investment. We would expect that

32 We are here referring to long-term capacity utilisation. Our prescriptions for short-term capacity utilisation and the resulting pricing are treated below in 3.5.7.

overstatement is currently the more relevant case. Thus, when there are changes in market conditions causing current and expected future output volumes to change as well, changes in the depreciation figure per unit of output should also be affected.

In ABC, depreciation is essentially defined per unit of output. The corresponding value is determined on the basis of an estimate of the total units of output for which the asset will render productive services over its useful life. This approach is commensurate with the requirement of the Boiteux uniform pricing rule and, together with the handling in ABC of the cost components that in FDC are falsely treated as pure common costs, comes close to providing a good approximation to a service's LRIC.

We conclude:

1. The main costs associated with interconnection are for long-lived capacity. They therefore represent capital costs that are the sum of financing costs and loss in value of the capital goods over time.
2. Financing costs are a difficult but standard problem in financial economics.
3. Loss in value of capital goods is conventionally captured through depreciation. We suggest to follow this practice. However, depreciation that makes the loss in value simply a function of time (e.g., straight line depreciation) is likely to result in cost patterns that are unacceptable for pricing. Rather, depreciation should be related to usage, with constant depreciation per unit of busy hour output.

3.5.7 Capacity-based versus peak-load pricing

So far we have dealt with the time-related aspect of pricing capacity. Now we address the issue arising from the fact that capacity is shared between various users. Once there are various users the question arises, what shall be priced? The issue of what shall be priced for interconnection has gained prominence for two categories of services. First, treated in the current section, is the question of defining the output "interconnection". What are the units in which interconnection shall be measured? This question leads to capacity versus usage pricing and the relationship of this issue to peak-load pricing. It also leads to an inquiry into the role of cost drivers. Second, treated in Section 3.6.4, is the issue of unbundling interconnection services into smaller categories that can be sold and priced separately.

From the above discussion of depreciation in relation to pricing it follows that pricing would be "capacity based" if a user paid at each point of time in relation to the depreciation charges for that part of the capacity that, either at the time of investment, or at the latest revaluation of the asset because of changing market conditions, was 'reserved' for him. We need not go into a discussion of the usefulness and/or competitive implications of this idea when applied to prices for normal users. The enormous transaction costs involved would by themselves forbid such an approach. The consumption patterns of individual users are highly varied and almost impossible to

predict (by the individuals and by the supplier). It would, however, not be unrealistic to apply capacity-based pricing to large users, in particular interconnecting network operators. Such users have predictable consumption patterns (derived from the law of large numbers). One probably beneficial aspect would be that in the long run the interconnecting operator would shoulder the true economic risk of the right expectations regarding demand of endusers having been made, i.e. the operator who is in a better position to evaluate the risk shoulders it. From this it also follows conversely that as long as interconnecting operators or service providers are new and small they should not be required to pay capacity-based charges. In their case the incumbent operator may actually be in a better position to assume the risk, especially if there are many such small demanders and the average risk per demander, due to the effect of correlation, is smaller than the individual risk.

Capacity-based costing would not preclude charging for operating costs on the basis of actual usage with which this kind of cost varies. Nor would it preclude, of course, charges based on actual usage if the latter exceeds the capacity that was reserved for the demander.

Capacity-based costing is also consistent with pure peak-load pricing. The capacity paid for is the amount needed at the peak. The charges due for requiring more services at the peak than had been reserved would have to equal the share of capacity covered by the capacity price plus a charge for the extra costs caused by exceeding that share. Charges during off-peak periods would have to cover only operating costs. Since interconnecting operators' total costs are highly sensitive to interconnection charges and since such operators themselves make their output pricing decisions based on such charges, it is important that the system peak be accurately reflected in peak-load pricing of interconnection.

The capacity costs relevant for interconnection depend on whether capacity expansion is required or not. If no capacity expansion is required we recommend to use the TO's historic SAC of the network as the basis. The proportionate share in capacity use by the interconnector during the busy hour would be a simple and acceptable allocator. This would mimic the result of joint ownership of network capacity in proportion to peak use. If capacity expansion is required the basis for charging should be the IC of expanding capacity.

Total network capacity costs can increase non-linearly with increasing network capacity. In particular, there may be increasing returns to scale. Pricing network capacity at its marginal costs could then lead to insufficient cost coverage. We believe that the best way to avoid this problem is to price capacity (both for peak-load pricing and for capacity-based pricing) in proportion to peak capacity utilisation. This corresponds to pricing by AIC of capacity. Information on increasing returns to scale is hard to come by, and two-part tariffs or other nonlinear pricing schedules are likely to burden entrants.

In practice, charges for call conveyance (conveyance charges) are often priced by the minute, and off-peak charges are distinctly positive, in spite of the almost total absence of usage-related network costs. One argument is that these off-peak prices reflect overhead costs. However, any overhead costs that are not taken care of in one-time interconnection charges, in charges for call attempts and in capacity charges are likely to be very small. What remains then is an argument that the time profile and sizes of peaks are uncertain. Given the regularity of system peaks this argument is certainly not convincing. It is more likely that per-minute charges have simply been inferred from end-user charges to interconnection charges, since minutes of use are easily measured.[33]

We consider capacity-based interconnection charges to be the optimal approach for interconnection between a sophisticated TO and a sophisticated interconnector. In practice, however, it may be difficult to move directly toward such capacity-based charges. Also, the demands of interconnectors on the charging system may differ, depending on whether the interconnector is a TO, a mobile operator or a service provider.

We therefore conclude by suggesting a flexible and optional approach to the type of charging:

1. If possible, capacity-based charges should be offered, and they could be applied either ex ante or ex post. (a) Ex-ante application would mean that the interconnector and TO would agree on the busy hour and the busy hour contribution(s) to be paid by the interconnector. This might require both parties to make point estimates, and there could be penalties for exceeding limits and bonuses for staying below. (b) Ex-post application of capacity-based charging would be very similar to peak-load pricing, only that it would apply to the TO's actual systems peak hour rather than to a predefined schedule.
2. As an alternative or option, sophisticated peak-load pricing of interconnection services would be offered. This would be based on the expected system peak. Uncertainty could be taken care of by spreading the capacity charges according to the probability with which the system peak occurs at different hours of the week.
3. As a further option the interconnector could choose to be charged according to the time-of-day schedules offered to retail customers. These schedules are likely to be unsophisticated and driven by concerns other than the system peak (e.g., regular business hours).

33 Nonlinear per-minute pricing schedules have also been discussed in the literature. See Mitchell and Vogelsang (1991, Chapter 10).

3.5.8 Prescribed price cap regulation

We have advocated cost-based interconnection charges and believe that this is the best way to begin a regime of interconnection charges in the transition from monopoly to a competitive environment. However, we do not believe that cost-based charges could or should continue to rule at every moment in time. This would be administratively burdensome and would not give TOs the right incentive to keep their costs down.

Regulatory authorities increasingly resort to the instrument of price-cap regulation. Under price caps, the overall level of regulated prices may change over time in step with the rate of general inflation less a specified factor 'X' for productivity growth of the regulated industry, where the value of the factor 'X' remains fixed for some number of years. During this time, the firm can change its prices within the constraints imposed by the price caps. These constraints include the following:

- upper bounds on the level of prices given by the price cap formula. These bounds hold for the services included under price caps. There may be different baskets with different price cap formulas. In particular, interconnection services may either be included in one basket with retail services or may be in a basket of their own.

- limits on the restructuring of prices. Such limits are either the natural result of the size of baskets or the result of further constraints on restructuring or rebalancing. Naturally, there is less room for restructuring if a basket contains only few items than if it contains all the firm's services. Rebalancing constraints can also include bands with lower bounds. The pricing flexibility provided under price caps has raised the fear of predatory pricing or price squeezes exercised by the incumbent TO. The specter is that the TO would, for example, increase its interconnection charges and decrease its retail trunk tariffs, thus squeezing out interconnectors. Lower bounds on prices are supposed to prevent such price squeezes or predatory pricing by a dominant TO. Keeping interconnection and retail services in separate baskets, however, will prevent squeezing and is likely to prevent predation without explicitly imposing lower bounds on prices.

Whenever the regulator has to specify (or respecify) the parameters of the price-cap regime (which may mean setting the absolute level of starting prices, or setting prices anew, and fixing the value of the productivity factor for the coming years) he or she would have to make a cost evaluation on which to base the required decisions, and this would basically follow the same rules as when setting the initial tariffs. Beyond this, what the regulator can hope for, depending on his or her ingenuity and negotiating skills, is to come reasonably close to an optimal value of the productivity factor in the price-cap formula. That value should be such that it pushes the firm as close as possible to the goal of the lowest attainable long-run costs.

Under a price cap regime, we know that there may be a tendency for prices to move over time toward Ramsey prices. So if price caps are installed we should not worry so much about the price structure actually being implemented, except that one should

determine the initial price level and the size of separate baskets as a precaution against predatory pricing or price squeezing which may otherwise be possible under price caps. If there is cost regulation, for example to set the stage for price caps at a later date, imposition of a Ramsey price structure is probably not a feasible option. This would in particular be true in the less advanced countries due to the lack of cost accounting expertise within the TO and the absence of the necessary regulatory instruments. Here again Laughhunn's proposal of using some flexible FDC approach may appear to be relevant.

Under price caps, the incumbent TO may also want to offer optional (nonlinear) interconnection charges as an alternative to the price cap tariffs. The price cap tariffs then form a benchmark against which interconnectors could make their choices. They would only choose the optional tariffs if they prefer them to the benchmark tariffs. For household consumers such optional tariffs would be unambiguously welfare improving. For resellers, however, such options may affect competitive positions and advantage larger over smaller interconnectors. Nevertheless, optional tariffs are worth considering, if only as a way to decrease regulation over time.

We conclude:

1. For the establishment of initial interconnection charges, a cost-based pricing approach is appropriate; for their adjustment over time, the regime of price cap regulation.
2. Price cap regulation leaves a number of parameters to be determined by the regulator. These parameters include (a) productivity adjustment factors, (b) the scope of price caps and the size of baskets of services, (c) restrictions on price rebalancing within baskets, and (d) the length of time for which the first three parameters are set and the method by which they can be changed.
3. There are good economic reasons for a price cap approach that gives the incumbent TO some pricing flexiblity, including the ability to offer optional tariffs.

3.5.9 Access charges for unbalanced tariffs and USOs

Normally the incumbent operator has no alternative but to accept it when the regulator significantly changes its opportunity set by opening the market. When interconnection is ordered, the operator is allowed to charge interconnection charges that in principle would be cost-oriented and possibly are derived on the basis of capacity costs. The charges would probably include average costs of capacity and common costs. As regards opportunity costs, the inclusion of an access charge may be allowed if this is warranted by special circumstances.

In our view, the regulator's position on the access charge should depend on his evaluation of the extent to which opening of the market has in fact eroded the regulated operator's market power and will in future prevent it from reaping extra benefits, either

in terms of supranormal profits or in unwarranted X-inefficiency. In other words, during the period of transition from monopoly to effective competition, one should leave the incumbent with the obligation to shoulder the burden of the local network cross subsidy or USOs, to the extent that the regulator has convinced himself that it is still enjoying advantages that competitors do not have. If these remaining advantages are not considered sufficient, there may have to be some additional source of revenues to help to cover unbalanced tariffs or the costs of USOs.

Note that the above approach rejects the notion that with the mere formal opening of the market a kind of parity is reached between incumbent and new competitors. Under this notion, if tariffs are unbalanced or if the incumbent faces USO burdens the market entrants should automatically be considered contributors to the money needed to fill any gap and thus incur the same competitive handicap, so that not requiring them to contribute automatically means that they are provided with an entry assistance. On the contrary, the continued obligation placed on the incumbent to cover local access losses or the costs of USOs, at least in the short and medium run, is to be seen as an additional means to make entry conditions commensurate with what would exist if the incumbent had not had its protection for decades in the past. In addition, not including specific access charges in interconnection charges puts pressures on the incumbent TO and on the regulator (a) to rebalance the retail rate structure,[34] (b) to justify additional burdens carried by the incumbent TO in terms of USOs and (c) to find other ways to pay for USOs. The incumbent TO may actually have comparative advantages in fulfilling USOs, and that can be determined during this initial time period.

How can one know whether there is a local access loss or not? This obviously depends on how such a loss is defined and how it can be measured. One straight-forward definition is that a local access loss exists to the extent that a profit-maximising TO would want to cease serving access to customers at the current tariffs. Contrary to widespread practice and political arguments, this definition is directed at customers rather than at individual services. The reasons why we prefer this definition are:

(a) Access may not be a service at all. Pricing access would then only be the fixed part of a two-part pricing arrangement.

(b) Even if access is a separate service it is jointly consumed with other services by the same TO subscriber. Consumers benefit from low connection and rental charges which may translate into higher usage (via the network externality). For the TO, access is paid under the same account with usage.

(c) It is incremental (avoided) cost based and thereby avoids arbitrary cost allocations.

(d) The TO may even benefit from subscribers that are individually not cost-covering but increase usage by others.

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34 In our view, the current ADC practice in the UK, where BT loses its right to ADCs if it does not fully utilise its ability to rebalance rates, could invite BT to price consumer access above cost.

Thus, the customer (group) is the relevant unit of observation for an eventual local access loss. Whether a local access loss actually exists can then be established in a two-step procedure: First, calculate whether the incremental costs of subscriber classes and combinations of subscriber classes are covered by the revenues from those customers. If all subscriber classes (and combinations) cover their incremental costs there can be no local access loss. Second, if there are any subscriber classes whose incremental costs are not covered, calculate the TO's total return from all network services on network assets, based on interconnection charges without any access charges. If this return is at or above the TO's cost of capital then the local access loss has been covered elsewhere and does not need to be covered by interconnection charges. In principle, all these calculations should be made for the case after the effect of interconnection has been factored in. However, the effects of interconnection on market shares and sales of the incumbent TO are usually gradual (for the case of no vertical or horizontal divestiture of the TO). Therefore, current figures can be used instead of projections. It only has to be assured that interconnection charges can be changed in case of large changes in the TO's market share.

While we clearly prefer a customer specific approach to local access losses, many countries have been using a service specific approach. As the reason for this we conjecture a mixture of regulatory inertia (fear to change price structures even if the average customer ends up paying the same as before) and accounting convenience. If one accepts that regulators in the short run are unable to move to such a customer specific approach, the local access loss may also have to be measured for local access as a service. In this case the direct costs of local access should be calculated and compared to the income from subscriber connection charges and line rentals paid by subscribers. Any resulting deficit (and the costs of general overheads) then needs to be shared by all the remaining services, of which interconnection is only one. It becomes a regulatory decision how this sharing should occur, but it is not clear a priori that interconnection should bear proportionally more than any other service. This is where the regulator may be guided qualitatively by the Ramsey approach. Recall that the required markup under this approach depends on the demand elasticities, the amount that needs to be raised and on the state of competition. In our view, however, the regulator may want to use the *desired* competitiveness of the sector rather than its *actual* competitiveness to determine the markup for interconnection charges.

If a decision has been made to cover USOs or a local access loss through interconnection charges, it still needs to be addressed how this can best be done. In their opposition to the ECPR (mentioned in Section 3.5.3.3 above) Ergas and Ralph (1994) provide an example of lump-sum access charges. Such lump-sum charges may not be acceptable due to the high costs they may impose on small entrants. However, under presubscription to competing trunk carriers, there exist more efficient and acceptable charges in the form of charges paid on the basis of numbers of customers interconnected rather than on the basis of calls conveyed. This way, a long-distance company would pay a fee for each of its customers that need to be accessed via the incumbent TO. Similarly, the incumbent TO would impute the same charge to each of

its customers. These access charges could be passed on to the customers in any way deemed optimal by each of the operators (and would be in addition to the connection charge currently collected by the TO from all its customers).

Under price caps for interconnection charges, the portion for USOs or local access losses is likely to be best treated as an external factor, changes of which are passed through to the extent that they depend on regulatory decisions.

We conclude:

1. Access charges are not our preferred way of financing USOs and local access losses caused by an unbalanced tariff structure.
2. It would make economic sense if regulators use the time between starting an interconnection regime and the time access charges become a pressing issue to rebalance tariffs and find other ways of financing USOs.
3. If that cannot be achieved, the standards for calculating the amounts to be raised by access charges should be high and the burden of proof upon the incumbent.
4. If access charges are necessary nevertheless they should be imposed in the least distortionary manner, preferably not on a per minute basis.

3.5.10 Concluding observations on pricing

Some concluding observations as regards this section: We have seen that costs depend heavily on investment decisions and that these decisions in turn are strongly influenced by expectations. Thus costs are not something objective and independent of the actions of the major players. In a market with vigorous competition, one can trust that managment normally makes the right decisions, both with regard to investment and the costing of long-lived capital goods. In a regulated industry, it is the regulator who by strongly influencing expectations determines to a large extent what the costs are. The regulator then also has to decide on tariffs and charges. In these circumstances, management may not have the incentive to determine costs as accurately as possible, to the effect that reported costs are often not at all reflective of the actual cost causation. Given this, it appears to be less shocking if the regulator proceeds to also determine how the costs should be measured. The regulator should shy away from trying to determine costs in actual detail, however.

Another important aspect is that questions of the costing of interconnection services and questions connected with their pricing must be considered as distinct issues. As shown in the preceding paragraph, the regulator's role with respect to costing is to define methodology by which costs are to be determined but not to get involved in their actual calculation. Once costs are known, the question of how they are included in charges must then be a separate decision in which the regulator may also be involved,

to the extent that he determines actual values. In this decision a number of policy considerations (efficiency, equity, market conditions, etc.) may play a role.

Over time, as the market for interconnection develops, regulation of interconnection should decline and give way to competition policy as a safety net. How can one gradually deregulate interconnection charges? In our view, the path toward deregulation goes via flexibility and the establishment of competition policy standards for interconnection charges. Flexibility would first be introduced in the form of price caps which, over time, would be increasingly freed from rebalancing and restructuring constraints. Furthermore, optional tariffs could be introduced as alternatives to capped tariffs. Then the scope of price caps would be changed. Paradoxically, both an increase and a decrease of their scope can increase the flexibility of a TO's pricing policy. An increase in the scope of price caps allows the firm more restructuring because now more different prices can be traded off against each other. A decrease in the scope of price caps can increase pricing flexibility because those prices outside the cap are only constrained by the market. Thus, the question is if the regulator wants to deregulate by reducing the number of services constrained or by constraining all services less. At the same time that pricing flexibility is increased standards should be imposed for prices that are not considered compatible with competition. Such prices would normally be those below incremental costs or above stand-alone costs. Exceptions would need special justification in case prices were challenged under competition law.

3.6 Non-price issues

3.6.1. Structural alternatives - accounting separation

Structural separation of local and trunk and information services has been practiced in the US for some time but not much elsewhere. There are ample signs that vertical reintegration occurs even in the US. Thus, there seem to be enough economies of scope between these services. On the other hand, vertical integration along with interconnection with nonintegrated operators creates problems of market power that need to be addressed through regulation. Accounting separation has been proposed as a less drastic measure than structural separation to solve some of the market power problems without altogether giving up economies of scope.

Accounting separation has become a potentially important policy tool for interconnection agreements. It can help identify the costs of interconnection and ensure that TOs charge the same interconnection prices to themselves as they charge to others. Accounting separation shall also reveal the existence of cross subsidies, specifically in favour of those final goods markets where interconnecting operators compete. It is seen as a(n imperfect) substitute for divestiture or separate subsidiaries without the accompanying sacrifice in scale and scope economies. The potential drawback of accounting separation lies in the imperfections of accounting cost allocation. What accounting separation can potentially achieve is some increase in transparency of costs and internal transfer pricing. This increase depends on the quality

of the accounting data and the level of detail at which accounting separation is pursued. Accounting separation makes sense if interconnection prices themselves are based on the same accounting cost data.[35] However, accounting separation, by establishing inefficient transfer prices and by imposing administrative burdens, may have its own cost in terms of lost economies of scale and scope.

A crucial question for accounting separation is, which parts should be separated. The answer depends on feasibility and desirability. From the perspective of interconnection, the following tasks may be addressed through accounting separation, (a) calculate local access losses, (b) detect price squeezing of interconnecting operators, (c) establish costs of interconnection, (d) separate competitive and monopoly spheres. All these tasks require an incremental cost approach to be done satisfactorily.

We conclude:

1. Accounting separation is likely to be preferable to structural separation when it comes to the preservation of economies of scale and scope. However, not all such economies are preserved under accounting separation and the efficiency of internal transactions may be affected through unclear incentives (because accounting separation and command structures need not coincide).
2. Accounting separation is no panacea to discover cross subsidies, price squeezes or local access losses.
3. Accounting separation based on incremental cost would be most useful.

3.6.2 Equal access

The notion of equal access gives specific content to the right (or duty) to interconnect. The term "equal access" is normally used for the access of final users to trunk carriers. In a nutshell, equal access means that access to alternative operators is the same as access to the incumbent TO. Equal access can be viewed from an operator or from a customer perspective. Unequal access from a customer perspective implies that the operators receive unequal treatment as well. Unequal access affects customer convenience and the competitive position of operators.

From a customer perspective, equal access can be realised on a presubsription basis or on a call-by-call basis. The two approaches are likely to imply different competitive outcomes in the end-user telecommunications market. From an operator perspective, equal access is directly related to interconnection and means things such as collocation, direct access to data bases and to numbering resources.

35 Thus, accounting separation may have to be incremental cost based. This could mean that accounting separation separates out costs that are not assigned to any services.

While equal access appears to provide equality between the incumbent TO and its competing interconnectors, the incumbent usually maintains advantages that give it a superior market position.[36] In that sense, equal access always comes in shades, and it may therefore be appropriate to consider various grades of unequal access along with equal access. If unequal access is cheaper to provide it may allow for effective niche entry at lower quality but still with strong competitive effects. For example, short-distance - intraLATA - trunk competition in the US has been quite effective in lowering tariffs in spite of the requirement of dialing five extra digits to reach alternative operators.

Since incumbent TOs do not usually provide equal access voluntarily, the question is if equal access should be a regulatory requirement. Some countries have imposed such a requirement, some are currently conducting cost-benefit analyses. Equal access can provide strong benefits for interconnecting parties (in the form of lower costs of access to a trunk operator) and can improve competitive market conditions (by reducing costs of switching suppliers). However, it comes at a cost in terms of lost economies of scope for the incumbent TO and setup costs. Setup costs, in particular, can be saved by learning from equal access experience in other countries.

We conclude:

1. There is a case for regulators to make cost-benefit analyses of alternative approaches to introducing equal access in their specific country.
2. Countries should learn from each other.
3. Specifically, standardisation for equal access arrangements should be considered.
4. As more experience is accumulated, the cost of equal access will fall, making the case for equal access more and more compelling.

3.6.3 Quality issues in interconnection

Quality issues in interconnection have been treated extensively in Chapter 2. There are some specific economic issues related to quality. Interconnection means that telecommunications services are jointly provided by several operators. The customer experiencing quality problems, such as congestion or bad transmission quality, cannot assign quality problems to one of the operators. To the extent that the customer subcribes to only one operator he or she will hold that operator responsible. Then the quality assignment becomes a problem between the operators. Again, this is not always easy. If quality cannot be assigned there may be free riding on the quality of the other operator. Such free riding makes the larger operators particularly concerned about

36 Because of these advantages it appears dubious to make ADC waivers depend on the unavailability of equal access, as done in the UK.

quality. Another problem is that of peak congestion due to too much traffic. This could be due to wrong pricing, wrong capacity planning, technical problems, etc. Again, the incentives of the dominant TO and of interconnectors may differ.

The dominant TO wants to protect its network, while the interconnecting operator wants a quality of service commensurate with what the TO's own subscribers receive. Ordinarily, each party knows best what it and the other desire in terms of quality and both have a hard time formulating this in such a way that it can be adjudicated by a regulator. Also, quality monitoring is hard for a regulator to do (in contrast to price monitoring).

Hence, we conclude:

1. Quality determination and monitoring are best dealt with, at least initially, through negotiations between the parties.
2. Standard setting can facilitate reaching agreements on quality.
3. Industry arbitration with the help of the regulator should set in if bilateral party negotiations fail.

3.6.4 Unbundling

Unbundling of interconnect services is one of the most controversial issues. On the one hand unbundling has the potential to make the telecommunications markets and the market for interconnection more competitive. On the other hand, unbundling may sacrifice economies of scope that are achieved by bundling services, or unbundling may be costly to achieve, due to high transaction costs or regulation. Since the economic literature has discovered many motives for bundling of services, some of which are anticompetitive, the case for economies of scope and low transactions costs of bundling has to be made specifically before the call for unbundling is rejected.

The economics of the issue suggests the following approach:

- A functioning market would provide interconnectors with as much unbundling as they are willing to pay for. Interconnectors could then substitute their own services or network functions for those of the incumbent TO wherever the interconnectors are more efficient. This presupposes that the unbundled services (or network functions) are sold at costs.

- Absent this market, there may have to be an approach through an industry-wide committee in which, however, the regulator participates. The role of the regulator would have to be restricted to two tasks: (a) making sure that interconnectors receive the unbundled services for which there is a market demand and (b) ensure that unbundling does not interfere with other policy goals, such as geographic tariff averaging. While such goals may not be compatible with competition (unless

financed as USOs), geographic tariff averaging may also be in the interest of operators. Geographic tariff averaging is quite common in nonregulated industries (express and parcel services).

- It would be efficient if the administrative costs of creating an unbundled service element are covered through the charge for this element. If there is an imputation policy in place, according to which an incumbent TO has to impute to itself the interconnection charge paid by others, then the administrative part of the charge should be exempted from this policy. The burden of proof for demonstrating the costs of unbundling should be on the incumbent TO.

- Interconnectors continuing to buy bundled services should not have to pay for the costs of unbundling. There is a presumption that the bundled service does not cost more than the sum of unbundled services (without the administrative cost of unbundling). This presumption is based on the conjecture that an integrated TO is likely to experience economies of scope rather than diseconomies of scope.

- The demand relationship between unbundled services and telecommunications retail services are initially unknown. They are complex and difficult to learn. Unbundled services therefore cannot, in general, be priced under an ECPR or Ramsey rule determined by a regulator. Rather, a price cap approach is desirable that restricts the overall price of interconnection services but permits flexibility for the individual services. A nondiscrimination rule would nevertheless hold with respect to the different interconnectors.

The suggested approach would link unbundling to the size of the market for interconnection. Once that market is large enough the costs of unbundling could be spread over large quantities of unbundled elements, leading to low unbundling costs per unit of unbundled elements. This follows the dictum that the "division of labour is limited by the extent of the market". A problem with this approach is that it may face a vicious circle in that the market only develops through unbundling. That fear can be limited in two ways. First, by taking advantage of successful experience with unbundling in other countries, for example, the US. Copying such successful experience would lower the costs of unbundling. Second, the fear can be limited by a regulatory determination based on the expectation of strong future market development. The determination would initially limit or eliminate the administrative or "restructuring" component of the unbundled charge element and would let the TO recover the restructuring costs later (and with interest), when the market has developed.

We conclude:

1. The desirability of unbundling depends on the administrative and construction costs of offering unbundled elements. The benefits of unbundling consist of increased flexibility in combining network elements, resulting in cost savings and increased competition.
2. The process of unbundling should be industry driven, with some regulatory guidance that unbundling should occur if its benefits exceed its costs.
3. In principle, consumers of unbundled elements should pay for the costs of unbundling (because they also derive the benefits). This also establishes a prima facie case that unbundling is desirable. Since unbundling costs (like costs of equal access) are largely one-time costs, they may have to be recovered over a longer period of time. A regulatory determination may be required to establish the appropriate costs per unit of unbundled element sold.
4. The more unbundling occurs the less can overhead and common costs be assigned. Thus, the FDC pricing approach becomes less and less feasible the more unbundling progresses.

4 Interconnection as a regulatory issue

4.1 The need for regulation

4.1.1 Impediments to satisfactory market solutions

We have seen in the discussion of interconnection as an economic issue that it may be arranged in a way to provide an optimal balance of benefits to the two or more partners in the transaction as well as to serve the general public interest. Even if one does not aim at optimal solutions but would be satisfied with some degree of approximation to them, it appears that these are difficult to achieve. What impedes the realisation of this kind of solution through the usual mechanism of the market? The main reason must be seen in the market structure of the telecommunications sector still prevalent in most countries. It usually exhibits a dominant (if not monopoly) integrated provider of telecommunications services having bottleneck control over access to most customers.

In such an environment, the incentives to the incumbent to offer interconnection to other network operators, in particular new market entrants, on a fair and efficient basis are mixed. The incentives may be positive and strong if the services the other networks offer are complementary to its own. The contrary is true, however, if the services are substitutive and competitive. Then the incumbent may expect only disadvantages instead of benefits from interconnection and attempt to refuse it altogether, offer it at too high a price or at a quality below the standard applied to its own end-user services. This practice may even be observed of incumbent carriers offering complementary services if, for example, they follow a strategy to enter the market of these services in future.

There are only a few cases in which in actual practice market entrants negotiated the interconnection of their networks with that of the incumbent completely on their own without any regulatory involvement. The most prominent, and in the present context most relevant, cases are the ones observed when the market in New Zealand was opened to competition (see the following Chapter 5 and the Annex for a detailed discussion). These cases demonstrate the hazards of such a laissez-faire approach. The interconnection arrangements that were negotiated by the new fixed as well as mobile services carriers were all reached at a price, either in terms of too high charges for interconnection services, long periods of only partially resolved litigation, and in the process very high transactions costs. Because of the emerging oligopoly structure of the market, there is only a modest prospect that the gains in efficiency that undoubtedly have intervened will in the end be passed on to customers instead of being retained by the carriers, especially the incumbent. Instructive also is the example of the early interconnection history in the US. There, in the 1970s, the courts opened the market by

forcing the incumbent Bell System to interconnect with new competitors after the regulatory authoritities had long refused to accede to such demands. The competitive process, which in the end proved unavoidable and beneficial, could have started much earlier if there had not been this retardation.

Regulatory policy in the market for end-user services may, beside market structure, also be a reason tending to impede economically desirable interconnection. This may be due to price distortions brought about by regulatory intervention that have the effect of making access to particular customer groups via interconnection so unattractive that the market entrants' stand-alone solutions appear more advantageous although the incremental costs of using the facilities of the incumbent would be less. The most common instance would be interconnection charges that are fixed in relation to retail prices that in turn average out the cost differences between low and high volume users. This circumstance is apt to result in partial non-realisation of interconnection in that the market entrant selects the stand-alone solution for high volume users while relying on interconnection for the rest of its actual (and potential) customers.

A situation of asymmetric regulation in the end-user market, assuming that it cannot be removed for reasons not to be discussed here, would by itself call for an involvement of the regulatory authority for the achievement of fair and efficient interconnection. Furthermore, the hazards contingent on leaving interconnection issues to be resolved by unrestricted negotiations between the actors would in the view of most policy makers and observers be sufficiently great as to argue against this approach and for some kind of regulatory oversight. This view would be reaffirmed even after considering the likely costs of such regulatory oversight in terms of the bureaucratic machinery and possibly arbitrary decisions. Such costs would be considered less than the alternative costs due to long drawn-out litigation and dynamic and allocative inefficiencies inherent in tight oligopolistic market structures left unregulated.

4.1.2 What kind of regulation ?

Even in EU countries with no authority to explicitly regulate the telecommunications sector there always exists an oversight over market players as regards their adherence to prescribed market rules. In other words there is at least a competition policy and an authority watching that the relevant codes are being observed. The question thus needs to be addressed whether a sector-specific regulation of the telecommunications sector is in fact needed or whether a competition policy, applied in the same way as to all other segments of the economy, could be considered sufficient to deal with its structural and institutional problems, in particular those posed by interconnection.

4.1.2.1 Competition policy

What can competition policy achieve? Competition policy can approach interconnection issues either by influencing the behavior of market participants or by influencing market structure.

The fact that interconnection means the provision of access to bottleneck facilities implies the danger of several types of behaviour relating to interconnection that would be forbidden under competition law. These types of behavior, known as abuse of a dominant firm's market power, include exclusion of competitors from the bottleneck facility, squeezing (charging a price for the bottleneck facility that is high relative to the price to end users), predatory pricing, price discrimination (raising rival's costs), bundling and vertical restraints (for example, fixing prices that interconnectors can charge end users). Competition policy can help uncover and rectify such abusive behaviour by offering (potential) interconnectors actual and punitive damage awards and by penalising offending parties. The prime advantage of using competition policy is its self-policing nature and its potentially flexible adaptation to changed circumstances. Its main drawbacks are that it only sets in retroactively, takes quite a long time until court decisions are made and causes high costs if it must be used on an ongoing basis. Furthermore, court decision are not easily reversed, even if circumstances change. All this is actually likely to make competition policy quite rigid and cumbersome. Also, it would certainly delay interconnection for the first entrants after opening of the telecommunications market.

In antitrust cases the US courts have consistently required monopolists to provide competitors with reasonable access to the essential facility. This does not, however, mean that the antitrust laws mandate absolutely equal access. Reasonableness is thus a weaker standard that would preclude undue discrimination but could allow justified discrimination, for example, due to technical infeasibility or high costs. A question to be addressed by policy, however, is whether there should not be entry assistance provided to emerging rivals of a dominant TO. If this is answered in the affirmative, the standards of competition policy may not be adequate to overcome monopolistic control over bottleneck facilities. Proactive regulation would appear more effective for this task.

A totally different issue from a dominant firm's abusive behaviour is that of collusion. This is actually one that probably can only be addressed successfully by competition policy. Contrary to the dominant firm case, collusion usually has the backing of the industry. Policing therefore depends either on outsiders or on consumers. A cartel office that is specifically engaged in detecting and prosecuting collusion probably can successfully fight producer interests and take a pro-consumer position.

Structural competition policy steps in when policy measures aimed at controlling behaviour are considered inadequate to deal with problems due to corporations' large size and deep pockets. Structural competition policies consist of forbidding mergers, prescribing separate subsidiaries and, as most radical measure, forcing the divestiture of parts of a corporation's businesses. It almost always confronts trade-offs between

economies of scale and scope on the one hand and the exercise of market power on the other. The handling of these cases is the domain of the cartel office. It alone has the machinery to carry such cases through the judiciary system, as will be necessary in most instances.

Structural competition policy has been pursued with particular vigour in the US where AT&T was divested and the Regional Bell Operating Companies have to use separate subsidiaries to enter certain lines of business. These kinds of actions necessarily get involved in questions of interconnection. Part of the relevant court decisions in the US therefore also addressed interconnection issues in prescribing rules that had to be adhered to the maintenance of fair competition. Their implementation, however, generally was not entrusted to the institutions applying competition policy but rather turned over to the regulatory authorities.

Structural policy measures may intervene to prevent mergers that are due (in part) to a failure to solve interconnection issues between different providers of telecomunnications services. The regulatory authority and the cartel office should cooperate on these cases so that all relevant information can be brought to bear on the cartel office's decisions on them.

We conclude:

1. The prevention of collusive behaviour by competing telecommunications suppliers should generally be the task of a cartel office applying general competition law.
2. Structural competition law is best pursued by a cartel office in conjunction with the courts.
3. Assuming that a specific regulatory authority is established, a cooperation between it and the cartel office is advisable inasmuch as the cases to be decided involve issues of interconnection (this will be taken up again in Section 4.1.2.2).

4.1.2.2 Government appointed regulatory authority

The most widespread policy approach to interconnection is proactive regulation by a government appointed Regulatory Authority (RA). Historically, this may have to do with the prevailing regulation of telecommunications markets for end users that made it natural to place competitive issues and therefore interconnection issues with the same agencies. A major difference with competition policy is the more industry-specific, proactive and ongoing nature of regulation. An immediate consequence is that regulation may be more adequate if industry-specific expertise and continuous adjudication are required. In our view, that is likely to be the case as long as telecommunications end-user markets are regulated and as long as the market for interconnection is highly asymmetric (dominated by a single firm) and has not yet matured in its rules.

Regulation deals with pricing and non-price issues. The criterion for determining interconnection issues by regulatory rule must be the public interest that is served. This has to be decided in general on the basis of the alternatives available to the operator or service provider requesting interconnection. There may be cases where viable alternatives to interconnection exist, and it might not be in the public interest and possibly deter innovation if it is then mandated. This might be particularly true if there are important technical difficulties in realising interconnection. Alternatively, interconnection may not be sought by a competitor because of distortions in the price structure of the incumbent TO, making it attractive to bypass its network, and in this case it would fall to the RA to correct or compensate for this situation and bring about the economically less costly solution through interconnection. It is likely that these issues are best handled by a government regulatory agency.

We clearly see the need for the establishment of a regulatory authority to oversee generally the process of introducing competition into telecommunications and making it to work and in particular to control the process of interconnection. As long as the market for interconnection services itself is not effectively competitive, the RA should have the authority to impose its view as regards the appropriate solutions to critical and contented issues between the parties.

There should be a division of labour between the RA and the cartel office. The RA's role would be to introduce and foster competition. It should do this by taking the initiative and inter alia using interconnection as an instrument. If, once the competitive process is under way, rules of competition are not adhered to, either by the incumbent or a new competitor, then it would be the role of the cartel office to deal with this subject matter. Also measures of structural policy would be the task of the cartel office. The cartel office should rely on its normal criteria for taking up cases and apply its normal standards in deciding them. It could, however, make use of the RA's expertise when forming its opinions. For example, the RA's greater familiarity with interconnection will more easily enable it to detect elements of collusive behaviour expressed in interconnection agreements or to determine whether interconnection issues are at the root of intended mergers or would make structural separation decisions unworkable or not.

In order to mitigate fears of arbitrary decisions, the relevant legislation should specifiy that the RA's decisions be subject to judicial review.

We thus conclude:

1. Issues of interconnection, like those of introducing competition generally, should fall under the jurisdiction of an authority explicitly instituted for the purpose of regulating the telecommunications sector.
2. The RA should have the power to impose its decision in all situations in which, according to its evaluation, the normal market process would not lead to acceptable solutions.
3. Matters falling under competition policy should be handled by the cartel office. The RA should co-operate with the cartel office in the evaluation of cases.
4. Legislation should provide that decisions by the RA are subject to judicial review to mitigate any fears of arbitrary regulation.

A large part of the following sections will be dedicated to specifying the particular measures that the RA may use and the reasons for using them, leaving as much degrees of freedom as possible to the immediately concerned parties. From this will emerge a picture of the right balance between the roles accorded the RA and the interconnecting parties.

We will not specify the RA more closely except to state that it is assumed either to have been instituted by government or to be itself part of the government and that it carries out its functions under a mandate usually derived from an act of parliament.

4.2 Options for a regulatory treatment of interconnection issues

4.2.1 Realisation of interconnection

4.2.1.1 Identifying the case of interconnection

Since any regulatory intervention tends to assign entitlements that may not emerge without this intervention, it is necessary that there be no ambiguity about when there is a case of interconnection. In other words, there must be a basic policy statement providing clear guidance on the matter.

From our discussion in Chapters 2 and 3 it follows that as a general category operators of telecommunications networks and service providers are the entities that should be considered for interconnection with other telecommunications networks and service providers, where we use "interconnection" as a generic term to designate access to respectively connection with the facilities of the other party. In this sense, interconnection includes what at other places has been called "special network access".

In the following we will have to indicate - which is particularly relevant at the "lower end" of interconnection, i.e. special network access - in what way interconnection differs from ordinary customer access.

The RA should potentially assume a case of interconnection whenever there is a competitive relationship between two telecommunications network operators or service providers and the one demands the use of the facilities of the other for the delivery of its own services. The definition applies clearly to the most relevant case, that of a new market entrant, either a network operator or a service provider, seeing itself dependent on the network of the incumbent telecommunications operator for the delivery of its services. It excludes the normal end user, be it the residential or business type customer.

For considerations of regulatory treatment, a distinction will have to be made between the different possible interconnection combinations, i.e.

(1) network - network,

(2) network - service provider,

(3) service provider - network, and

(4) service provider - service provider,

where we regard the first named entity as the provider and the second as the demander of interconnection. Combinations (1) and (2) undoubtedly fall under the RA's mandate regarding interconnection. All topics covered in this report are relevant for at least one if not both of these two combinations. The two combinations (3) and (4) are less likely to be of regulatory relevance. A network operator is in most cases also a service provider. In order to become the provider of any particular service it would just have to add elements in the value chain of a service. For such offerings it would ordinarily not face any restraints because of bottleneck facilities controlled by another service provider. The case is not quite the same but similar with respect to the relationships between different service providers as long as the service provider on the demand side is assured interconnection with a network operator. This is so because the service provider being requested to supply interconnection, as service provider, is unlikely to control a bottleneck resource.

In summary, we conclude:

1. Issues of interconnection may arise whenever there is a (potential) competitive relationship between two telecommunications network operators or service providers and the one demands the use of the facilities of the other for the delivery of its own services.
2. Regulatory attention should primarily be directed to the constellations of network - network and network - service provider interconnection.

4.2.1.2 Identifying the conditions for interconnection

We assume a liberalised market environment in the sense that legal monopolies are abolished and that there is an explicit policy to facilitate market entry of new competitors. In general, however, we assume that there is still a dominant incumbent network operator offering the whole range of telecommunications services, and competitors are either just entering or, if they have been in the market for some time already, are still small in relation to the incumbent. We further assume that the RA has the (explicit or implicit) mandate of pursuing a policy of introducing and *fostering* competition until the degree of concentration in the market has decreased to an extent that warrants treating the sector no differently than any other and leaving oversight of it to general competition policy. Given this mandate and recognising the importance of interconnection for the success of such a competition policy, it is important that the RA documents very clearly its position as to what it considers justified demands for interconnection.

There are several steps to developing such a position. One is to define the kinds of businesses (network operator or service provider) for which interconnection is a relevant concern; we have dealt with this point in Section 4.1.2.2. The next step would consist in defining the types and segments of networks with respect to which interconnection by justified demanders would be considered the subject of regulatory concern. Further the RA would have to specify by what kind of action or measure it intends to have interconnection realised in the possible different cases.

In Section 3.2, we have presented the economic arguments in favour of as well as against interconnection. We concluded there that the bottleneck property inherent in some parts of telecommunications networks and the realisation of positive externalities are the strongest reasons for seeking interconnection. The bottleneck property of a network, if not overcome, would prevent any other operator/provider from serving the market. The positive network externality as a consequence of interconnection substantially increases social welfare so that interconnection for this reason is highly desirable from the viewpoint of society. We concluded further, however, that the bottleneck property does not necessarily hold for all types of interconnection. We also indicated that there may be reasons of community of interest that would on a a-priori basis provide sufficient reason not to require interconnection with the network for which this interest exists.

From the analysis in Chapter 3 it follows that

- there are compelling reasons to declare the local network connecting single-line customers a bottleneck facility;
- the trunk network and the intelligent network (IN) of the incumbent TO also fulfill the conditions to be declared a bottleneck facility for service providers;

- local lines of multi-line customers, the trunk network and the IN of the incumbent TO should not be considered a priori to be bottleneck facilities for other network operators (offering long-distance and/or international telephony, mobile services, etc.);

- if that is necessary for the goal of opening the market to effective competition any network, network segment or specialised resource may temporarily be declared a bottleneck facility.

The RA should carry out a case-by-case evaluation of each individual situation given the existing structure of the particular national telecommunications market. This would be called for in particular in situations referred to under the last bullet above. A conceivable example of a temporary bottleneck facility could be the mobile network of the incumbent TO with which a competing mobile operator is denied interconnection because the TO would prefer interconnection to occur indirectly via the PSTN for reasons of the higher interconnection charges the interconnector would have to pay. Another example could be the incumbent TO's trunk network for the purposes of a new network operator during the specified time that the latter needs to put his own network in place. There may also be - unlikely - cases where service providers develop resources, like specialised data banks, that for other service providers and network operators become bottleneck facilities.

Under the last bullet above we referred to the impermanence of certain declarations of bottleneck facility. We emphasise that, in principle, all such declarations should be temporary, at least in a long-run perspective. This would depend on the development of competition. For example, once competition in the local loop has developed to an extent that single-line customers could also select between competing providers there would be no need any more to maintain the designated status of the local loop operated by the formerly dominant TO as a bottleneck facility. But, as mentioned, this is a long-run perspective.

From this we conclude:

1. The RA should clearly designate (a) the networks or network segments that constitute bottleneck facilities and (b), for each declared bottleneck facility, the classes of suppliers of telecommunications services that would be entitled to interconnect with it.
2. The RA should carry out the relevant evaluations balancing global externality effects and the effects of economies of scale and scope against the potential dynamic benefits that may arise when new competitors are denied interconnection and have to search for and find alternative ways of delivering their services.
3. The time period during which the status of bottleneck facility for a network or network segment is to be maintained should be specified. The end of that time period could be defined in terms of the competitive state of the relevant market.
4. For carrying out these evaluations, specific technical, economic and legal expertise will be required which should be at the disposal of the RA.

A comment regarding the last of above conclusions: There will in the sequel be further occasions to call for specific expertise on which the RA should be able to rely for arriving at its decisions. In order to avoid redundancy, and because these instances will be obvious, we consider the above statement of conclusion to apply to all such instances and shall not repeat it further.

4.2.1.3 Granting the right to interconnection

Once particular segments or the whole of a telecommunications network have been declared bottleneck facilities, service providers and other network operators should be granted adequate rights to interconnect with them. Conversely, the operator controlling these bottleneck facilities should be under an obligation to grant interconnection.

There are various options to choose from as to where these rights and duties are to be expressed. They could be enshrined in the law constituting the basis for public policy in the telecommunications sector, they could be the subject of secondary legislation (orders, directions, rules) promulgated by the RA, or they could be made part of the licences that are granted individual operators and providers. The approaches differ in respect of the significance accorded interconnection and in respect of the degree of flexibility with which the RA can react to changes in given circumstances. Enactment in a law would provide for greatest assurance of the right to potential demanders but be subject to greatest inflexibility. If they are expressed as part of a licence the assurance given is much less as licence conditions can always be changed; this, however, would be the necessary consequence of the advantage of this approach enabling the RA to respond flexibly to changing conditions.

There is the possibility that certain providers, for example simple resellers or providers of value added services, would be exempted from obtaining specific licences. The RA would have to specify clearly in a general regulation what kind of interconnection rights they have (in respect of the network services they need) and who would have the duty to supply them. A possible solution could be to declare the PSTN of the incumbent TO a bottleneck facility for their purposes and the policy statement should extend a blanket right to simple resellers and service providers as regards interconnection with it. The policy statement should further place the obligation on the incumbent TO to provide interconnection correspondingly.

In summary, our conclusions are:

1. Rights to obtain and duties to provide interconnection should be formulated in secondary legislation promulgated by the RA. Licences given to telecommunications network operators and, where relevant, to service providers should, in conformity with the policy statement, specify the conditions relevant to the particular case and provide for specifics according to the particular circumstances.
2. The right to demand and the duty to provide interconnection should be made contingent on the finding that a network or a network segment has been declared a bottleneck facility for the use intended by the demander. This should be specified in the licence.
3. If certain providers of telecommunications services are not required to have licences, the RA should specifiy in a regulation treating the case in general what their interconnection rights are and who has the duty to provide interconnection.

The approach expressed in these conclusions strikes, in our view, the proper balance between assurances with respect to the provision of interconnection that new market entrants need and the flexibility that the RA must have to respond if there is a consensus that circumstances have drastically changed. In any case, assuring the right to interconnection and obligating the incumbent TO to provide it is only the beginning of a process of negotiation between the parties and, as the case may be, regulatory determinations on many detailed aspects of the very complex business relationship that interconnection represents.

4.2.1.4 Providing for a framework for negotiating interconnection agreements

Declaring rights and duties regarding interconnection will in general not suffice to bring it about in an acceptable way. This will depend on the proper mix of roles assumed by the RA, in terms of ex-ante determinations and ex-post interventions if need be, and the role that the immediately concerned parties are allowed to assume in the process. We argued in our economic analysis that there has to be a right balance between issues of sufficient generality to require regulatory determinations and issues of a "localised" nature, reflecting specific technical, geographic, organisational or customer-specific

information, that are better left to be settled in negotiations between the parties. This balance has to be found in a framework for negotiating interconnection agreements that the RA puts in place.

In defining this framework, the RA must foremost define its own role in determining the various possible issues. This will be the subject of Subsections 4.2.2 and 4.2.3 which in turn deal with the pricing of interconnection services and non-price issues. Building on the results of this analysis, Section 4.3 will then develop a framework for negotiating interconnection agreements allowing for party negotiations to cover the subjects too specific to be dealt with by regulatory ex-ante determinations, providing nevertheless, however, for an involvement of the RA on a stand-by basis.

4.2.2 Pricing issues

4.2.2.1 The role of the Regulatory Authority (RA) in respect of interconnection charges

There is a wide range of possibilities of involvement by the RA with respect to charges for interconnection services. This involvement may range, at the one end, from leaving the fixing of charges completely to negotiations between the parties concerned and, at the other, to determining them on the basis of the RA's own evaluation of relevant costs and market conditions. In our empirical analysis covering 16 different countries, reported in Chapter 5 and the Annex, we have found examples of both extremes. The presumption underlying the analysis of this chapter is that the RA has the mandate to exercise its regulatory control over interconnection charges but that the involvement should be differentiated depending on the requirements of the cases in question.

As we showed in our discussion covering the economic issues about interconnection, there is a case for treating large demanders of interconnection services differently than smaller ones. The former would as a rule be other (potentially) relatively large network operators for which it would be right, also from the viewpoint of society, that they receive individually packaged interconnection services requiring, as it were, customised pricing. Among the latter one would normally find service providers and smaller network operators preferring to be able to choose their interconnection services from an array of standardised services offered at standardised charges.

The RA may consider the two approaches as prototypical for a situation when there has been competition for a while and some experience with interconnection has been gained. It will most probably have to start the process of implementing interconnection using one single approach, which in its form will be closer to indiviual negotiations. At this point, neither the RA nor the incumbent TO would be able to tell precisely what the menu of standardised services should be so that even for smaller demanders services would have to be determined individually. Once there has been experience with interconnection, the set of standardised services could be determined in a cooperative

process involving representatives of the smaller demanders, the incumbent TO as well as the RA.

The two prototypical approaches also define two different approaches of the RA towards interconnection charges. There is an a-priori case that the RA should treat the charges for standardised services much like tariffs for end-user services in that they need approval by the RA on an ex-ante basis. Once initially set and approved by the RA on the basis of the appropriate cost standard (discussed below), the RA will also have to decide on the regime by which these charges may be adjusted over time as cost conditions change. This could be done in that at specified time intervals the charges are newly determined by the RA, or, in that the RA installs a mechanism which allows for some pricing autonomy on the part of the carrier providing the services. The mechanism that fulfills this requirement and that, following our analysis of its properties in Chapter 3, we prefer for the purpose is price-cap regulation.

Individual interconnection arrangements and the corresponding charges may prima facie be left to negotiations between the parties. The roles that the RA could assume in the context of such negotiations are:

- Participate in the negotiations as a facilitator.
- Initiate arbitration if negotiations threaten to fail.
- Make ex-post determinations if negotiations in fact fail.

As a facilitator of negotiations the RA may be present at the meetings, either as an observer or an adviser to prevent the negotiations from getting stalled or proceeding in a dead-end direction. When using the instrument of arbitration, the RA may assign the role of arbitrator to outside parties. This approach has certain advantages over one in which the RA itself makes a determination. We will expand on these ideas in Section 4.3.4.

Irrespective of the scope available for facilitation of negotiations and arbitration by alternative agents, there should be a right to an ex-post determination. So that the prospect of the potential use of this instrument develops its full effect, the RA should indicate clearly before negotiations start what the standard is on the basis of which its determination would be made (see the following sections for what this standard should be). There should also be a policy statement regarding whether charges that have been agreed upon without active intervention of the RA will need to be approved, and, if this is the case, what the criteria are for such an approval. There may be no explicit approval procedure but the charges may be subject to the RA's scrutiny for anticompetitive conditions.

The adjustment over time as cost conditions of individually negotiated charges change may be done by negotiating anew, at specified time intervals or at times when prespecified conditions are fulfilled. There is then no reason to proceed differently than

when the charges were negotiated the first time. It may also be agreed between the parties that charges adjust following a scheme like the price-cap approach. If the RA had to pass a determination, it may impose the price-cap regime if it expects that also next time there may be no prospect of a negotiated result. If there is no reason for the latter expectation the finding of new charges may again be left to negotiations between the parties.

We conclude:

1. The RA should allow private party negotiations for the arriving at interconnection arrangements.
2. It should specify under what circumstances and in what way it will intervene in private party negotiations. This should be the case when negotiations threaten to fail or they in fact have failed. The approaches could include facilitation of negotiations, arbitration and ex-post determination.
3. The RA should aim at bringing about an understanding with the incumbent TO and smaller demanders (service providers and smaller network operators) regarding a standardised set of interconnection services.
4. Charges for the standardised set of interconnection charges should be proposed by the incumbent TO and be subject to the approval of the RA.
5. The RA will have to establish a regime by which charges for standardised interconnection services can be adjusted over time as demand and cost conditions change. The price-cap regime suggests itself as the best approach currently available.
6. The adjustment of charges over time for individually negotiated arrangements should be left to negotiations between the parties concerned.

As already mentioned, for both the individually negotiated interconnection arrangement and the set of standardised interconnection services, the RA would need to give specific directions regarding the methodology on the basis of which it would evaluate charges. Much of the immediately following discussion will focus on this point.

4.2.2.2 Socially-optimal vs. cost-based interconnection charges

Above we derived the need for regulatory intervention whenever a telecommunications network operator has control over bottleneck facilities and interconnection would result in the realisation of substantial positive network externalities. The very presence of network externalities prevents the normal market mechanism, even an otherwise functioning one, to achieve solutions that are optimal from a social point of view. The market mechanism by defintion is unable to take externalities into account. This problem still needs to be faced by the RA after it has guaranteed the right to interconnection and imposed the duty to offer it whenever bottleneck conditions prevail.

Our economic analysis has demonstrated the difficulties of deriving socially-optimal interconnection charges under conditions of network externalities. The results depend on a whole range of different, and under the various possible circumstances more or less plausible conditions, and their calculation would also require the availability of information that is normally not at the disposal of the RA. This conclusion holds in particular for the much discussed efficient component pricing rule (ECPR) and the sophisticated versions of Ramsey pricing, both of which are so-called second-best pricing approaches in that they provide pricing rules that are socially-optimal after one has taken into account constraints dictated by reality.

We came to the conclusion that, while socially-optimal pricing rules allow much insight, the attempt to implement them outright would in all likelihood be infeasible. In the following we therefore propose an approach that we think would achieve a reasonable approximation to results that follow from these rules.

The RA should require a methodology for determining interconnection charges that is based on costs. Costs should be basically divided into two parts: (a) costs caused by the service in question (or, more realistically, those that can be traced/attributed to the service), and (b) costs that can not be so traced and are therefore common costs. The first type of costs would determine the lower limit for the charge of a particular interconnection service or facility. The second type of costs would have to be covered through contributions from all services where the corresponding percentage markups on direct costs would, however, not necessarily be equal across the different services. On the contrary, as we argue below, there are good reasons that they differ between the different services.

In the economic analysis of Chapter 3 we identified the standard of Long-Run Average Incremental Cost (*LRAIC*) as the one that best meets the regulatory requirement of a standard for the direct cost of interconnection services. This standard should be applied to all categories of services supplied by the TO. All costs not accounted for when long-run incremental costs of all services are added up (i.e. the sum of amounts arrived at by multiplying *LRAIC* with volume of the relevant service) should be counted as overhead and common costs. This would in particular also include the difference between the historic costs of a service irreversibly sunk in the past (because investments made in the past are irreversible) and the costs of the service evaluated at current, possibly lower prices of inputs.

Interconnection charges set at *LRAIC* would fail to provide contributions to the regulated firm's common costs and other justified revenue requirements. Therefore markups on this cost standard should be allowed on the basis of feasible Ramsey pricing. For this, the markup for interconnection services should be determined in conjunction with those for all other regulated, in particular end-user, services offered by the incumbent. This would require that in setting markups on top of *LRAIC* for interconnection services one takes into account the relevant market conditions and the corresponding markups on the *LRAIC* for all these other services. Setting the markups

for all services differently according to perceived market conditions should permit the incumbent to set prices that meet its overall revenue requirement.

The percentage markups on top of *LRAIC* for interconnection services should vary between zero, as lower limit, and, as upper limit, the minimum uniform markup, i.e. that common markup which, when applied to the *LRAIC* of each service, would lead to revenues that cover all costs, including common costs, and all other revenue requirements. The reason to constrain markups for interconnection services within this range is that in the market for the typical end-user services for which interconnection services are needed there is generally an above average degree of competition, meaning an above average price elasticity, which in the Ramsey calculation would make for below average markups. Furthermore, lower interconnection prices mean lower input prices for imperfect competitors which will intensify competition and thereby increase welfare. This also argues for the markup for interconnection services to be less than the average markup. At the limit, which expressly should not be excluded, this would imply that, when the degree of competition is very high, a markup of near zero may indeed be appropriate. Conversely, the minimum uniform markup should definitely define an upper bound.

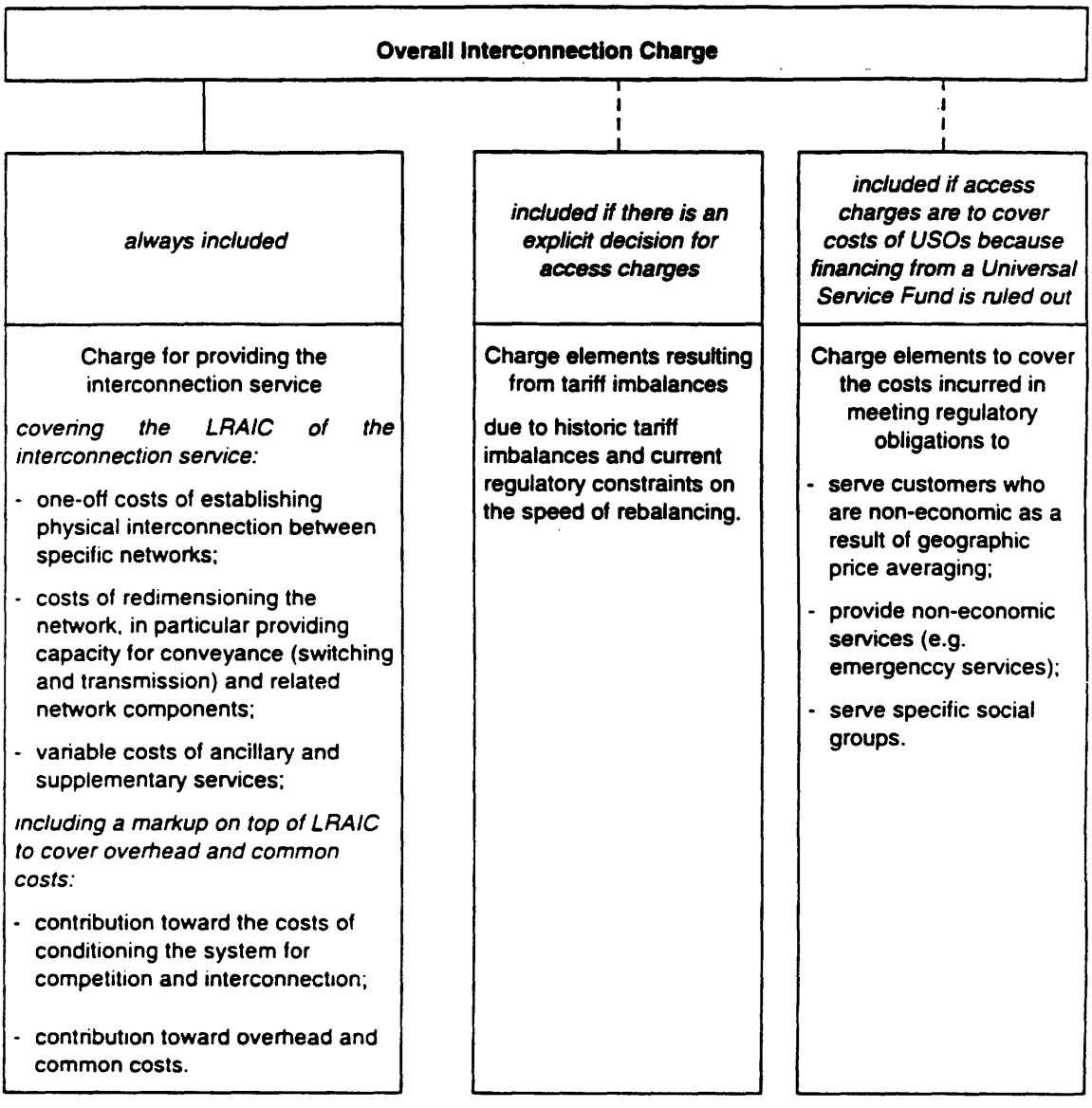
From the above, we conclude:

1. The RA should not aim to impose interconnection charges that claim to correspond exactly to socially-optimal prices.
2. The RA should define lower and upper limits within which interconnection charges must be set.
3. The standard for setting the lower limit of an interconnection charge should be that of Long-Run Average Incremental Cost (*LRAIC*) as defined above.
4. The upper limit of an interconnection charge should be a charge calculated by adding to *LRAIC* a markup that, when applied to the *LRAIC* of each service, would lead to revenues sufficient to cover all revenue requirements (minimum uniform markup).

In conclusion we refer to Chapter 3 where we discussed the different types of costs that are incurred through the provision of interconnection services (Section 3.5.4) and, further, developed the argument that access charges, to cover the costs of an unbalanced tariff structure and of USOs, should not be part of interconnection charges (Sections 3.2.7 and 3.5.9). In respect of the costs of an unbalanced tariff structure, we argued that one should rely on the process of rebalancing to eliminate them over time, and in respect of the costs of USOs, that their financing through a Universal Service Fund would be the most efficient approach. We recognised, however, that existing constraints may necessitate the use of access charges for these purposes.

We do not intend to continue this discussion here but provide in Figure 4.2.2.2-1 an overview over the composition of overall interconnection charges that would be consistent with regulatory requirements. The figure shows the various types of costs entering into the charge for capacity and services used for interconnection, as well as the types of costs to be covered by access charges, if it is decided to use them.

Figure 4.2.2.2-1: The composition of the overall interconnection charge



4.2.2.3 The mechanisms for arriving at interconnection charges

We divide the discussion in this section into two parts, one dealing with the case where there shall be private party negotiations with the aim of agreeing on interconnection charges for an individualised set of services, the other with the case where charges for a standardised set of interconnection services are to be fixed by way of a proposal and approval process between RA and TO.

On entering negotiations, parties to a prospective interconnection agreement should be instructed by the RA to find charges that are within the bounds defined above in Section 4.2.2.2: the lower limit should be the *LRAIC* and the upper limit the *LRAIC* plus the minimum uniform markup. The RA should indicate that, if no agreement was reached and it were asked to make an ex-post determination, it would determine a charge in that range on the basis of its assessment of the demand conditions in the market. This would provide proper incentives for the two sides in the negotiations. Not knowing what the RA would do in case of failure of negotiations, they both would have a preference for a settlement on their own accord. Of course, if either party speculated that it would have a good chance that its view on charges would be confirmed by the RA, it might opt to let negotiations fail and rely on the RA's decision. This would have to be accepted as a legitimate part of the process.

As regards charges for standardised services, the fixing of these charges would have to wait until agreement on the relevant set of these services had been reached, which would most probably occur only after some time and after consultations involving demanders as well as the TO and the RA. The interconnection charges would then have to be set in a process in which the TO submits a proposal for the charges and the RA examines and approves them. They would have to fall within the bounds defined above. Most probably, the process could profit from the prior experience with finding interconnection charges in private party negotiations and possibly ex-post determinations by the RA. Conversely, the standard charges, once established, could serve as benchmarks for individual negotiations in the sense that any interconnector could request to be served under them.

For the sake of supporting the emergence of competition, there may be a case for relatively low markups on *LRAIC* in the case of charges for standardised interconnection services. It is granted that this approach would at first provide smaller contributions to common costs and the revenue requirement of the incumbent TO than is warranted. The regime that would provide for the adjustment of charges over time as demand and cost conditions change, preferably the price-cap regime, could then be specified in a way that the firm is able to generate sufficient contributions over time. As mentioned, this approach would amount to an explicit policy of facilitating competitive entry. The extent of entry assistance would abate with time, however, as the regulated firm would under the price adjustment regime increase the margin between charges and costs.

Our conclusions are:

1. The parties in negotiations for interconnection charges should be given ranges, with lower and upper limits, within which the charges are to be fixed. The lower limit should equal *LRAIC* and the upper limit *LRAIC* plus the minimum uniform markup, as discussed in Section 4.2.2.2.
2. If negotiations fail, the RA should determine charges that fall within the given range using its assessment of demand conditions on the different markets.
3. Charges for standardised interconnection services should also be fixed within the range given above. They would result from a process in which the incumbent TO submits a proposal which the RA examines and approves if it meets the RA's criteria. If the proposal does not meet these criteria, the RA makes a determination which the TO must accept.

4.2.2.4 Cost accounting as the basis for cost-based charges

The best cost accounting approach currently available to derive cost measures is Activity-Based Costing (ABC). It appears that, if consistently applied and based on forward-looking cost data, ABC will lead to measures that are close to reflecting truly efficient *LRAIC*.

The methodology of ABC is likely to be more demanding than the methodology currently used by most TOs, which is likely to be a version of fully distributed costs (FDC) using historic prices. We are aware that there cannot be replacement of, for example, FDC by an ABC methodology immediately. Until adequate cost accounting is introduced, there should be efforts toward a flexible use of the available cost accounting methodology in order to mitigate any distorting effects of this approach; preferably, however, use then should be made of information from engineering cost models, which are normally available in TOs.

The process by which the cost methodology is implemented should be monitored by the RA. The RA should also always have access to the cost accounting records of the firms it regulates.

From the above we conclude:

1. The RA should require TOs falling under their mandate to use an ABC methodology, based on forward-looking cost data, for the costing of their services.
2. Until an ABC methology can be put in place, in order to avoid grossly misleading cost figures as the basis for interconnection charges,
   - the available methodology should be used as flexibly as possible,
   - reliance should also be placed on information from engineering cost models.
3. The RA should always have access to the regulated firms' cost accounting records.

As already mentioned in Chapter 1.2.3, there is a study under way, carried out by Arthur Anderson and entitled "Cost Allocation and the General Accounting Principles to be used in the establishment of Interconnection/Access Charges", investigating the concrete requirements regarding cost accounting to be placed on TOs for the purpose of costing interconnection services. We will leave to this study any further consideration of the matter.

4.2.2.5 Accounting separation as safeguard against cross subsidisation

When the business units of the incumbent TO that offer services in competition with new market entrants use the same network services as interconnectors - and this will normally be the case - the internal transfer prices for these services should be set following the same pricing standard as applied to charges for external interconnectors, i.e. they should be based on *LRAIC* and include the same markups to cover overhead and common costs. It may well be that due to the application of this standard economies of scope are lost for the downstream units of the TO. This loss must, however, be accepted as less important than the risk of manipulation of the cost data by the incumbent for purposes of giving its own units undue competitive advantages. In any case, the benefits of economies of scope remain with the upstream business units of the TO that supply the interconnect services.

Provided that this standard is maintained throughout, the question of cross subsidisation then becomes one of whether the prices for the incumbent's competitive final services cover all relevant costs, including the costs of the services that correspond to interconnection services. This would obviously mean that the revenues from the sale of competitive services must not only cover the incumbent's actual *LRAICs* of these services but also the markups on these *LRAICs*.

The RA should require the incumbent TO to separate its revenue and cost accounts in a way that the adherence to this condition can be verified. The accounts should show the internal transfers between the TO's different business units of all services, in particular of those corresponding to interconnection services. Furthermore, they should show all other direct costs and the revenues for each of the competitive end services.

On the basis of this information the required comparisons could be performed. The TO's business organisation should be aligned so that it corresponds to the requirements of this accounting separation.

Under the suggested approach of accounting separation it would be natural to collect the total of all overhead and common costs on a separate cost account and to set against it all the contributions earned by the different services from these margins (as well as the negative contributions, for example the loss on local access). The RA should require the use of such an account as it would increase transparency regarding the overall in addition to the service-specific profitability of the regulated firm.

The provision of information on the basis of separate revenue and cost accounts need not necessarily be done on a continuous basis. The information that separate accounts can provide with respect to cross subsidisation is really meaningful only if it is compiled on an incremental cost basis. If the cost accounting system is still done according to a different standard it would be difficult to provide that information continuously, even if only approximately. It would then be preferable to have reporting along accounting separation principles be done only periodically but with the maximum possible extent of relevant adjustments to the figures.

We conclude:

1. The RA should consider requiring accounting separation as a safeguard against cross subsidisation.
2. Accounting separation should to the extent possible be carried out on a long-run incremental cost basis.

4.2.2.6 The structure of interconnection charges

The question of the structure of interconnection charges poses itself differently for the two different types of interconnection arrangements, i.e. the individually tailored interconnection packages demanded by large users of interconnection services, on the one hand, and the standardised unbundled services demanded by service providers and smaller network operators, on the other. The former will probably be served best by being able to pay directly for the capacity that is placed at their disposal, with adjustments for deviations of actual use from the capacity ordered. For the latter a structure of prices based on actual usage would be the most relevant one. That structure couid, however, also reflect the differences in cost causation due to usage during peak and off-peak hours. This could result in a two-part structure of tariffs with a fixed part per unit of time and a usage-sensitive part that is lower than in the case of a

strictly linear price structure. We have discussed the various aspects of the appropriate structure of interconnection charges in our analysis of Chapter 3.[36]

We conclude:

1. The RA should support demands for capacity-based charges by large users (network operators) of interconnection services.
2. The RA should consider a methodology for determining charges for standardised services that is based on the cost due to the use of capacity during peak and off-peak hours.

4.2.2.7 The burden of an unbalanced tariff structure and the provision of USOs

In Chapter 3.5.9, we have discussed in detail the efficient treatment of burdens placed on TOs due to an unbalanced tariff structure or the obligation to provide USOs. We demonstrated that

- for the burden of an unbalanced tariff structure there should initially be no access charge allowed, and
- with respect to USOs, the efficient approach to their financing would be by way of a Universal Service Fund.

We need not add further to the arguments developed there except to point to aspects of proper measurement and calculation that would have to be monitored by the RA.

Whenever compensation of a burden placed on a TO, i.e. the costs of an unbalanced tariff structure or of USOs, is to take place, the costs in question need careful determination. In particular, the amounts potentially to be recovered need to be determined for each relevant period as a separate amount. From the total amount so determined, the access charge or the contribution from the USF for that period would have to be calculated.

For the local access loss, which is usually the most intensively discussed item in this context, the following is the outline of a suggested methodology for its calculation: Determine a forward looking cost measure for the local loop, differentiated by types of local networks (metropolitan, medium city, small city, rural) and taking particularly into account existing infrastructure such as ducts and other very long-lived facilities. The

36 When we support the use of capacity-based charging, with its implication that the demander for interconnection services pay for actual investment cost of the capacity in question, we do not mean that these charges should not include a contribution to common costs, or in other words, the TO's revenue requirement as discussed in Section 4.2.2.2. These contributions, or the markup on the incremental cost, would have to be negotiated along with the establishing of that cost. The same obviously also holds for charges on a peak/off peak basis or in the form of a two-part tariff.

costs of large parts of local networks are sunk costs which were incurred far back in the past and which will not recur for a long time in the future. For this evaluation, special studies would need to be carried out. Having made the determination on costs, one would need to decide to what extent the sunk costs of the past should be considered having already been covered by profits made in the past. One could presume this if the TO in question had made particularly large profits in the past. Only after having also answered this question could one proceed to the calculation of an access loss to be covered from other sources.

We conclude:

1. For the fixing of an access charge or contributions to the USF, a very careful calculation of the costs of an unbalanced tariff structure or of USOs needs to be done.

2. Careful calculation of the local access loss would particularly be relevant. This would involve the establishment of the proper cost measure for the local loop (forward looking, based on current prices) as well as considerations regarding how much of these costs could be considered to be or have already been covered by the incumbent's supra-normal profits from other services, currently as well as in the past.

4.2.2.8 The safeguarding of network integrity

There is no question that the interconnection of different networks and service providers requires careful attention to maintaining the integrity of networks, in particular that of the PSTN. At this point there is overwhelming evidence that the technical measures to assure network integrity are available and can readily be implemented. As we discussed in Chapter 2.6, if there are several suppliers of network services this can be expected to actually increase the reliability of telecommunications services.

What still needs to be discussed is the question of who pays for the cost of these measures. As a first approach, consider the optimal result in a case where there are networks of symmetric size that compete with each other. Network integrity would then be a matter of equal interest for all network operators. In particular, each operator of a network knows that, to make sure that his network is protected, he himself must give assurances not to imperil those of his competitors. This provides the incentive for all competitors to seek a common solution that is satisfactory for all and can be achieved at least cost. Since the cost of providing network integrity will be lower if assured through one common approach than if each network operator sought its own solution, one should expect that this common approach is selected and the cost of the system is assumed by all on an equal basis. Inasmuch as charges for end-user services cover all costs, the users of all networks pay for the cost of network integrity.

The introduction of competition into the telecommunications sector is to serve all customers in the markets where competition becomes the prevalent mode. It will in particular also benefit those customers that, although not switching their business to new market entrants, will take advantage of the incumbent's lower tariffs due to competition. Given that the benefits of competition will be spread over all customers in the relevant markets, it appears natural and fair that the costs of its introduction be also so spread. Therefore, following our discussion in Chapter 3.5.4, these costs should be borne by the incumbent as well as the new competitors.

At the beginning of the process of introducing competition into the sector, it would be the incumbent TO that assumes the responsibility of assuring the integrity of its network. The cost for this would then have to be included in the charges for network services that it charges its own business units downstream as well as its competitors through interconnection charges. As competition develops and competing networks gain in size, the operators of the latter will have an interest of their own in assuring the integrity of networks, not only of their own networks but overall, and be interested in finding common least-cost solutions.

We conclude:

1. The RA should work out a methodology by which the cost of extra measures of network integrity by the incumbent TO are to be shared between the incumbent and new competitors.
2. As the networks of market entrants grow in size, they themselves will have an incentive to find common least-cost solutions of assuring network integrity.

4.2.3 Non-price issues

Besides on pricing issues, intervention by the RA may be required on a number of non-price issues. In these cases as well, the involvement of the RA may be in the form of

- an ex-ante determination,
- policy statements providing guidance to private party negotiations or decision processes at industry fora,
- participation at private party negotiations as a facilitator of negotiations,
- arbitration if negotiations threaten to fail, or
- ex-post determinations if negotiations in fact do not lead to an agreement.

Again, also with respect to non-price issues on which in principle negotiated outcomes would be preferred, the parties, in particular the interconnection demanding operators

and service providers, should have a right to obtain an ex-post determination to clearly demonstrate that the right to interconnection will also be implemented.

4.2.3.1 Equal access

From the perspective of customers, equal access is assured if their access to alternative long-distance providers of telephone services by end-users is the same as access to the incumbent TO. It is usually achieved when a customer may express a choice as to which provider is to serve him or her, that choice is recorded at the local exchange, usually belonging to the telephone company serving the local network as a monopoly, and the customer's long-distance calls are then automatically routed to the carrier in question. This preferred mode of equal access is referred to as "preselection".

Another form of equal access would require that each competitor be identified by a distinct code, in form of a prefix, that the local exchange would recognise so that it could route the dialled long-distance calls to the corresponding long-distance carrier. If that code consisted of only one digit, this could be a mode of equal access having attractive features for consumers as it would allow flexibility of selection. It restricts, however, the number of competitors to only nine. As soon as there are two-digit prefixes, the advantages of flexibility are probably already considerably reduced.

It is an empirical observation that equal access in the form of preselection is actively demanded by competitive providers of long-distance services. An example is the market entrant in New Zealand who negotiated with the incumbent TO equal access in the form of preselection without any support from a regulatory authority, agreeing to take over 100% of the costs involved. Benefits are seen to arise not only for the competitors but also for the economy as a whole in that it supports the competitive process. The provision of equal access is not unlike access to a bottleneck facility in that only the incumbent TO can provide it.

The RA has to address the question of whether to leave the achievement of equal access in a first round to private party negotiations or to order it ex-ante, and if it is ordered, who is to bear the cost. The balance of expert opinion on the matter, taking into account the beneficial effect it has on competition in long-distance telephony as well as the probable reluctance of the incumbent TO to provide such access, is that it should be ordered on an ex-ante basis. Following our analysis in Chapter 3.5.4, the incremental cost of its provision should be borne by the incumbent as well as the new competitor(s).

The RA could enhance the prospect of early installation of equal access facilities if it offered an incentive to the incumbent TO in the form of ending a particular favourable treatment of new competitors once equal access is achieved. This could for example consist of renegotiating interconnection charges that initially were determined by the RA. Using this approach should depend on the whole set of conditions making up the interconnection framework.

We conclude:

1. The RA should take a decision supporting the early provision of equal access of final users to carriers of long-distance carriers.
2. The decision should consist of an ex-ante determination if reluctance to provide it on the part of the incumbent TO is expected.
3. If equal access is ordered by the RA, a methodology should be worked out assuring a fair sharing of the cost of establishing equal access between the incumbent TO and new competitors.

4.2.3.2 Collocation

The collocation of an interconnecting carrier's equipment accomplishing the physical interconnection or, as regards service providers, the collocation of their computers and switches on the premises of the interconnection granting network operator, brings advantages both in terms of quality and costs. If there are no reasons with opposite effects of comparable importance, it should be granted in order to minimise the cost of providing services in a competitive environment.

The RA's general position on collocation should be to require the incumbent TO to provide it unless the TO can show that acceding to the requirement is technically infeasible or not justifiable on economic grounds. As an alternative, the incumbent TO would have to offer so-called virtual collocation where interconnectors are not physically collocated but are otherwise connected to the system on terms that place them in no worse a position than if they had real collocation.

This would require that the incumbent TO charges its own downstream businesses for network services the same as its external interconnecting competitors, although the actual cost of serving its internal units, which are collocated, would be less. The benefits (in terms of higher internal revenues) of actual collocation that would be realised with its own downstream business units would be reaped by the upstream unit of the incumbent TO controlling the bottleneck facility. The justification for virtual collocation, through which the economic advantages of close physical interconnection are forgone, would be that none of the near-customer suppliers of services (internal or external) would benefit from a privileged relationship with the bottleneck supplier of network services and therefore fair competition would become possible.

Virtual collocation may mean that interconnection is realised at a level of quality that is less than if physical interconnection were realised. Interconnectors that are denied physical collocation and have to be satisfied with virtual collocation should be compensated for the loss in quality by a lower interconnection charge. In particular the charge should be less in relation to the internal charge that downstream businesses of the incumbent TO having physical interconnection are obliged to pay.

Summarising, we conclude:

1. The RA should require that the incumbent TO offer competitors physical collocation of their interconnecting equipment.
2. Virtual collocation should be accepted as an alternative to physical collocation.
3. Lower levels of the quality of interconnection due to virtual collocation should be compensated through lower charges.

4.2.3.3 Unbundling

The degree of the unbundling of services belongs to the essentially unsettled issues in the context of interconnection. It is difficult to sort out empirically to what extent the benefits it brings in terms of making the market more competitive warrant the sacrifice of economies of scale and scope that go along with it. The most pragmatic approach would be to leave the process of finding feasible and satisfactory solutions to an industry-wide committee consisting of industry representatives (like the Information Industry Liaison Committee - IILC - in the US). Such representatives provide maximum expertise and know about their demand for unbundling and the feasibility of supplying it. The RA may reserve for itself the role of intervening with its guidance to facilitate decisions in favour of pro-competitive solutions. It could use as a basis for identifying solutions developments in other countries with more experience.

Following our discussion in Section 4.2.2.1, charges for unbundled services would have to be approved (or determined) by the RA if they fall into the category of standardised services. Also if negotiations fail, the RA would need to be able to differentiate costs according to the degree of unbundling. The proper approach is to include in the charges for unbundled services the extra cost that is due to the very process of unbundling. It would then be necessary that the cost accounting system provide the information about this additional cost or, alternatively, the cost saved if no unbundling is demanded by a particular demander.

We conclude:

1. The RA would find it difficult to determine on the basis of its own evaluation the proper degree of unbundling of interconnection services.
2. The best alternative appears to consist in the creation of an industry-wide committee consisting of industry representatives for the purpose of finding feasible and satisfactory solutions.
3. The role of the RA in respect to determining the degree of unbundling may best be restricted to providing guidance in support of solutions that promise to support future development of competition.
4. The RA would need to make a clear policy statement as to the pricing of unbundled services.

4.2.3.4 Points of interconnection

The issue of points of interconnection is essentially a special aspect of the issue of unbundling. If there is a sufficient degree of unbundling of interconnection services, and if demanders for these services can freely select from the available set according to their needs, it follows immediately that there are also sufficient points of interconnection for demanders of interconnection services to select from.

There is, however, an additional aspect connected with the provision of points of interconnection. The determination of points of interconnection has been used in some countries (US, Japan) to equalise the conditions of access for new competitors and the incumbent TO. This has usually been achieved at the cost of a substantial sacrifice in economies of scope. Our analysis, as an extension of that on unbundling, leads us to the conlusion that the RA is well advised not to impose a particular configuration of points of interconnection.

As in the case of the negotiation of interconnection charges, the RA should indicate the range within which it would expect solutions to be realised. The general regulatory requirement should be that the TO, to the extent that doing so is technically feasible and economically justified, should comply with demands by interconnectors to obtain access to points in the network that are as close as possible to those preferred by them. This would in the case of local access normally mean as close as possible to their customers' location. Non-agreement on this issue in negotiations would be subject to ex-post determination by the RA.

As regards the process of finding solutions for the standardised points of interconnection, for smaller demanders, this should be entrusted to the same industry committee charged with the comparable task in respect of the unbundling of services in general. Points of interconnection as part of specially designed packages of

interconnection services for large users should be left to private party negotiations. In these cases the RA should intervene only if negotiations fail.

We conclude:

1. The RA is not well positioned to determine on an ex-ante basis the proper interconnection points for the various demanders of interconnection services.
2. In the case of the demand for individualised packages of interconnection services, the determination of points of interconnection should be left to private party negotiations with a role for the RA if negotiations fail.
3. Solutions for the standardised points of interconnection should be the task of the industry committee entrusted with finding solutions for the proper degree of the unbundling of services in general.

4.2.3.5 End-to-end quality of services

The provision of services by new competitors is not infrequently associated with the notion of inferior quality. From this one can conclude that the RA should assure that the introduction of competition be accompanied by requirements placed on new competitors regarding end-to-end quality.

Such a sweeping conclusion neglects, however, (a) that the services of new market entrants may well be of superior quality and (b) that there may also well be a demand for services of lower quality if they are offered at lower prices. The essential point is that interconnectors should not get a quality of service that they do not want or should not have to pay a price for high quality services while actually getting a lower grade. Conversely, the legitimate concern of the incumbent operator may be that, independent of what quality of interconnection he offers, he might be identified with the quality the new market entrant brings to market which, if of a low grade, could reflect on his reputation with end users. It must be recognised, however, that, whatever the issue, it would be very difficult for the RA to decide to what extent end-to-end quality should be guaranteed at a particular level.

Issues of quality should in general be left to negotiations between the parties concerned. If an agreement cannot be reached during negotiations, the RA should be ready to intervene to bring about a solution. For this it should preferably proceed by facilitation of negotiations, mediation or expert arbitration, and only as last resort to ex-post determination. The fallback solution of the RA should be that the interconnector be supplied with the same quality that the incumbent TO provides itself. The industry-wide committee charged with finding solutions to the unbundling of services later to be offered on a standardised basis should also be charged with the setting of performance parameters for the resulting interconnection services in such a way as to assure appropriate goals of end-to-end quality (see Section 4.2.3.3).

We therefore conclude:

1. Questions of performance parameters for end-to-end quality should be a matter to be decided in negotiation between the interconnection parties.

2. When called upon to make a determination, the RA should require that the incumbent TO provide to interconnectors the same quality of service as it does to itself.

3. Performance parameters of standardised interconnection services should be determined in the industry-wide committee dealing with the unbundling of services.

4.2.3.6 Standards

In Chapter 2 we discussed the general aspects of standardisation. We found that standards reduce transactions costs and can serve the functioning of markets. This would in particular be true in a telecommunications environment of interconnecting networks where interoperability of services, network security and integrity must be assured at the interfaces. We showed that standards may evolve through adoption of a standard of a dominant firm, spontaneous adoption through the market, and conscious industry collaboration. As the first is undesirable (and therefore often prevented by government intervention) and the second unlikely to occur, it is the third which is often regarded as the best compromise.

The process of standardisation is highly complex and as an activity may introduce significant costs. The effect of standards may be ambiguous. As mentioned above, they reduce transactions costs and are therefore beneficial. Furthermore, they may make innovations in telecommunications equipment and software more attractive. On the other, standards may lock-in technology and thereby delay the introduction of new services or interconnect access. Standards may in general retard technical progress.

We concluded in Chapter 2 that an optimal balance should be sought between the gains and the costs of standardisation for interconnection. The RA could best assure this objective through relying on existing industry-wide standardisation organisations. If none exists, the RA should take the initiative in bringing about the establishment of such an organisation. The RA should take part in the work of these organisations. Its role in the standardisation process should be to prevent the nonagreement on issues through possible stalling tactics of some participants as well as to block any tendency of participating firms to collude to the detriment of competitors and consumers in general.

Following the analysis of Chapter 2.4.2, we thus conclude:

1. The RA should support the process of standardisation at existing industry-wide standardisation committees. It should initiate the establishment of such a committee if none exists. It should be represented at the committees and take part in their work.
2. The RA's role in the standardisation process should mainly be limited to the prevention of non-agreement and collusion among the participants.
3. The RA should reserve mandatory standards for interconnection interfaces only for services and technical components of networks for which the benefits of harmonisation are very high (see Chapter 2.4.2).

4.2.3.7 Public access to interconnection agreements

The regulatory treatment of issues of interconnection derives from the fact that there is bottleneck control by the incumbent TO over networks or segments of a network. Regulation overcomes the bottleneck which the normal market process would not have been able to accomplish. The RA has the mandate to take actions to this effect since it advances the competitive process which serves the public interest.

For the market development effect to materialise, it must be assured that potential competitors are informed of the conditions on which they can enter the market. Regulatory determinations regarding the use of bottleneck facilities are obviously very important information for this purpose. From this it follows that the parts of interconnection agreements that were subject to a determination by the RA should be placed in the public domain for scrutiny by interested parties.

A case could also be made for requiring that the results of private party negotiations be made public as long as they concern the use of bottleneck facilities. The rationale for this could be based on the assumption that the results of private party negotiations could never be more favourable for the demander of interconnection than if determined by the regulator and the regulator's determination should be accessible to all. If there are deviations from what the regulator determines (or would determine) this could reflect anticompetitive conditions that the interested public should be able to verify.

The problem with this position is that, being a departure from normal practice in the application of competition law, it would require strong justification. The argument that the negotiated results should reflect the regulator's determination may not be relevant if, for example, there was as yet no such determination. Moreover, one would observe negotiated results most likely in the case of individually packaged interconnection services that are tailored to the particular requirements of the demander. Providing all interested parties access to the contents of the interconnection agreement may reveal a substantial part of the business plans of this carrier or service provider so that the

requirement may violate common norms of data protection. The very fact of a negotiated result may also reflect the working of the market process which one might not want to inhibit with unnecessary disclosure requirements.

We conclude:

1. There are strong arguments in favour of making the regulated parts of interconnection agreements accessible to the public.
2. The case for making all agreements that cover the interconnection with bottleneck facilities accessible to the public is less strong. It would need justification on the basis of particular circumstances.

4.2.3.8 Numbering

Numbering is a large subject for which there are expectations of many new developments. One need only mention European or even global services with unified numbering spaces and universal personal numbering. These developments will with time also impact interconnection issues. For the immediate demands of interconnecting new network operators and service providers, however, the numbering requirements are of a less spectacular nature.

The issues need to be considered according to whether it is the question of interconnecting TOs offering long-distance telephone services, TOs entering the market for local telephony, mobile network operators, or service providers. We take up the different cases in turn:

- *TOs offering long distance telephone services* generally demand equal access as a consequence of which, if granted in the form of preselection, they would not need any particular numbering arrangement. To allow the customer to overide his assigned preselection, there must be available a code, in form of a prefix, signaling to the local exchange that an override of the preselection is to be made, as well as in addition a distinct code (carrier identification code (CIC)) for each of the competitors for purposes of identification at the local exchange so that the relevant calls can be routed to it. Such a distinct CIC for each competitor must in any case also be available if there is no equal access in the form of preselection and the customer must address the desired carrier by dialling the code beforehand. One critical condition for both the override code and the CIC is that they not contain too many digits as otherwise dialing becomes very cumbersome.

- *TOs offering local telephone services* need blocks of numbers from the local numbering space assigned to them which are of adequate size to accommodate their customers.

- *Mobile network operators* need their own numbering space which can be accessed via an access code that in the relevant numbering space has the same status as a code by which, when making long-distance calls, geographical areas (other local networks) are addressed. The requirement regarding the code is that it not contain too many digits. A code containing more than three digits is usually not acceptable.

- *Service providers* may have special numbering requirements when they want numbers to convey pricing and content information.

The RA must assure that the specific requirements discussed above are met as the need for them arises. For this it is necessary that the RA assume the regulatory authority over the relevant numbering domain. The technical problems posed by each requirement differ according to the relative scarcity in the access code and number spaces caused by the current use of codes and numbers. Normally, however, the obstacles to solving these problems should not prove unsurmountable nor to be very costly. In deciding on new uses of numbering space, the RA should reserve priority treatment to the demands from interconnecting carriers and service providers.

We conclude:

1. The provision of adequate access codes and numbers in the relevant numbering domain needed by new network operators and service providers should in most cases not be problematic.
2. The RA needs to assume the regulatory authority over the relevant numbering domain.
3. When deciding on new uses of space in the numbering domain, the demands from interconnecting network operators and service providers for access codes and numbers should be given priority.

4.3 A framework for negotiating interconnection agreements

4.3.1 General observations

Interconnection arrangements, as repeatedly emphasised, should in principle be the outcome of commercial negotiations. Given the reality of imperfections in the market for interconnection services, likely to persist for some time to come, a regulatory involvement with respect to at least a number of issues will be inevitable. In the preceding sections, we have discussed various options that the RA has in this respect. In the following, we will discuss the resulting framework for negotiating interconnection as it presents itself to those TOs demanding as well as those offering interconnection.

The discussion will be organised according to the regulatory approach taken, i.e. ex-ante determination, deferral to private party negotiations, ex-post determination, mediation or arbitration procedures. As the prototype of negotiation with respect to which we carry out the discussion, we take the type where an individualised package of interconnection services between an alternative larger network operator and the incumbent TO is to be negotiated. In this type of negotiation a larger number of issues needs to be dealt with than in the type in which unbundled standardised services are demanded with charges already determined and approved by the RA.

4.3.2 Preconditions to be met through ex-ante determinations

Predeterminations may be made through legislation enacted by parliament or in the form of policy determinations on the part of the RA. Which approach is selected should depend on the importance accorded the particular issue. Issues covered in legislation have a higher order of significance; they can, however, less easily be adjusted once circumstances change. They should be reserved for issues for which it is essential that the policy in question is backed by the political will expressed by a passage through parliament. In the following we will not differentiate as to what issues are to be covered by the one or other approach as this will have to depend on particular circumstances.

There should be clear ex-ante determinations on the following interconnection issues from which private party negotiations would have to start:

- The right to interconnection of new network operators and service providers to designated telecommunications networks.
- Principles that the RA applies for the determination of interconnection charges as well as of access charges if they are used.
- The cost accounting methodology to be used by the TO so that the relevant cost standard can be applied.
- The mechanism by which changes over time of interconnection charges, that initially were either determined or approved by the RA, are controlled.
- Provision of equal access and collocation.
- Conditions of numbering.
- Rules regarding publication of all or a selected range of the terms in interconnection agreements.
- Technical standards where they are broad enough to fall under the aegis of the RA.
- The right of any party to interconnection negotiations to obtain a determination by the RA if such negotiations fail.

4.3.3 Issues to be left to negotiations between the parties

Issues that need to be resolved for an operative interconnection arrangement and that are not determined ex ante by the RA, should be resolved in negotiations between the parties to such an arrangement. Leaving the issues to negoatiations does not necessarily imply a declaration by the RA that it would in no case consider them as subject to an ex-ante determination. It may simply reflect the RA's assessment that the information required to come to a solution on the issues is so specific that the parties concerned should first have the opportunity to settle them. Further, the determination of which topics to include in the list of issues to be negotiated is to some degree an empirical question.

As mentioned, we next consider the issues needing agreement in negotiations between an incumbent TO and a new network operator for an individually packaged interconnection arrangement. The following list names obvious candidates of issues that should be included in the agenda for such negotiations:

- Concrete structure and rates of interconnection charges.
- Changes of interconnection charges over time.
- Locations of the points of interconnection.
- Concrete technical realisation of interconnection.
- Quality of interconnection services (signals, completion rates, etc.).
- Access to ancillary and supplementary services.
- The precise set of signalling functionalities to be provided by the interconnection providing carrier.
- Network management, forecasting of traffic flow, provisioning.
- Realisation of network protection.
- Intellectual property rights.
- Liability and indemnity.
- The method of dispute resolution procedure to be used before a determination by the regulator could be requested.
- Dates and time periods for carrying out agreement, duration and renegotiation of agreement.

There is the question of whether the RA should explicitly decide which issues are to be covered mandatorily in negotiations and by doing so limit the right of either party to an

ex-post determination to the items on that list. Proceeding this way could provide some legal safeguard for the incumbent against the perceived danger of being forced to provide interconnection on inessential but difficult-to-provide services. On consideration, there appear to be good reasons for giving greater weight to not closing the list in this way. There is the converse and not so unlikely possibility that particular services or functionalities neccessary for interconnection are not included in the list and that could then be used as a means to stall negotiations and to attempt not to open the bottleneck facilities after all. In our view it would be better to leave it to the RA as part of the ex-post determination on which issues it is to pass a decision.

Parties enter the negotiations taking the RA's basic ex-ante determinations as the starting point of their deliberations. The RA should also, depending on the given situation, place particular restrictions on the negotiating process and on the range of expected results and impose minimum standards (if there are any) to be met. The most important restriction on a negotiation as a process would be the one regarding a maximum time period within which it should come to a conclusion and after which, in case of non-agreement, a determination of the RA could be requested. This would place a bar on tactics of procrastination and stalling negotiations. Further, some assurances must be obtained against the possibility that negotiations are allowed to fail on obviously spurious grounds.

An important restriction that could be essential in bringing about quick results would be on the range of acceptable rates of interconnection charges. This could obviously only be done if enough is already known in general about costs and the degree of cost orientation of existing tariffs. For example, suppose the RA knows that the incumbent TO's end-user tariff for local calls covers its costs. Then the RA should state its definite expectation that interconnection for originating and terminating access for a competing supplier of trunk services should not be more than a given percentage of that local tariff. The information that we have gathered in our empirical work indicates that in this case, applying an incremental cost standard and allowing for a markup, the range should be between 50% and 70% of the local tariff.

4.3.4 Industry committees, facilitation of negotiations, arbitration

If the issues to be solved are of sufficient complexity so that the RA is not in a position to pass a determination on them, either ex-ante or ex-post, there is the institution of an industry-wide committee to work out solutions. The RA would be involved in the proceedings through active participation or participation in an observer role and would use its influence to support results that promise to be in the general interest.

We have identified three main groups of issues amenable to this kind of approach in which the RA takes the role more of a mediator than a regulator:

- Unbundling of services.

- Standardisation of interfaces.
- Quality of end-to-end services.

In respect of all three groups of issues there are opposing tendencies. Finely unbundled services, interfaces that are largely standardised, and guaranteed end-to-end quality of services all are supportive of competition and should therefore be considered desirable. At the same time, all are achieved at the cost of inefficiencies. Very finely unbundled services involve losses of economies of scope and scale, and a great degree of standardisation and rigid quality requirements harbour the risk of stifling innovation. The RA is in a poor position to make the proper trade-offs to pass the right decisions.

Generally, the RA as mediator may also assist on issues that in principle are to be agreed upon in negotiations, in other words, the RA might act as a facilitator of negotiations. The most typical form would be that a representative of the RA participates as an observer and adviser at the meetings. The presence of the regulator at the negotiating table would tend to prevent deadlocks on spurious grounds (due, for example, to unfounded distrust by one of the parties) and thereby act as facilitator.

When negotiations fail, despite the guidance afforded by ex-ante determinations, the parties can rely on ex-post determinations to get a decision on the issues. There is, however, also the instrument of arbitration where the role of arbitrator is assigned to outside parties. This approach has also the advantage of flexibility as, depending on the problem at hand, the most knowledgeable and expert persons available could be selected. It would furthermore help to lessen the odium of arbitrariness that is sometimes associated with regulatory action. The regulatory agency would have to define the rules and criteria by which outside arbitrators were to make their decisions, and further specify the definitiveness with which such arbitration is to hold. Arbitration applied in this way is essentially a substitute for ex-post determination by the regulator with the RA as acting persona replaced by the outside arbitrator. There may be instances, however, where there are not enough people available in the industry with the required technical as well as regulatory expertise and who are so placed that they would be eligible for this kind of role.

4.4 Implications of a an interconnection regime for the international settlement process

Interconnection between incumbent telecommunications network operators of different countries is currently following the international settlements process, which is based on the presumption that these operators do not compete with each other on their domestic territory. Once a unified interconnection regime is established covering the Member States of the EU, whereby new market entrants will be able to compete across international borders, the question arises how this will impact on the international settlement system and what the policy of the RA should be. There are basically two options, either to bring the settlement system within the ambit of the interconnection

regime or to allow it to co-exist with it. We will argue that the second option should be preferred provided that certain precautions are taken.

Under the settlement system, a national territory appears like one single large access area for the partner of the incumbent TO of that country. For access to this area it pays one unique interconnection charge, i.e. the accounting rate, which is necessarily averaged for the whole of that territory. An integral feature of the regime is that the partner usually obtains the same accounting rate as the interconnection charge for access to its national territory. Accounting rates are generally considered too high as well as the corresponding end-user tariffs.

One of the main effects of the new interconnection regime will be to introduce competition into international telecommunications. New competitors will be able to access customers through interconnection at the local level, paying no more than cost-based charges, and depend for national and international transport on their own facilities. This competition will mean that the traditional settlement system will come under severe pressure.

One should expect that the incumbent TOs will adjust their relationships under the current settlement system in response to these developments. The new types of relationships will depend on the way they decide to compete or cooperate with each other in future. In principle, the new types of agreement need not differ from those that will emerge under the interconnection regime discussed in this report. However, incumbent TOs from different Member States may have an interest in reciprocal agreements raising issues of competition policy if these agreements disadvantage the newly entered competitors. The regulatory authorities would have to watch out for developments of this nature and deal with these issues by applying the relevant competition policy either at the national or at the level of the EU.

The current settlement system may have a longer lease on life in relation to countries outside the EU. One should expect this to be the case in particular in respect of countries with restrictive telecommunications policies whose incumbent TOs are still in a position to make exclusive dealings. The situation would effectively amount to a prolongation of the status quo and need not be affected by the establishment of the interconnection regime. Changes would have to await developments at international fora outside the EU, in particular the new General Agreement of Trade in Services (GATS) under the roof of the newly established World Trade Organisation (WTO).

There are additional issues due to global alliances of firms based in countries with a restrictive telecommunications policy. These firms have legal advantages in their home countries and want to make use of the openness of other, more liberal countries while firms based in those liberal countries have no free access to the restrictive countries. The asymmetry in these relationships has resulted in the policy of opening domestic markets to foreign firms only to the extent that the home markets of these firms are open to domestic operators. There is a problem with this approach as the openness of

markets will always differ across sovereign nations, due to different legal systems, tax policies and regulatory policies.

The EU will have to deal with this issue. The urgency to develop a policy once the EU's liberal interconnection regime is put in place should depend on an evaluation of the importance of the telecommunications traffic with countries posing the problem and the corresponding impairment to the overall competitive situation. Again there would be a role for GATS and the WTO. In any case, these considerations should not interfere with the process of introducing the interconnection regime.

We conclude:

1. The regulatory authorities should for the time being not interfere with the current international settlement system. It can be expected that this system will rapidly adjust and with time become part of the interconnection regime in those countries covered by the regime.
2. The regulatory authorities should be aware of the potential for anticompetitive elements in future (settlement or interconnection) agreements between the former monopoly suppliers of international telecommunications services.
3. A policy may have to be developed vis-à-vis countries not covered by the prospective interconnection regime, in particular countries with a restrictive telecommunciations policy whose suppliers might exploit the liberal regime in the EU to their advantage.

5 Experience with interconnection policies in 16 countries

A part of this project consisted of detailed studies of interconnection policies in the twelve Member States of the European Union and four overseas countries (Australia, Japan, New Zealand and USA). This section contains summaries of these studies and a cross country comparison. Readers who are interested in the full-length country studies are referred to the separate annex to this main report.

5.1 Member States of the European Union

5.1.1 Belgium

5.1.1.1 Introduction

By the "Act on the Reform of Certain Public Enterprises" of March 21, 1991 the exclusive right to provide 'public telecommunications' was given to the 100 per cent state-owned enterprise Belgacom. This right comprises operating the public telecommunications infrastructure and publicly accessible installations (e.g., public payphones) and the supply of the 'reserved (monopoly) services': voice telephony, telex, mobile, and paging services, telegraphy, and the provision of 'fixed connections' (leased lines).

All other services are liberalised and called 'non-reserved' or 'commercial' (e.g., X.25, value-added services, and video conferencing). So any market participant, including Belgacom itself, is allowed to provide these services, provided that direct or indirect use is made of the public telecommunications infrastructure. Accordingly, Belgacom is under the obligation to assure equal access to the reserved services for all persons or entities offering a non-reserved service. Belgacom is allowed to refuse access only on the grounds of the 'essential requirements': security of network operations, maintenance of network integrity, interoperability of services, and protection of data.

The regulatory functions in Belgium are assigned to an official administration of the state, the Belgian Institute for Post and Telecommunications ('BIPT'). The Minister of Communications takes the final regulatory responsibility.

5.1.1.2 Status of interconnection

At the time of this writing there are no arrangements between Belgacom and / or other market participants for interconnection or special network access. One agreement, however, is currently being negotiated:

- Belgacom and Airtouch Belgium, a subsidiary of the US company Airtouch Communications, are forming a company for offering mobile communications. Belgacom by itself has already been operating its GSM mobile network Proximus since January 1994. An interconnection agreement between Belgacom and its new subsidiary, Belgacom Mobile, is simultaneously being negotiated.

Furthermore, the BIPT just authorised the private company Ram Mobile Data Belgium, which is a joint venture of the US company BellSouth and France Telecom Mobiles International, to build and operate a mobile packet-switched network. RAM will begin to offer its services in the first half of 1995. It can be expected that RAM will demand access to one of the fixed packet-switched networks in Belgium (the two biggest of these are being operated by Belgacom and the bank-owned company Banksys). As X.25 services belong to the non-reserved services there will probably be less need for a regulatory intervention than in the GSM case as the parties are expected to agree commercially on the conditions of interconnection.

5.1.1.3 Specific aspects and future developments

At the moment the most important development in the Belgian telecommunications sector can be observed in the market for mobile services as the BIPT is currently redrafting the telecommunications law in order to allow competition in this market.

The most urgent need for regulatory action is identified in the field of the GSM. The BIPT will license a second GSM mobile operator as soon as possible. The way of regulating interconnection will have to be worked out by the time the second GSM operator has obtained its licence as then "there will be an exclusive right to interconnect" as the BIPT says.

The BIPT is studying possible regulatory actions in the field of interconnection. It is regarded as a matter under strict control and approval of the BIPT. The general principles of interconnection regulation will be: Agreements will be based on objective and non-discriminative conditions, the tariffs to be paid for access to the network of an operator with an exclusive right will have to be cost-oriented and every reasonable request by an applicant for capacity, quality and location of the access points must be satisfied. The BIPT furthermore identifies an urgent need to develop a common European guideline for interconnection.

The BIPT is currently working out a "cahier de charge" to handle the GSM case which will be prepublished in September 1994. It will contain the conditions for providing GSM mobile services and a general framework for the interconnection of the GSM network and the PSTN. The way of dealing with GSM interconnection will be the following: The two parties conclude a commercial agreement on the conditions of interconnection which will have to comply with the general framework of the cahier de charge. Afterwards the agreement has to be approved by the BIPT.

Belgacom will mainly be confronted with two kinds of problems in the field of interconnection: The problems will be technical, i.e.,

- the choice of the level of the switch hierarchy at which interconnection with the PSTN will be realised,
- the optimisation of routing in the PSTN,
- measurement problems according to the fact that 15 % of the exchanges are not yet digitalised,

and economic, i.e.,

- to solve the problem of possible substitution effects, Belgacom's tariff strategy has to be developed on the one hand with reference to the European (ONP) legislation on this issue ("cost orientation") and on the other hand with reference to the fact that Belgacom should earn an acceptable margin above costs from the provision of the product "interconnection". This problem concerns the question of how to calculate exactly fully-distributed costs and especially Belgacom's access deficit.

Another important development in Belgian telecommunications policy is the discussion on the (partial) privatisation of Belgacom. As the government recently announced, it will sell less than 50 % of its Belgacom shares probably in 1995 or 1996.

To summarise, all these developments in the fields of privatisation and liberalisation ensure that the issue of interconnection will rapidly be moving into the central focus of Belgian telecommunications policy.

5.1.2 Denmark

5.1.2.1 Introduction

5.1.2.1.1 Status of interconnection arrangements

Denmark is a special case in the European Union in respect of telecommunications. By the end of 1993, the penetration of mobile telephones had reached about 6.5 per 100 inhibitants; approximately 1/3 of the terminals met the digital pan-European (GSM-) standard. In compliance with European competition policy, a liberal regime was ensured for digital mobile telephony (GSM). Dansk Mobil Telefon I/S ("SONOFON") was granted a special licence to compete with the incumbent TO's daughter company, Tele Danmark Mobil A/S. To date, the second GSM operator is the only independent national operator with full ('trunk-side') interconnection to the network of Tele Danmark A/S, i.e., on terms other than standard published subscriber ('line-side') conditions

approved by the supervisory authorities. Denmark is also the EU member state with the highest fixed telephone penetration (58.7 subscribers per 100 inhabitants) and the highest average usage of each subscriber line. Overall, Danish call charges for both fixed and mobile telephony are among the lowest in the EU. The installation charge and the subscription fee for fixed telephony differ between regions, an inheritance from the historical division of (Southern) Denmark among four independent regional telephone companies until 1991, which has contributed to the early achievement of the cost-based Danish tariff structure and to a pragmatic engineering tradition for interconnect arrangements. Denmark reversed structural policy in 1991, when a limited-liability holding company, Tele Danmark A/S, started to take over the four regional operating companies and the international carrier, TELECOM A/S.

5.1.2.1.2 Regulatory conditions for interconnect agreements

Danish regulatory developments are based on liberalisation of services, not of (fixed) infrastructure. This means that ('trunk side') interconnection to the concessionary telecommunications infrastructure is presently limited to wireless networks being liberalised in pursuance of EU competition policy. This is discussed further in Section 5.1.2.3. Service liberalisation, on the other hand, takes place on general public access ('line-side') conditions determined or approved by the Minister of Communications. Legally, room for (re-)negotiation of special interconnect agreements with Tele Danmark A/S exists only for the licensed network operators of reserved services, i.e., at present only the national GSM operators. The minister must approve all such interconnect agreements. Liberalised telecommunication services are overseen by the Minister, notably with a view to consumer protection. Apart from ensuring this, it would not be customary for Danish politics to interfere in negotations between contracting business partners, e.g., a TO and a VAS provider. Unfair competition or misuse of a dominant position may be reported to the Danish Competition Council or the Commission.

5.1.2.2 Institutional and legal conditions for interconnection

5.1.2.2.1 Market structure: the regulatory framework and entry conditions

Danish telecommunications are governed by the Telecommunications Act of 1897, as amended by later laws in 1990, in 1992 and recently in 1994. These laws are broad Enabling Acts without much detail. The 1990-amendment of the law resulted in a concentration of the hitherto divested Danish telecommunications infrastructure and public service provision into a single private holding company, Tele Danmark A/S. This holding was granted an exclusive concession on the following: telephone services; text and data communication services; provision of leased lines; wireless communication services (mobile and satellite); point-to-point transport of radio- and television-

programmes, e.g., to cable operators (CATV distribution itself is not part of the concession); the transmission and switching facilities necessary for the above services, as well as for all third parties offering services to (parts of) the public. The 1990 Act also empowered the minister to liberalise service areas originally within the exclusive concession. This mandate was later invoked to liberalise the public data communication service as from January 1993 in accordance with European policy, as well as private installation and operation of (closed) telecommunications networks on single premises. However, the 1990 Act laid down that licences conferring special rights to a limited number of network operators have to be granted by special laws. Therefore, the Minister is expressly not empowered to grant new operator licences by Decree. So far, the only case has been the special GSM Act passed simultaneously with the general Enabling Act. A new act is being drafted to implement EU policy on provision of certain wireless networks and the associated services in Europe (e.g., using the ERMES and DECT-standards). This legal requirement is of immediate importance for interconnection arrangements between operators. Thus, the GSM Act empowered the Minister to fix the conditions for interconnection to other operators. Amendments to the 1990 Act have occurred in 1992, introducing additional regulation and control of premium-rate value-added services (service-900), and in March 1994, opening pure resale of leased-line capacity to voice telephony.

5.1.2.2.2 Tariff structure

In the past, the tariffs of the independent Danish regional companies were not subsidised from the state's monopoly profits on long-distance and international traffic. So the tariffs included sufficient return on investment in the access networks. Therefore, Tele Danmark's fixed telephone tariffs are well 'rebalanced' to reflect operator costs: Long-distance call charges (0.70 DKK per minute beyond 75 km, including 25% VAT) are only about twice the local call charges. The fixed fees for installation and subscription contribute significantly to coverage of the local-loop (access) costs, which consequently do not have to be subsidised from elsewhere. An access deficit charge on mobile calls was not found to be justified with the Danish tariff structure. All public telephone calls conveyed by resellers using the liberalised leased lines must terminate in Tele Danmark's subscriber network(s). Therefore, such calls will also be subject to cost-based tariffing of the subscriber access and do not require separate settlements of access deficit charges. Moreover, an announced introduction of price-cap tariff regulation as from January 1, 1995 (instead of the current system of approval of each individual tariff change by the Minister), will allow Tele Danmark A/S some extra flexibility to respond to the increased competition from voice resellers by fine-tuning of its balanced tariffs, if necessary.

5.1.2.2.3 Specific regulatory provisions for interconnection arrangements

The special ('trunk side') interconnection rights for licensed operators will generally follow from the separate legislation required for issuing a special licence in Danmark (so far only granted for the second GSM operator). As Tele Danmark's concession does not preclude operation of a similar network (and the associated public services) within the same reserved area, the interconnection conditions must ensure fair and non-discriminatory treatment of the interconnecting operator by the concessionary. The concession describes Tele Danmark's obligation to work out in advance such conditions, which are subject to approval by the Minister. In the actual practice, the conditions were determined by negotiation of an interconnect agreement between the parties. The two GSM interconnect agreements are not available for public review. However, the specific competition rules in force for mobile communications are described in a Ministerial instruction dated July 8, 1993, which contains provisions concerning

1) forbidden cross subsidies

2) non-discrimination between similar services or networks

3) requirements for separate accounts in order to control compliance with the above rules. This is to be checked by the external accountants of the respective companies, who are to issue annual compliance statements. It is not quite clear how the Minister would handle non-compliance, as the relevant Acts do not contain explicit sanctions. A possibility might be for the Minister to report non-compliance to the Danish Competition Council.

The Minister is empowered to prescribe access conditions for services, transmission paths and switch installations not covered by the concession or by the special licences referred to above. The law gives a broad outline of the considerations when formulating future access conditions, but refrains from detailed rules.

The reciprocity requirements for liberalisation of pure resale of voice telephone capacity over international leased lines discussed above will be imposed using the legal mandate to grant permission to such resellers. Thus, calls from mobile subscribers connected via NMT or GSM in Denmark may be allowed to be carried abroad by any service provider in the competitive domain, using pure resale of leased line capacity, if the Minister accepts that the destination country has a similar liberal regime. Another example of access conditions for unreserved services mandated by the above considerations are the Service-900 requirements, which classify audiotex services in three categories according to pricing and content, with different access conditions. All subscribers have unrestricted access to Category I (lowest charges; no violence or information harmful to children, no gambling or sexual information). All subscribers connected to switches which allow individual number blocking on request have access to Category II (medium charges; no violence or information harmful to children, no gambling or sexual information). Subscribers desiring access to Category III (highest

charges) must apply for access to the operating telephone company, which is allowed to offer this service only via switches technically capable of giving access from designated subscriber lines. Obviously, the concern here is consumer protection, not universal service. Compliance with the content regulation of the three categories is controlled by a special Service-900 council.

5.1.2.3 The incumbent operator: Tele Danmark A/S

At least 51% of Tele Danmark's share capital is to be held by the state. The recent flotation of shares resulted in a major net capital injection into the company, which was allowed to keep the proceeds from the flotation of the state's shares. The shares were hailed by analysts as one of the best privatisation buys in European telecommunications, and were oversubscribed by a factor of four. Tele Danmark's own capital rose to some 70% of the total operating capital. The European Commission has approved this unusual arrangement. The net consolidated revenues of Tele Danmark A/S in 1993 were 16,200 Mill. DKK, of which 72% was earned in the concessionary area, and the rest in competitive business areas. The regional operating companies have followed their own evolutionary strategies until 1991, as partly reflected in the different fixed charges still in force. In the coming years, the presence of ISDN and the further digitalisation and development of IN will gradually unify the more advanced technical functions of importance for modern interconnectivity arrangements. However, except for any new network operators with special rights granted by law in the coming years (ERMES- and DECT-operators), the present legal infrastructure monopoly would appear to leave little scope for interconnection agreements between network operators in Denmark.

5.1.2.4 The mobile operators in Denmark

5.1.2.4.1 Tele Danmark Mobil A/S

In 1993, 8% of Tele Danmark A/S net revenues came from its daughter company Tele Danmark Mobil A/S, which at the end of the year had 72,000 GSM subscribers, 252,000 NMT subscribers and 59,000 paging subscribers. The net revenues originated from fixed subscriber charges (24%) and variable traffic charges (76%). Peak traffic charges are the same for NMT- and GSM-subscribers; off-peak charges can be lower. In particular, Tele Danmark Mobil offers a "vacation subscription" on the analog NMT system; this may become an attractive alternative to a standard telephone in weekend cottages, not only for the user, but also for Tele Danmark A/S, which does not have to install and maintain a little-used fixed subscriber line in rural holiday areas. Tele Danmark Mobil is free to lower its tariffs in the competitive area (GSM), and may reduce NMT tariffs by up to 25% without seeking approval from the Minister. It has

contracts with a number of resellers. There is no shared cellular infrastructure with the GSM competitor, Dansk Mobil Telefon I/S.

5.1.2.4.2 Dansk Mobil Telefon I/S ("SONOFON")

SONOFON is the brand name of the second operator with a GSM licence in Denmark. It is a partnership with full liability of the partners (I/S). These are the two telecommunications companies GN Store Nord (Denmark) and BellSouth (US), and the investment companies Nordic Tele Holding and Incentive, respectively. By the end of 1993, SONOFON had some 30,000 subscribers to its GSM service. Its traffic charges (DKK 1.33 per minute off-peak; DK 2.66 per minute during peak day hours) are 5% lower than Tele Danmark Mobil's corresponding charges. Despite this, its number of subscribers grew more slowly than Tele Danmark's in 1993. SONOFON sources claim that the competing GSM operator and his resellers had offered GSM terminals on dumping conditions during campaigns, notably during the Christmas period 1993.

5.1.2.5 A sketch of the two Danish GSM interconnect agreements

SONOFON is not the "second" GSM operator in Denmark in terms of interconnect agreements. On the contrary, it was this operator who actually negotiated the detailed terms with Tele Danmark A/S after receiving a licence from the Minister in 1991. Subsequently, Tele Danmark A/S imposed the same terms on its daughter company Tele Danmark Mobil, and these terms were approved by the Minister, who thus appears to have used the non-discriminatory principle of the "most favoured nation" approach.

The agreements are confidential. This is believed to be due to the sensitive pricing issue for the leased lines needed by both operators to connect their radio base stations and GSM switches to the gateway points in the infrastructure of Tele Danmark. The Danish GSM licence does not grant permission to set up and operate any own alternative fixed infrastructure for this purpose, e.g., using radio relays links. As a compensation, it would seem reasonable to grant each public GSM operator a discount in the public interest. In the Danish context with a mature, yet unsaturated analog mobile system (NMT), it might well be argued that such a leased-line discount should ensure matching to the corresponding internal cost price of the equivalent fixed infrastructure of the NMT system. The latter would otherwise enjoy an unfair pricing bias below GSM, simply due to its ownership by the concessionary.

The agreement is further based on a geographical development strategy of mutual delivery from and to the Mobile Switching Centres (MSCs) of the GSM operator via the nearest interconnection point in the concessionary's infrastructure; a maximum of 8 to 10 such points are eventually foreseen, dependent on the growth of traffic volume. Accordingly, the national interconnection charge (for both conveyance in the fixed network and access to its subscribers) is simply determined by the regional tariff for

fixed telephony (0.47 DKK per minute by day), less an (undisclosed) discount. Similarly, the conveyance charge for international traffic (including roaming) is derived from Tele Danmark's international tariff system, less a discount which is understood to be smaller than the discount for national traffic. This might provide an incentive for SONOFON to exploit the new leased-line resale liberalisation in international roaming agreements. This would presumably have to be accepted by the Danish Minister if the leased line would terminate in the national fixed telephone networks, and appropriate national conveyance charges were paid from there to the terminating GSM-network(s).

From the above indications, there appears to be no additional access deficit charges payable to Tele Danmark. This is reasonable in view of the cost-covering local telephone charge in Denmark.

There is no right of equipment collocation on Tele Danmark's premises.

It is our impression that SONOFON is much more content with the interconnect agreement with Tele Danmark A/S than with the aggressive marketing strategy of the competitor. This may be understood by noting that the terms were negotiated by SONOFON itself with the four regional telephone companies (acting on behalf of Tele Danmark A/S), and that the resulting agreement was actually drafted by SONOFON's legal counsel. The same terms, conditions and charges were subsequently invoked for the competitor's interconnection agreement with the parent company, and the Minister approved this procedure as being reasonable and non-discriminatory for the two interconnecting GSM-operators.

5.1.3 France

5.1.3.1 Introduction

The evolution of the regulatory and economic context in France is dominated by the year 1990, during which two laws were passed, one in July, which transformed France Telecom (FT) into a kind of public company and a second, in December, which defined the regulatory framework under which competition may be opened in France. Basically, France Telecom keeps its monopoly on infrastructure provision and voice telephony and telex. A new category is defined, "bearer services", for which a licence is needed from the Minister of Post and Telecommunications. Finally, an important category of networks, the so-called "independent networks" has been authorised, for the usage of "closed user groups".

During the years 1990-92, further liberalisation measures were taken. France Telecom has been given a "Contrat de Plan" which establishes the rights and duties of the public operator, in particular with regard to tariffs. VSAT networks (one way and two ways) have been authorised by the Minister. Trunked systems have been licensed to private operators, in different parts of the country. Several decrees have been passed to

implement the liberalisation procedures contained in the law of 1990. SFR and France Telecom have been granted a licence to operate a GSM mobile network.

5.1.3.2 Market structure

At the moment, France Telecom still remains the main operator of telecommunications services in France. SFR (Société Française de Radiotéléphonie), a company held to 43.5% by CGE, Compagnie Générale des Eaux (a holding company specialised in water distribution, civil engineering, manufacturing of thermal equipment, and real estate property), Vodafone, and BellSouth, are providing analog (NMT 450) mobile services in competition with France Telecom's Radiocom 2000, as well as GSM services in competition with FT's Itineris services.

Bearer services may be provided upon leased lines or cable television networks. They are essentially delivered by Transpac, the subsidiary of France Telecom. Recently, Sprint International has been granted a licence by DGPT, and BT France is in the process of being awarded one. Compagnie Générale de Videocommunications (CGV), a subsidiary of CGE operating cable television networks, has been granted a bearer service licence in order to provide conveyance services to the DECT network that CGV has been authorised to operate in Saint Maur.

At the end of 1992, there were, according to the DGPT, 97 independent networks connected to the public network. However, most of these independent networks are small networks, geographically limited. Among the largest are the ones of EDF, which up to now had consisted of local "islands" with limited interconnection points with the public networks, mainly for providing local interfaces with the customers.

The French regulation policy is framed by the Law n° 90-117 of December 30, 1990 "Defining the new regulatory framework of the French telecommunication policy" which established the conditions of competition in telecommunication in France. The law declares that "the public telecommunications operator alone may establish telecommunications network infrastructures which are open to the general public", but "by derogation, the Minister of Telecommunications may license a person other than the public telecommunications operator to establish or operate a radio network, ..." The Law authorises the Minister to license wire "independent networks", namely "telecommunications networks designed for private or shared use". "Shared" means that the network is "reserved for use by several private individuals or corporate entities who are members of one or more closed user groups in order to exchange internal communications within the same group. The regulator himself has gradually been extending the scope of its definition.

Network to network interconnections may occur, stricto sensu, in the following cases: interconnection between the licensed mobile networks and the public network, and interconnection between independent networks and the public network, subject to the

restrictions defined above. But other interconnection problems may arise, related to the interoperability of services.

5.1.3.3 Interconnection of mobile networks

For analog mobile services, namely NMT and Radiocom 2000, the agreement for interconnection has not given special rights to SFR to access FT's public networks. SFR has leased lines to FT at list prices. SFR had an obligation to interconnect their switch to the closest local switch.

Concerning the usage of the network, no particular charging conditions were fixed between SFR and FT. For the traffic going from the mobile to the fixed network, SFR is considered as a customer to FT and has been able to get the same advantages as any large customer, namely, a higher subscription fee and a lower usage price (reductions of up to 50% for the usage). This special tariff designed for large subscribers is called "Trafic Plus". For the traffic originated from the fixed network to the public network, the calling party did not have any extra expenses to pay, its call being considered by FT as a normal call. The difference was due by the callee. It represented a unit charge every 8 seconds. Therefore, no payment was made by France Telecom to SFR for calls originated from the fixed network to the mobile network. Those conditions have been changed after the June 1994 determination by the Minister of Post and Telecommunications.

For GSM services, an agreement between SFR and FT has also been reached on a commercial basis. SFR has recently put the dispute in front of the Minister who, after consultation with DGPT, had to give an arbitrage. In June 1994 this arbitrage has been given to the advantage of SFR.

Concerning the access to the switched network and its usage, SFR did also benefit from the determination. Before it, the usage related payments that SFR had to incur to connect one of its subscribers with a third party accessible through the PSTN were the following:

- The tariff of the outgoing traffic from the GSM network to the PSTN was 0.4 telecom unit[37] every 24 seconds for a local call, and 0.8 unit every 24 seconds for national calls. This applied to each successful conversation. The DGPT has calculated that the GSM operator benefited from a 20 % rebate on the national traffic charges. No rebate was available for international calls.

- After the determination, the tariff for local calls is 0.169 unit every 24 seconds, and 0.368 unit every 24 seconds for national calls. No rebate is still available for international calls. SFR also obtains a rebate for calls to the audiotex and videotex kiosque (0.063 unit per period of 24 seconds). SFR gets a payment from France

37 The "unit" is the list price of a local call at peak hour.

Telecom for billing and charging (9% of the sums which have to be paid by SFR to France Telecom).

- For incoming call traffic issued from the PSTN to the GSM network, the service was charged, before the determination, on the basis of outgoing traffic (0.4 and 0.8 telecom units every 24 seconds) multiplied by 1.6. This represented the difference between what FT receives from the caller and what FT pays to SFR. It is the price of usage of the public network for an incoming call. The coefficient 1.6 was added to take account of the discrepancy of efficiency between the two networks. In other words, calls originating from the PSTN may not reach their termination due to a lower quality of service of the GSM compared to the PSTN. In compensation for this gap in efficiency (which puts a burden on the PSTN, since calls that are started inside it and are not terminated do not give receipts to FT), SFR pays more to FT than FT to SFR.

- After the determination, the new tariffs applying for outgoing traffic (0.169 and 0.368 unit every 24 seconds) are valid for incoming traffic. The coefficient of 1.6 mentioned above, has been decreased to 1.1. The price that a caller from the fixed network has to pay for reaching the callee from the mobile network has to be announced by SFR to France Telecom at minimum 3 months in advance. The GSM no longer has to provide an audiotex box or a call forwarding feature, which would improve its quality of service. The difference of efficiency between the two networks will be supervised by a "Comité de Pilotage" (Steering Committee) which will adjust the coefficient accordingly. As for outgoing calls, a supplementary charge is due by SFR to FT, equal to 9 % of the sums paid by the subscribers of the RTPC, to take account of the necessity for France Telecom to charge and bill customers in lieu of SFR.

The determination of June 1994 also presents the principles governing the evolution of the interconnection tariffs. Analog and digital leased lines at 64 kbit/s, 2 Mbit/s, 8 Mbit/s, and 34 Mbit/s prices will evolve from March 1, 1995 to December 31, 1996 at the retail price index minus 3%. Beyond, another price cap will be set up. For switched services, the same price cap (RPI-3% from March 1, 1995 to March 1, 1996) will apply to the usage related connection charges, in absence of a substantial tariff rebalancing of subscription and local call charges.

For telepoint services, an interesting case is CGV's experimental test in Saint Maur, authorised by DGPT. The Saint Maur licence does not oblige CGV to interconnect with other radio electrical networks, while the Pointel licence of France Telecom does contain such an obligation. This asymmetry, to some extent, reflects the asymmetry between the two licences: one is "experimental", the other is permanent.

On the other hand the separation of accounts between the DECT activity of CGV and the rest of its activity is clearly required. The only purpose of this separation of accounts is to ensure that receipts and expenses generated by the licence are clearly identified. But the licence does not prohibit any transfer of resources between this activity and the rest of activities of the group. In contrast, in the case of Pointel the separation of

accounts is required in order to make sure that competition is not hindered by undue transfer of resources from activities to which the operator has exclusive rights to activities in the competitive domain.

5.1.3.4 Interconnection of independent networks

The Law of December 29, 1990 offers the possibility to set up, after authorisation by the Ministry, "independent networks", namely wire networks to interconnect either the members of a corporate entity or the members of a "closed user group", defined as a community of entities having a common economic or social interest but not necessarily linked together with financial participations (e.g., a car manufacturer and its concessionaires). These independent networks may be connected to the public network but the conditions of interconnection are organised in such a way as not to breach the monopoly on voice telephony.

Generally, the interconnection is handled through a termination point. Such a termination point is, according to the law, defined as "a physical point of connection, which meets the specifications needed for access to the network, and to transmit and receive data through this connection". They are considered to be an integral part of the public network.

The practice of interconnection in France has been so far to scale down the potentialities of independent networks in order not to bypass the usage of the French public network. For example, when the independent network is accessed by a third party (not belonging to the closed user group) the communications inside the independent network may not go beyond a local taxation area. This may change in the future.

5.1.3.5 Interconnection of services

5.1.3.5.1 Bearer services

In the French regulation, bearer services occupy a middle position between voice telephony (still a monopoly) and value-added service (completely open to competition). Bearer services were originally intended as data services (X.25 in particular) which would be subject to an authorisation by the Ministry. Bearer services have recently been extended to the transportation of voice, and this may represent a way to liberalise the voice telephony market without waiting for the 1998 deadline, and without passing a law for this.

At the moment there are only 3 authorised owners of licences of bearer services for data transport: Transpac, Sprint, and BT France (the latter has not yet officially been awarded the licence, but claims to have it). To these, one has to add the Compagnie

Générale des Eaux for the delivery of its bearer service over its cable network to the DECT operator in Saint Maur.

So far, there have been no problems raised on account of the interconnection of bearer services since the licences were issued too recently to have competitors arguing about their interconnection with Transpac or the public network. One of our interview partners, belonging to the French subsidiary of a big international operator, said that interconnection of bearer services (X.25) may not be necessary for data transmission. But if this happened, several regulatory problems might occur such as the numbering of X.25 access, the interconnection charges, and perhaps some exchange of data between the two interconnected network operators for network management. These issues would have to be tackled by the regulatory authority.

5.1.3.5.2 Kiosque services

"Kiosque" services are provided by France Telecom to service providers (SP) of videotex and audiotex services. Under this principle, FT acts as a host which interconnects with SP computers and manages the commercial and technical interface with the customer. FT meters, bills and charges the customer and pays the SP a standard amount of money in accordance with the use the customer has made of the SP's service.

A point may be raised whether FT, as the operator of the public network, is entitled to organise the market for videotex and audiotex services and to establish the conditions of interconnection to these services without any regulation by DGPT. The latter answers that videotex and audiotex services are open to free competition. If an SP is not content with the service provided by FT through the kiosque system he or she can have a direct access to the customer and set up his or her own kiosque system. Therefore, there is no need, according to DGPT, to intervene in the market organisation, provided FT does not abuse its dominant position. When a competitive supply of either Minitel or Audiotel (the trademark of FT's services) emerges, DGPT may intervene to ensure that the conditions of fair competition are fulfilled.

5.1.3.5.3 Intelligent networks

The present state of thinking in terms of access to intelligent network features is quite limited in France, particularly outside France Telecom. Service providers say that this issue is too far ahead of their concern and in any case, it is up to France Telecom to decide what would be meant by "intelligent network" since the public operator is much more advanced than they are on this issue. The opinion of FT is that there is no need of ONP for intelligent networks, because, by definition, intelligent network functionalities would be in the competitive sector, and ONP principles would not apply to an area where exclusive rights are not granted to France Telecom. It might be necessary to clarify some specific situations where FT has a dominant (but not necessarily abusively

dominant) position, but this could be achieved through a control ex post, on a case-by-case basis.

5.1.3.6 Accounting separation

In order to give a fair access to the public network to any competitor, including the subsidiaries of the public operator, the separation of accounts between the activities related to the operation of the public network and voice telephony and telex services and other, competitive services (including bearer services) are required from the public operator in all the licences granted to its subsidiaries, as well as in its own terms of references (Cahier des Charges de France Telecom). Moreover, cost accounting may be necessary in the activity of the public operator, to avoid cross subsidisation and to compute interconnection charges on a fair basis.

The French regulator seemingly does not share the attitude of Oftel exemplified in the document "Interconnection and accounting separation: The next steps". This document discusses the possibility of splitting the activity of the network operation of a public operator into several costing units and then evaluates the cost of each unit. This approach may be subject, according to the French regulator, to at least three drawbacks:

- The regulator runs the risk of having to do the business of the public operator managers, namely, having to know in detail the costs of each and every piece of the operator's activity, and to carry out this activity in place of management.

- More probably, there will always be an asymmetry of information between the regulator and the regulated company, thereby creating the possibility for opportunistic behavior.

- Even if the behavior of the public operator's managers is "fair", the intimacy created between the regulator and the regulated company through the common detailed examination of the accounts may give rise to a "capture", or at the very least to a type of "complicity", in which each of the parties loses the perception of its own role.

5.1.3.7 The future of regulation in France

The French regulator is pondering a transition to a more competition oriented regulation regime. Interconnection issues in that repect may become essential. Whatever the form of liberalisation, the transition will evolve from a legal monopoly to a licences granting regime. It may rely on an extension of the existing possibilities given by the Law of December 29, 1990:

- Independent networks are already licensed. By extending the concept of closed user groups, or by externalising the activity of operating the independent networks

through the creation of a separate subsidiary by the owners of those independent networks (EDF, SNCF , etc.), the resale of capacity may become much easier.

- Cable television networks may benefit from the possibility to provide telephony services to improve their profitability, while diversifying their activity towards interactive image services. However, this activity may be regulated simply because there are many foreign investors in those companies.

- Teleports may offer a third alternative for the liberalisation of infrastructures, but they also should be given the obligation of universal service provision in their area (at least) and their scope should be limited in order to avoid the creation of local telephony franchises around a city.

Whatever its form, the trend towards liberalisation of the infrastructure provision in France may be encouraged and controlled by the regulator.

5.1.4. Germany

5.1.4.1 Introduction

The process towards restructuring of the postal and telecommunications sectors started in 1987 when the Government appointed a commission to review the need for and possibilities of a reform in Germany. This so-called *Postreform I* culminated with the passage of the *Poststrukturgesetz* in 1989. On the organisational side, the restructuring involved a separation of the regulatory and operational functions and the breaking up of the Deutsche Bundespost into three public enterprises with DBP Telekom (Telekom) taking telecommunications.

With respect to the supply of telecommunications services, monopoly was declared the exception and competition the rule. While Telekom retained monopoly of the telephone service and fixed transmission links, satellite communications for data and other services were exempted from this monopoly, privately owned mobile telephone networks were permitted (and subsequently licensed), and data and value-added network services were completely liberalised.

Implementation of the reform started at the beginning of 1990 and has been progressing since. Besides the various operations of Telekom in the market segments open to competition, more than 380 providers of telecommunications services were in February 1994 on register with the Federal Ministry of Post and Telecommunications (FMPT). Most notable among these are two digital cellular mobile services networks, more than 50 trunked mobile services networks, and 40 satellite services networks, all operated by private companies. A large share of the attention of the regulator has in the past years been directed towards developing and implementing a framework within

which suitable candidates for offering the mentioned services could be selected and licensed.

Currently (mid-1994) the second round of reforms, the *Postreform II*, has come to a conclusion with passage of the corresponding laws through parliament. The reform will transform the successor (public) enterprises of the former Deutsche Bundespost into corporations under private law and also create a regulatory council (the *Regulierungsrat*). The latter will in future have powers of consent as regards regulatory measures and will have to be consulted by the FMPT when making appointments to key positions in the regulatory domain.

5.1.4.2 The framework for interconnection

5.1.4.2.1 The legal framework

The Telecommunications Installation Act (*Fernmeldeanlagengesetz*, FAG) governs the rights regarding establishment and operation of telecommunications facilities. It specifies that the FMPT may grant licences for special networks to operators other than Telekom. Issues of interconnection are, however, not dealt with in the FAG specifically; conditions for interconnection with Telekom are always specified in the licence. The FMPT generally assures the right to interconnection already in the call for tender for licences where it also provides specific information on the matter for the orientation of bidders. Concurrently, by a specific regulatory act, Telekom is obliged to provide access to its network for the licensees.

As part of a set of regulations on the telephone service and infrastructure monopoly, the FMPT has developed general principles regarding interconnection, which are primarily aimed at service providers. These principles prescribe that leased lines obtained from Telekom can freely be interconnected with each other and with the PSTN as well as with the networks of private service providers; subscriber lines may be used as transmission paths for services other than the telephone service; Telekom must assure a non-discriminatory interconnection between subscriber lines and private networks; and non-discriminatory access for service providers is to be implemented. Telekom was called upon to devise and submit to the Minister for approval a concept and a time schedule by which it plans to comply with the requirements. This concept has in the meantime been submitted by Telekom and is currently in the process of public discussion. A decision on it by the regulator is expected by the end of 1994 (see Section 5.1.4.2.6).

The regulations state as a general principle that tariffs and other conditions of supply have to be non-discriminatory. This means that Telekom as a supplier of leased lines or services over the telephone network may not concede to its own competitive units terms that are better than offered private service providers. If there are economies of scope the benefit of these economies are to accrue to the monopoly area in terms of

lower charges for end users there and not in terms of lower internal prices for units offering competitive services.

Access charges to compensate Telekom for universal service obligations placed on it are not provided for. Note too that these rules regarding tariffs and the setting of non-discriminatory internal prices concern only the transmission links in the telephone network, not the switching and ancillary facilities as these are not defined to be part of the monopoly. Thus, the determination of tariffs and prices for switching functions when carried out by Telekom for a customer/competitor is not addressed. Telekom would be free to set tariffs and internal prices as dictated by competitive conditions.

Nowhere in the regulations concerning the licensing of new competitors or in the licences themselves are there provisions that would make the terms and conditions of privately negotiated interconnection agreements publicly available. Similarly, the terms of the Mannesmann/Telekom interconnection agreement, beyond that what is known from the determination procedure (see Section 5.1.4.2.3), are not open to the public.

5.1.4.2.2 Current status of interconnection arrangements

We mentioned above that there are now about 380 registered suppliers of telecommunications services. Most of these use the Telekom facilities on Telekom's general contract terms and conditions (this might change once Telekom's new concept of ONP access to its network has been approved by the regulator and is implemented). Interconnection arrangements in the sense that particular terms had to be arrived at or be determined by the regulator exist in the cases of the cellular mobile networks.

The first controversial case of interconnection concerned the private GSM cellular mobile telephone network D 2 of Mannesmann Mobilfunk.[38] This was a pioneering case in the sense that for the first time in the German context the regulator, against the determined opposition of the incumbent carrier and much of public opinion, enforced a ruling by which the new competitor was granted terms of interconnection that were substantially more advantageous than had initially been offered by Telekom. Mannesmann and accordingly DeTeMobil was also given the right to build its own microwave links to connect Mobile Services Switching Centers (MSCs) and Base Station Controllers (BSCs). This constituted a departure from the exclusive rights normally held by Telekom to construct and maintain fixed-link networks. In Section 5.1.4.2.3 we provide a more detailed description of the process that led to this determination.

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38 The conditions for interconnection of the D 1 network to the PSTN were negotiated concurrently. No disputes surfaced regarding the negotiations between the operators of the D 1 network, at first DeTeCon and afterwards DeTeMobil, on the one hand and Telekom on the other. Both DeTeCon and DeTeMobil are subsidiaries of Telekom. As it turned out, the charges accorded Mannesmann have also been applied to the D 1 operators.

The consortium E-Plus, in which two large German companies, Veba and Thyssen, are the major shareholders, won in 1993 the licence for a digital cellular mobile network using the DCS 1800 standard. In the call for tender, the charges for leased lines and for use of the PSTN that were determined in the Mannesmann case were listed as an orientation for bidders. For a more detailed analysis of interconnection issues that have arisen between E-Plus and Telekom see Section 5.1.4.2.4.

Reportedly, Telekom's established analog cellular operation, the so-called *C-Netz*, is also now going to be provided with interconnection services from Telekom's monopoly area on the conditions enjoyed by the three digital cellular networks.

Telekom has transferred all its mobile telecommunications operations to a 100 % owned subsidiary, DeTeMobil. This company has been awarded licences similar to the ones held by its privately owned competitors, and in particular containing similar assurances regarding interconnection.

The FMPT just established the right of the mobile operators to interconnect their networks directly. It can be expected that there will be some interconnection agreements in this area in the near future. For details regarding this development see Section 5.1.4.2.5.

The licences of the approximately 40 private satellite networks give them the right to interconnect with networks of Telekom, including the PSTN, on Telekom's general contract terms and conditions. Satellite networks can be used for any kind of data communications and for this purpose be interconnected with the PSTN. They can be used for telephone service only by special permission from the FMPT as specified in the licence. This was important early after German reunification in 1989 as it was thought that through the provision of telephony over private satellite networks the then existing general bottleneck could be alleviated. This aspect has since then become unimportant as has the provision of telephony over satellite networks.

The more than 50 trunked mobile networks that have been licensed since 1990 have the right to be interconnected with the PSTN of Telekom. This interconnection is provided according to Telekom's general contract terms and conditions, but special arrangements may also be negotiated with Telekom subject to the approval by the FMPT as regards charges.

In June 1994, the FMPT selected the Gesellschaft für Datenfunk (GfD), a consortium led by RWE, one of the large electricity utilities in the country, to obtain a licence for a mobile radio data network. The licence provides for the right to interconnect with Telekom's networks. It specifies that use of the PSTN shall be according to Telekom's general contract terms and conditions while the terms for the provision of leased lines shall have to be agreed between the new operator and Telekom, subject to approval by the FMPT as regards charges.

Furthermore, in August 1994 the Deutsche Funkruf Gesellschaft (DFR) and the MiniRuf GmbH received licences for operating private paging networks. The call for tender contains assurances regarding interconnection with the networks of Telekom. The terms for the use of the PSTN as well as for the provision of leased lines will have to be negotiated with Telekom, subject, as before, to the approval by the FMPT.

The same conditions hold for the call for tender for a terrestrial flight telephone system (TFTS) for which the FMPT invited bids in April 1994. The licence will furthermore grant the right of the licensee to interconnect its network to fixed networks abroad and to cellular mobile networks in Germany and abroad. So far there has been no final decision on the tender as the first decision of the FMPT to license the Telekom subsidiary DeTeMobil, was blocked by a German Administrative Court which was responding to a complaint filed by two Telekom rivals for the licence.

As mentioned, licences for the trunked mobile, mobile radio data, and the paging services networks contain passages to the effect that charges for leased lines and/or use of the PSTN may be negotiated between the operators and Telekom according to the needs of the particular services. So far, the praxis has been to grant these operators no more favourable conditions than are generally extended to end users.

5.1.4.2.3 The Mannesmann/Telekom interconnection determination: a case study in regulation

The determination in the matter of interconnection of the Mannesmann's GSM network with the PSTN was the most complex issue that the regulator had to face so far. The proceedings leading to this determination took from October 1990 to September 1991. During this period it occupied front stage in the whole public discussion surrounding telecommunications liberalisation. The case is of sufficient interest to discuss it briefly below as indicative of the problems that may arise between a bottleneck supplier and a customer, particularly one setting out to compete with the bottleneck supplier in its own markets.

Mannesmann's licence provides that it and Telekom were to negotiate regarding tariffs for leased lines and use of the PSTN. In case of not reaching agreement, Telekom was to determine tariffs and submit them for approval to the FMPT. Negotiations between Mannesmann and Telekom were conducted from early 1990 until October 1990 when they were broken off without success. Telekom then submitted a tariff proposal to the Minister with the request for approval. The Minister was immediately aware of the significance of the case. He informed the two parties that he would need several months for the necessary careful review. He appointed an advisory body of experts that was to consult him on the matter.

In February 1991 the Minister informed Telekom and Mannesmann that he had found Telekom's tariffs for both the 2Mbit/s leased lines and the use of the PSTN too high. He requested that Telekom revise its offer and decrease its tariffs by 60 % in the case of

the 2Mbit/s leased lines and by 30 % in the case use of the PSTN. He allowed a period until mid-June for Telekom to respond to his request. He pointed out that his rejection of Telekom's offer followed a review of Telecom's calculations and a comparison with tariffs that in other countries are paid in comparable situations.

Telekom did not comply with the request. Consequently, in June 1991, the Minister officially rejected Telekom's offer and at the same time declared he would be prepared to approve tariffs which relative to the initial levels were cut by 54 % in case of the 2Mbit/s leased lines and 21 % in case of the handed-over traffic, the reductions in the percentages being explained by the Minister as representing his partial acceptance of Telekom's claim that it was facing an extra burden in East Germany. At the same time, the Minister announced that he was extending to Mannesmann the right to install its own microwave fixed links to connect its installations on the local level wherever it was advantageous to do so given Telekom's tariffs for leased lines. Telekom declared immediately that it was not prepared to accept the Minister's decision so that the matter had to be taken to the *Infrastrukturrat* which by law is the body to be consulted in case of disagreements between the Minister and Telekom in such matters. In September 1991 this body sustained the Minister and Telekom subsequently implemented the decision as regards its tariffs.

The monthly rentals for 2Mbit/s leased lines that resulted from the determination amount to between 40 % and 50 % of the tariffs according to Telekom's general contract terms and conditions. The charges for use of the PSTN represent rebalanced charges in the sense that the local charges are closer to the corresponding end-user tariffs than the regional and long-distance tariffs. This adjustment was not part of the determination by the Minister but Telekom was allowed to carry it out after the determination became effective. The charge for access to customers at the local level is about 80 % of the tariff for a local call whereas the charge for use of the PSTN for long-distance conveyance is from 70 % to 50 % of the corresponding tariffs.

The charges resulting from the determination were in principle based on long-run incremental costs. This standard could, however, only approximately be applied as all the relevant information for its rigorous application could not be made available. In March 1993, all charges for leased lines and conveyance paid by Mannesmann were placed under a price-cap regulation whereby the charges may be adjusted according to the rate of inflation minus a factor X equalling 4 %. The price-cap regulation of these charges also apply to the other operators of mobile services.

Interconnection of the Mannesmann network actually takes place at the second hierarchical level of the PSTN's trunk exchanges. As far as we know, technical aspects posed difficult problems but were not controversial in the negotiations between Mannesmann and Telekom. There have been complaints on the part of Mannesmann as regards the specifications of leased lines that Telekom was ready to meet; these complaints were, however, not in the forefront of the debate.

As mentioned, the terms and conditions of the Mannesmann/Telekom agreement hold accordingly for the interconnection of DeTeMobil's D 1 network with the Telekom network.

5.1.4.2.4 Interconnection of the E-Plus network and the PSTN

As mentioned above, the charges for leased lines and for use of the PSTN that were determined in the Mannesmann case were listed as an orientation for bidders in the call for tender for a DCS 1800 network. The E-Plus licence granted in 1993 specifies that the terms of interconnection are to be negotiated with Telekom and the ensuing negotiations led to a pre-agreement that was approved by the FMPT in June 1994. In this pre-agreement, E-Plus provisionally agreed to the charges of the Mannesmann determination.

Since then, E-Plus has voiced dissatisfaction with a number of conditions in the pre-agreement:

- The leased line interconnection charges (e.g., about 30,000 DM per year for a 2 Mbit/s-line of 10 km length) are regarded as too high if compared to charges in other European countries.

- So far, a share of 70 % of the traffic in the E-Plus network is outgoing and directed to the PSTN. This traffic is normally handed over locally. E-Plus then has to pay a conveyance charge during business hours of 0.088 DM per minute to Telekom (the charge was raised recently from 0.077 DM according to the price-cap regime). This amount is not regarded as cost-oriented by E-Plus as end users have to pay only marginally more than this charge.[39] [40]

- E-Plus claims to have no control over the quality of the transmission lines as it has to pay the same amount for a 2 Mbit/s-line with 96.5%-availability as for a 2 Mbit/s-line with 99%-availability and Telekom has the right to choose the kind of line to be provided.

- E-Plus is not content with the availability of maintenance services. Provision of these services within 12 hours during the week, within 48 hours on the weekend, and within 5 hours by paying a special fee, are again conditions which it claims to be far less favourable than those in comparable cases.

The above issues are the subject of discussions between Telekom and E-Plus with a view of concluding the main interconnection agreement by December 1994.

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39 End users pay for local calls on a six-minute-per-pulse basis with one pulse costing 0.23 DM. Using conventional conversion methods, based on an average duration of a local call of about 3 minutes, this amounts to a tariff of between 0.09 DM and 0.10 DM per minute.

40 Telekom's position on this is that end-user tariffs for local calls are themselves not cost covering.

5.1.4.2.5 Direct interconnection of mobile networks

The E-Plus licence of May 1993 contains an article which gives E-Plus the right to interconnect its network directly to the D networks and to digital cellular mobile networks abroad. In consequence of that the FMPT accordingly adapted the licences which for the two GSM networks did not provide for this right before that date. The adaptation became effective in March 1994. Furthermore, the FMPT is preparing the final version of the C licence which will also establish the right of DeTeMobil to interconnect the C network to the digital mobile networks.

So far, there have been no direct interconnection agreements between any of the German mobile operators. But it can be expected that Mannesmann, DeTeMobil and E-Plus will begin negotiations about interconnection in the near future. As there are so far no particular regulatory restrictions, and as mutual interconnection can be assumed to be in their common interest, it can be expected that these negotiations will take place on a purely commercial basis, without interventions of the FMPT.

5.1.4.2.6 Telekom's concept for access to its network according to ONP

Following the instructions by the regulator, Telekom submitted a concept for the implementation of ONP to the functions of the telephone network in mid-1993. It encompasses all possible kinds of access, from the simple analog telephone access by the ordinary user to the very special solutions that an interconnecting network would need. The concept is currently being discussed with all interested parties and a decision on it by the regulator is expected by the end of 1994.

It proposes to introduce new non-discriminatory access services depending on market needs. The services are to provide access to the functions of the PSTN, to additional functions which create added value, and to other networks. "Additional functions" in particular also mean IN functionalities.

Telekom identifies three groups of access products: (1) batch products for end users, (2) specific products, and (3) special solutions. Interconnection services as generic products belong to (2) while such special interconnection arrangements as for the mobile networks are grouped with (3). Telekom deals with specific end-user demands for access also under (2) and (3); these cases need not interest us here, except to note that Telekom deals with the various modes of access to its network primarily on the basis of the complexity of required features.

Under "specific products" Telekom includes seven interconnection services that we list below together with interpretation and comments:

(a) *Access oriented toward local network with SS No 7 "A".* This type of access is designed for large on-site installations PBXs, e.g., for airports, or private network operators who want to offer their competitive services locally. It appears that there

is no clear boundary between access for end users and access for competitive service providers as this type of access is offered to both groups of demanders.

(b) *Access oriented toward local network and intended for incoming traffic.* This type of access is suitable for local providers of information services, e.g., cinema announcements or other info-lines.

(c) *Access oriented toward overall network with D channel signalling.* Once competition in telephony is allowed in Germany, this access could be suitable for resellers who would not need SS No. 7 signalling.

(d) *Access oriented toward overall network with SS No. 7 "A".* This should be considered the generic product for interconnecting networks. Note that it would be a bundled service. One should expect, however, that the particular requirements of any actual future interconnecting network would call for a solution that then makes it belong to group (3). As noted, the interconnection arrangements with the cellular mobile networks have in fact been grouped this way.

(e) *Access oriented toward overall network but exclusively intended for incoming traffic.* This access is intended for services like televoting, teledialogue, private information providers, interactive videotext.

(f) *Special access for packet-based data.* This is the typical access for data service providers based on the X.25 interface. It will allow to send packet data from X.25 networks to Euro-ISDN connections and vice versa. As soon as the tariffs are approved by the regulator, Telekom will provide this type of access as the first special access solution available for service providers.

(g) *IN access with SS No. 7 "A".* This is supposed to provide access to competitive additional network functions. Its development is seen to depend on international standardisation still to be worked out. The procedures to be applied should provide customers with best possible protection and autonomy.

Telekom is in the process of developing concrete service offerings corresponding to the solutions proposed in the concept. Solutions (b), (c), (e) and (f) are expected to be available at the end of 1994 (i.e., for applications that would then be open to private interests under current legislation). Solutions (a), (d) and (g) would be introduced if sufficient demand materialises. Demand for access (d) with the specific requirements of networks offering competing telephone service will most certainly come forward starting in 1998 or even before that.

Another important part of the Telekom concept deals with the regulatory requirement whereby Telekom has to assure equal opportunity between itself and private service providers. In the concept this question is dealt with under the term "equal access" according to the ONP framework directive. For Telekom this means non-discriminatory access, as well as non-discriminatory and efficient use of public telecommunications

networks by competitors, or, in concrete terms, the non-discriminatory provision of accesses to the telephone network as a service in the competitive market.

As regards the location of access, Telekom has studied two alternative models to establish equal access:

- *Collocation,* meaning housing the equipment of dominant carriers as well as that of their competitors in the same location in order to avoid discrimination with regard to access to public networks. This model is rejected by Telekom for practical, safety, and business reasons.

- The realisation of the principle *"respective tariff = transfer price",* meaning that after the definition of interfaces between the monopoly and the competitive sector the same prices will internally be charged for the connection of Telekom Switching Network Nodes (SNNs) belonging to the competitive sector as for the connection of private SNNs to Transmission Network Nodes (TNNs) in the area of Telekom's network monopoly. The problems relating to equal access in the case of monopoly transmission paths are also to be solved by this principle. The realisation would lead to financial parity between Telekom competitive sectors and competitors as buyers of monopoly services, and thus to a non-discriminatory solution.

It will have to be examined whether Telekom's arguments against collocation remain valid in the future and whether the realisation of the principle "respective tariff = transfer price" will solve all difficulties in establishing equal access.

5.1.4.3 Evaluation

The German telecommunications policy has made some steps aimed at liberalisation and one can observe a lot of activity in the market. All in all about 400 service providers, including two big mobile operators, have joined the market. So far, however, no general regulatory framework has been developed. The existing interconnection arrangements (Telekom / DeTeMobil, Telekom / Mannesmann and Telekom / E-Plus) were regulated, or negotiated case by case. Service providers looking for access to Telekom's network have so far to accept the normal (and therefore high) end-user tariffs and must await approval and implementation of Telekom's ONP concept.

The parties to the individually regulated or negotiated interconnection arrangements do not consider the existing regulatory decisions on the matter as satisfactory. Recently, E-Plus has been on the record that interconnection charges are too high and the quality of interconnection services is insufficient. One can assume that this by extension holds for the Mannesmann / Telekom relation. From this it follows that additional regulatory work regarding the existing agreements must be undertaken.

The ONP access concept submitted by Telekom can be expected to substantially alter the situation. Provided tariffs meet the justified demands of service providers, the

concept constitutes a rather comprehensive set of interconnection offerings. It can claim to be innovative compared to developments in other European countries. Furthermore, it could serve as a basis for a German regulatory framework for interconnection.

5.1.5 Greece

5.1.5.1 Introduction

Three companies are the main players in the Greek telecommunications sector, which is regulated by the Ministry of Transport and Communications.

Traditionally, the most important of the three is the 100 per cent state owned Hellenic Telecommunications Organisation (OTE), which has the exclusive right to provide basic telephony, telegraph and telex services and facilities, fixed and mobile satellite services, Data-B/C-Video leased lines services, marine mobile services, and directory assistance.

In addition, two competitive providers of GSM mobile services were licensed in August 1992 and began to offer their services in July 1993:

1. Panafon, owned by Vodafone (45 %), France Telecom (35 %), Intracom (10 %), a local telecom-manufacturer, and Databank SA (10 %), a Greek value-added service provider.

2. STET Hellas, owned by STET International (75 %), a subsidiary of the Italian telecommunications holding company STET SpA, Nynex (20 %) and Interamerican (5 %), a Greek insurance group.

5.1.5.2 Status of interconnection agreements

There are currently three interconnection agreements in force: the two fixed / mobile agreements OTE / STET and OTE / Panafon and the mobile / mobile agreement STET / Panafon. At the moment, there are no arrangements for special access to the OTE network. Service providers are treated as normal customers.

The three interconnection agreements were realised in two very different ways:

- The two fixed / mobile agreements were concluded under the influence of a strong regulatory involvement. Already in the two GSM licences nearly all of the most important interconnection issues were regulated ex ante in a detailed way. Furthermore, the regulator was involved in the negotiating process in order to assure that the conditions of the licence were fulfilled by the agreement. Finally, the licence contains a mediation / arbitration procedure in the event that the operators cannot

agree on interconnection terms. Regulatory action of this kind was necessary in respect of the points of interconnection.

- In contrast, the mobile / mobile agreement between Panafon and STET was totally left to commercial negotiations between the two parties. The regulator was in no way involved in the process. In the center of this agreement is the principle: "Each of the two operators keeps what he gets". This means that no interconnection charges are paid by either of the two parties. The principle was introduced under the assumption that no excess of incoming/outgoing traffic occurs on either side. At the moment, Panafon gets some benefit out of this game because 20 % more traffic goes from Panafon to STET than from STET to Panafon. But both operators expect that this difference will disappear in the near future.

5.1.5.3 Approach to various interconnection issues

As noted above, nearly all of the most important interconnection issues were fixed in the GSM licences and so regulated ex ante. This involved the right to interconnect to the PSTN (fixed in the licence), fixing not only the principles but also the interconnection charges as a percentage of the GSM operator's revenues, fixing the numbering plan, imposition on the GSM operators of standards approved according to national and European regulations, as well as prescribing the billing arrangement between the PSTN and the GSM (fixed in the licence). The issues regarding points of interconnection, quality of interconnection services, and provision of leased lines by OTE were left out in the conditions of the licence. They fall under the general condition specifying that there will be mediation / arbitration by the regulator in the event of non-agreement between the PSTN and the GSM operator. As mentioned above, this was invoked regarding the issue of POIs with the result that OTE has to provide access to its network not only in Athens but also in other large Greek cities.

Although there is no universal service obligation in the Greek legislation on telecommunications, one can say that as a public telecommunications operator OTE is implicitly under such an obligation. The new version of the telecommunications law will contain an explicit universal service obligation for OTE. At the same time the Greek regulator is working on the issue of cost-orientation. Currently, OTE's tariff structure can not be regarded as cost-oriented as it is not subject to any cost standard. Therefore no statement is possible as to whether the two mobile operators do or do not pay access charges, either explicitly or implicitly.

The mobile / mobile agreement between Panafon and STET does not need regulatory approval as it is completely in the private domain. This also holds for the fixed / mobile agreements OTE / Panafon and OTE / STET as long as each of the involved parties is satisfied that the conditions fixed in the mobile operator's licences are met by the terms of the agreement. The Ministry as regulator has access only to the two fixed / mobile interconnection agreements, not to the mobile / mobile agreement. There is no public access to any of the three agreements.

It was noted above that there are no regulatory requirements with regard to cost standards and therefore also not for interconnection services. The licence, however, contains a paragraph stating the following: If during the eight years following the initiation of commercial cellular services an EC directive requires the PSTN operator to implement cost-based pricing for providing interconnection to the GSM network, and if, furthermore, the PSTN operator establishes that its costs of providing such interconnection to the GSM network are both determinable and reasonable in comparison to the costs of PSTN and cellular networks in other countries, the GSM and the PSTN operator shall negotiate a cost-based interconnection charge.

5.1.5.4 Specific problems and future developments

The mobile operators express dissatisfaction with the speed with which OTE provides access to its network and leased lines. It is particularly noteworthy that the new operators have to pay the normal leased line tariffs. The operators intend to construct their own (microwave) transmission networks according to the conditions of the licence but the MTC, which is responsible for the allocation of frequencies, has so far assigned the required microwave frequencies to Panafon and STET only after long delays. Until May 1994, only the frequencies for forty links in the area of Attica had been formally approved.

It is to be doubted that OTE's interconnection charges can be regarded as cost-oriented. It is safe to assume that the revenues of the GSM operators, which serve as basis for fixing the charges, do not reflect the costs of interconnection at OTE.

The Telecommunications Act of 1992 defines the regulatory responsibilities of the MTC and those of a new independent state authority, the National Telecommunications Commission (NTC). Although the five members of the NTC were designated in July 1993 the NTC never began to fulfil its regulatory tasks. The above-mentioned problems perhaps could have been avoided if the NTC had been able to begin to work as an independent regulatory authority as was initially intended. Some of the problems may result from the fact that the Ministry is still in the double role of acting as owner of OTE and at the same time being regulator of the Greek telecommunications sector.

Three important developments can be observed in Greece at the moment:

- The Telecommunications Act of 1992 is under reexamination concerning the adoption of the EC Directives 387 & 388/90. Amendment of the Act may result in NTC being able to work effectively.

- Another important fact for future developments in Greece will be the planned partial privatisation of OTE. As the Greek government announced in May 1994, 25 % of its OTE shares will be sold, with overseas investors likely to take up more than half of the issue.

- The realisation of another plan of the Government recently presented to the Parliament would have direct consequences on the status of the interconnection agreements in Greece: It is planned to grant OTE a licence for the provision of land mobile services. It can be expected that there will be intense discussion about this plan because it would mean a clear violation of the passage in the STET and Panafon licence above mentioned which states that there will be no other mobile operator in Greece within a period of eight years (until the year 2000).

5.1.6 Ireland

5.1.6.1 Introduction

The Minister for Transport, Energy & Communications administers government policy to the Irish telecommunications sector. He currently holds the 100 per cent state share holding in the public telecommunications operator Telecom Eireann (TE) and is also responsible for the regulatory functions.

Article 87 of the Postal and Telecommunications Services Act of 1983 (the 'Act') defines the exclusive rights of TE. The European Communities (Telecommunications Services) Regulations (No. 45 of 1992) amended this Act and especially Article 87 to give effect to the European Council Directives 90/387/EEC and 90/388/EEC. As of June 1994 TE has the exclusive right of offering, providing and maintaining the public telecommunications network and of offering, providing and maintaining voice telephony services, telex services, mobile radio telephony service, paging services and satellite services within the state.

5.1.6.2 Status of interconnection

The development of a specific regulatory interconnection / special access regime in Ireland is at a very preliminary stage. There are no interconnection / special access agreements yet as TE, through Eircell, its business unit providing mobile services, is currently the sole telecommunications operator for both fixed and mobile services. Service providers are treated as normal customers.

Nevertheless, all interconnection issues are being examined urgently in the context of the proposed award in 1994 of a second GSM licence. This second GSM operator will have to be in a position to comprehensively interconnect with the fixed network. It is therefore expected that the official Irish position on interconnection will become clear in the course of 1994.

5.1.6.3 Specific aspects and future developments

It is planned to separate the regulatory functions of the Ministry from its functions as owner of TE and to establish in the near future an independent authority outside the Civil Service. One can expect this to have some influence on the regulatory process concerning interconnection.

TE considers interconnection / special access as a matter of considerable significance in the provision of telecommunications services in a competitive environment. The Irish telecommunications sector will be fully competitive at the latest by the year 2003 (Ireland received a five-year exemption from the European voice telephony liberalisation requirement in 1998; until now no political decision has been taken as to whether or not to use this potential derogation). TE regards interconnection as primarily a commercial and technical issue, but only after the establishment of a regime based on principles which require regulatory input. The principles include matters such as the definition of universal service obligation (there is no specific definition in the Act or in other laws and regulations), how the local access deficit should be dealt with, access arrangements, respective rights of the parties, and conciliation/arbitration procedures.

TE sees interconnection as an issue to be dealt with at a national rather than European level. Only broad principles should be set at EU level as it is unrealistic to expect that interconnection arrangements will not differ according to the different telecommunications environments prevalent in the various Member States.

5.1.7 Italy

5.1.7.1 Introduction

When studying the complex structure of the Italian telecommunications sector one has to distinguish between the situation before May 19, 1994 and the situation after this date. On that day the shareholders' meeting of Società Italiana per l'Esercizio delle Telecomunicazioni (SIP) decided that the five main Italian telecommunications companies will merge into one Telecom Italia by August 1994.

The situation before May 1994 was the following: The IRI group - Istituto per la Ricostruzione Industriale, the Italian state holding company - controlled approximately 52 % of the telecommunication sector sub-holding STET - Società Finanziara Telefónica - which itself owns 51 % or more of the following companies:

- SIP, which provides the local telecommunications network and parts of the trunk network, local voice telephony, mobile and data communications,
- Italcable, providing intercontinental telephone and telex services,

- Telespazio, which offers satellite communications facilities, and

- SIRM (Società Italiana Radio Maritima), providing maritime radio services.

These four companies as well as the wholly and directly state-owned carrier *IRITEL* (the former state agency ASST), which owns over 60 % of the trunk network and provides European telephone and telex services, are merging into Telecom Italia. The areas which are still defined as monopoly services carried out by the five above mentioned companies constituting Telecom Italia are voice telephony, the provision of the fixed infrastructure, and satellite communications.

Another important development in the Italian telecommunications sector was the granting of a licence for operating a second GSM mobile communications network to the Omnitel-Pronto Italia consortium at the end of March 1994. The leading position in this consortium is taken by Olivetti with a 35.5 % stake. SIP has been offering cellular mobile services since 1984 (analog) and 1992 (GSM) based on monopoly rights.

The Ministry for Posts and Telecommunications is the regulatory authority in Italy.

5.1.7.2 Status of interconnection

In the situation before the merger that created Telecom Italia in May 1994, the distribution of revenues from voice telephony between the different Italian telecommunications operators was regulated in the following way: SIP had the task of collecting the revenues from its clients. 10.5 % of the revenues from a European or a trunk call over the Iritel network had to be given to Iritel and 10.5 % of the revenues from an intercontinental call had to be given to Italcable. This kind of 'interconnection' will now become a matter of internal cost and revenue accounting.

With regard to the fact that there are still no regulations in the field of interconnection and special access in Italy, SIP considers the Italian service providers as "users" which means that normal interfaces and tariffs are applied when they get access to the SIP network.

Nevertheless SIP believes that interconnection/special access is one of the most important issues to be tackled for the emerging of a new competitive environment for all telecommunications services. It is seen as an issue which has great importance from a political, technical and commercial point of view. It must be handled right to ensure that the market will develop in accordance with fair competitive rules. It is seen to be strictly linked with the problem of universal service obligations, cost accounting systems, access charges and so forth.

The only interconnection case that will have to be regulated in the next months is the interconnection between the second GSM network of Omnitel-Pronto and the SIP/Iritel network as Omnitel-Pronto will begin to operate in January 1995. At the moment two main critical points can be identified in the discussion between the Ministry and

Omnitel-Pronto concerning the regulation of this interconnection case. The first point concerns the determination of interconnection charges. The second point concerns the routing of the traffic. Omnitel-Pronto under the leadership of Olivetti has the possibility to use the network of Olivetti Data Communications. Furthermore, after an agreement with the Italian TV company RAI, Omnitel-Pronto is able to direct its traffic over the RAI transmission network. So Omnitel-Pronto's interest is to route its traffic as far as possible over its own trunk lines or the RAI network. On the other side Telecom Italia wants Omnitel-Pronto to be obliged to a mandatory use of Telecom Italia's trunk network in order to get its capacities fully used and in order not to be burdened only with the expensive local distribution.

As soon as the negotiations over the terms for interconnecting the networks are concluded, the Ministry will grant the licences to Omnitel-Pronto and Telecom Italia which will provide for the same opportunities, obligations and limits for both parties. The aim of the regulator is to assure that Telecom Italia will have no advantage under the new licence. For example, it will be obliged to observe transparency by introducing a separate administration and separate accounts for its mobile services division.

5.1.8 Luxembourg

By legislative action in 1990, and effective from 1992, the former state *Administration des Postes et Télécommunications* was converted into the public, 100 %-state-owned corporation *Postes et Télécommunications (P&T)*. The responsibility for regulatory matters remained with the Ministry of Telecommunications.

The exclusive right to provide voice telephony services and the public infrastructure was given to P&T by regulations in August and October 1990. All other services via the fixed public network are non-reserved and do not require specific authorisation.

P&T so far (as of October 1994) has not entered into any detailed interconnection/ special access agreements with other market participants. All problems that have arisen so far have been solved on an ad hoc basis.

P&T has, however, been studying several questions in the field of interconnection and special access, e.g., the fixing of charges, funding of the universal service obligation, technical standards for interconnection / special access.

In general, there is a paucity of information available on the issues of interconnection in Luxembourg.

5.1.9 The Netherlands

5.1.9.1 Introduction

Competition has not been introduced as yet in the domestic public voice telephone market or even in mobile telephony. Hence, no interconnection agreements have yet been made. From July 1, 1994, the incumbent TO (PTT Telecom Netherlands) operates a network meeting the digital GSM standard; a second GSM-operator is to be licensed in 1995. The Government is also preparing new legislation to introduce a second national telecommunications (fixed) network operator to compete with PTT Telecom from 1995-96, except in voice telephony. In accordance with EU policy, voice telephony will be liberalised as from 1998 and so can be offered by an alternative fixed network operator. The Dutch policies and market developments are described in more detail in Sections 5.1.9.2 and 5.1.9.3, respectively.

The second fixed operator will need an interconnection agreement with the incumbent and may, on the other hand, offer interconnection to the various digital mobile networks, including ERMES paging networks. This makes the Dutch scope for different interconnection arrangements potentially wider and more complex than in most other EU member states, with the exception of the UK. The corresponding wholesale service arrangements of interconnect access in preparation by PTT Telecom are summarised in Section 5.1.9.4.

The specific details of interconnection guidelines or requirements, such as conditions for pricing, quality, capacity, delivery time, objectivity and non-discrimination, are not laid down in the GSM-law, but have to be prescribed in more detailed rules and regulations by Ministerial Directives yet to be issued. The basic principle assumed for interconnection is that of a commercial agreement negotiated between business partners; the regulator (i.e., the Ministry) intervenes only if a determination is requested by (one of) the parties. Being commercial contracts, interconnect agreements will probably not be published.

5.1.9.2 Institutional and legal conditions for interconnection.

5.1.9.2.1 Market structure: the regulatory framework and entry conditions

Dutch telecommunications are governed by the Telecommunications Act of 1988. As from January 1, 1989, the new private limited-liability holding company of PTT Telecom, KPN, was granted an exclusive concession on the following

- public telephone services
- telex and public data communication services

- provision of leased lines

- the public infrastructure (i.e., transmission and switching network) facilities, both wired and wireless, necessary for the above and other services to (parts of) the general public, except broadcast (air and cable) distribution.

The 1988 Act liberalised the terminal and value-added service markets in Holland. As from January 1993, the public data communication service was liberalised, too, in accordance with European policy. The latter change took place using a provision in the Act allowing (re)definition of the concessionary services by Ministerial Decree. However, this option was not exercised to liberalise the (digital) mobile telephone service, based on the pan-European GSM-standard. This was implemented through a lengthy legislative procedure, eventually resulting in a major amendment to the 1988 Act in mid-1994.

5.1.9.2.2 Legal provisions for mobile-interconnection arrangements and non-discriminatory treatment of competitors.

The points at issue with respect to interconnection and fair competition in the so-called GSM-amendments were:

a) the removal from the concession of radio infrastructure required for the new mobile services, in particular base-station transmitters;

b) relaxation of the restrictions on leased-line usage, to allow a mobile licence holder to couple his cellular base stations to base station controllers and mobile switching centres. To leave licence holders more freedom in negotiations with PTT Telecom, they are allowed to install and use alternative radio relays at 18 GHz without separate licensing. If PTT Telecom proves incapable or unwilling to install cables to meet the fixed-networking requirements of the holder of a licence, the latter may also seek the permission of the Minister to establish his own cable lines;

c) inclusion of an obligation of the concessionary (i.e., PTT Telecom) to provide the leased lines specified above and to provide the requested interconnections of the licensed mobile network(s) to the concessionary's infrastructure, on non-discriminatory and reasonable terms, yet to be specified by Ministerial Order. PTT Telecom is legally required to provide all facilities asked for, unless these

- are technically infeasible

- violate the integrity or other essential requirements to be met by PTT Telecom

- cannot reasonably be demanded by the service to be provided by the licence holder;

d) inclusion of a legal permission for licence holders to make interconnection arrangements with

- the infrastructure of other licence holders

- the infrastructure of a foreign operator, using leased lines provided by the concessionary or by a third party in accordance with the Act (the latter possibility is a prelude to the creation of a second concessionary fixed network operator in 1995 - see Section 5.1.9.2.4);

e) inclusion of a provision for Ministerial intervention at the request of a licence holder, in the event that an agreement cannot be reached with the concessionary about conditions for provision of interconnection and/or leased lines. The Minister is required to give a decision within eight weeks of receiving the necessary information from the concessionary and the licence holder; they have two weeks to surrender such information. The Minister may instruct the concessionary to act otherwise, if the latter is deemed to impose unreasonable conditions or unjustified denial of service on the licence holder;

f) requirements for licence holders to treat resellers and service providers reasonably and on objective, non-discriminatory conditions, subject to a Ministerial Directive yet to be specified;

g) requirements for KPN (as the first GSM licence holder) to accept a request from the second licence holder to be a reseller of KPN's GSM service until the second GSM infrastructure has evolved sufficiently, and to allow the numbering series granted under the second licence to be used on KPN's GSM network in this interim period.

It should be emphasised that most of the specific details of interconnection guidelines or requirements, such as conditions for pricing, quality, capacity, delivery time, objectivity and non-discrimination, are not laid down in the law, but have yet to be prescribed in more detailed rules and regulations by Ministerial Directives. This is a matter of some concern for the bidders on the second GSM licence, who have to prepare their offers in the second part of 1994. Draft directives are under juridical review by the Conseil d'Etat ("Raad van State"), and may not be ready in due time.

The GSM-amendments were made very late, compared to most other EU member states. This was partly due to the strong emphasis in the re-regulation on a legalistic rather than a pragmatic approach to the modification of the exclusive concession of KPN.

5.1.9.2.3 Tariff regulations: Access deficit charges?

In general, the tariffs of PTT Telecom are set by the concessionary himself, subject to a price-cap control regime. This has allowed PTT Telecom to begin a major re-balancing towards more cost-oriented tariffs in recent years. A nominal increase of 100% for call

charges for (long) local calls within a year has been accompanied by considerable public discussion. Although the overall Dutch consumer tariff basket is one of the cheapest in Europe, PTT Telecom has announced that no further increases are expected, before VAT is to be levied on all telecommunication transactions in 1996.

It will thus take some time to reach completely cost-oriented tariffs in The Netherlands, so an access deficit charge for interconnecting operators cannot be ruled out, at least in the beginning. The argument is further complicated by the advent of a second operator as from 1995, who may offer public domestic telephony from 1998 (see Section 5.1.9.2.4).

The tariffs for analog leased lines rose on average by 11.5% in 1993, while those for digital leased lines dropped by 21%. According to the GSM amendments, the legislator may allow - or even expect as a result of his permission to employ alternatives to leased lines - that leased lines be provided to the interconnecting licensees by the concessionary on more favourable conditions than the general public tariffs.

5.1.9.2.4 Dutch perspectives on further liberalisation and interconnection needs in the near future

In 1993, the Government published a White Paper on the future telecommunications policy in The Netherlands. The White Paper built on the three-layer model for telecommunications provision depicted as part of Figure 2.1.2-1.

This layered model was later adopted in the Delors White Paper. Briefly summarised, the position taken by the Dutch Government was that

a) future horizontal competition must be possible within each layer, including the infrastructural (lowest) layer, where a second operator would be allowed to compete with PTT Telecom;

b) equal access in accordance with ONP-principles must be ensured to all facilities and services in the immediate lower layer. Service providers and resellers should enjoy terms and conditions similar to classical 'vertically integrated' suppliers such as PTT Telecom;

c) interconnection agreements between operators at any one layer should enhance integrity of infrastructure and effectiveness and national universality of network services;

d) liberalisation would be introduced on basic services in a 'managed' way, so as not to cause harm to (the privatisation of) the incumbent operator and his universal service obligations. This would call for an initial delay in competition on public voice telephony until 1998.

Among the potential new players, the White Paper designated the Government's preferred choice of owners of a second fixed infrastructure: A licence to provide leased lines to third parties would be given to the carrier networks of the electric-utility sector and the Dutch Railways, in combination with the local CATV networks. If these parties ensure mutual interoperability between their networks, competition with PTT Telecom on the lowest layer of Fig. 2.1.2-1 would be allowed from 1995. The GSM amendments to the 1988 Act allow use of the 'second' fixed infrastructure in support of the GSM operator's network, e.g., to couple base stations and mobile switching centres.

The advent of an alternative fixed telecommunications network in The Netherlands enhances the scope for (negotiating) interconnection arrangements in the years to come quite significantly, even before the 1998 liberalisation of public telephony in the EU.

5.1.9.3 Potential parties to interconnection arrangements

In 1993, there were no domestic business areas yet where competition from parties with interconnection arrangements played any role, due to the delay in introducing GSM in The Netherlands.

By the end of 1993, 93% of PTT Telecom's subscribers were connected to digital local switches. This is a high figure by most European standards. However, the functionalities of Euro-ISDN could be offered only in 30 urban areas, covering some 40% of the potential business users. There were 7.63 million PSTN subscriber lines and only 1500 ISDN subscriber lines by the end of 1993.

In 1993, 6% of PTT Telecom's net revenues came from its mobile services, which at the end of the year had some 380,000 paging subscribers and 240,000 voice subscribers. PTT Telecom introduced GSM on July 1, 1994.

A public packet-switched mobile data service, using the Mobitex industry standard, was introduced by RAM Mobile Data in 1993. Roaming agreements with neighbouring European countries are being prepared. There is no special interconnection agreement with PTT Telecom. A number of consortia have been or are being formed to be able to qualify for the GSM-tendering procedure. The three chief candidates all involve a major Dutch bank (ING, RABO and ABN-AMRO) and a foreign network operator (Vodafone, Bell South and PacTel, respectively).

In view of the emphasis in the proposed tendering procedure on actual business plans to which the successful bidder will be committed as a selection criterion, the consortia are very cautious with information about their individual interconnection plans. This proves not only a problem for the authors of this country study, but also for PTT Telecom, which is legally obliged to treat all candidates in an equal, non-selective way.

5.1.9.4 PTT plans for interconnect access

PTT Telecom has disclosed interesting information about its plans for providing interconnect access to its public switched infrastructure as a business activity. It is believed that this interesting disclosure is designed to resolve some of the deadlocks perceived in the complex relation between the regulator, the concessionary, and the competing bidders for mobile licences. The complexity is enhanced by the possible advent of a second fixed network operator in 1995, who will also become involved in considerations of interconnectivity arrangements with PTT Telecom and the successful bidders for a GSM-licence and ERMES-paging licences. The interconnect access includes the following standard package of service elements:

1) Network coupling, using international standards (ETSI). The coupling may take place at two national access points (NAPs), located in Arnhem and Amsterdam, and providing access to all 7 million PTT subscribers. 26 regional access points (RAPs) will become available from 1996. Interconnect agreements will be made for a number of years, based on the interconnector's service management needs in terms of traffic, service levels, quality, availability and routing strategy.

2) Establishment of call connections, based on service management needs in terms of numbers and (time and space) distribution of calls, quality, and service levels;

3) Traffic handling within the PTT network, based on the above service management needs

4) Billing of interconnect access, standard per month. In addition, six optional service elements can be offered.

The tariffs for the 4 elements included in the standard package may be built up as follows:

1) The coupling charge will contain a fixed part per access port, plus a distance dependent, fixed monthly tariff for any 2 Mbit/s leased line to the relevant NAP or RAP;

2) The call connection charge will be a fixed amount for a successful connection;

3) The traffic charges will be made on a per-second basis;

4) The interconnect access billing fee will be included in the above fees. For most of the optional service elements, charging will correspond to that for services in the fixed network.

5.1.10 Portugal

The structure of the telephone industry in Portugal is legally fixed by a division into three classes of telecommunications operators. Fundamental services are reserved for monopoly provision by government concession to public or private operators; complementary network services are open to licensed competition; and value-added services are open to all registered suppliers.

Two public TOs provide fundamental services. One operator emerged from the merger of Telefones de Lisboa e Porto (TLP) and Telecom Portugal (TP) in 1994 provides national services and international services to Europe and North Africa. The second operator, Marconi, provides international and offshore services.

The regulatory body, the Portuguese Institute of Communications (ICP), licenses complementary service operators and registers value-added service providers.

The public TOs are interconnected at digital transit exchanges. Mobile carriers, other complementary service operators, and value-added service providers are also interconnected at digital transit exchanges. GSM service is provided by two operators - TMN (a subsidiary of TLP and TP), and its private competitor, Telecel. TMN and TP have some collocated equipment; Telecel has not sought collocation. GSM and other mobile operators lease lines from the TOs and are not permitted to own fixed transmission facilities.

The major interconnection and settlements relationships for mobile operators are defined prior to the tendering of a mobile licence. They include the right to interconnect; the right to standards and specifications, including signalling; special prices for leased lines used for interconnection; and special delivery time for services provided by the fixed network operator. Quality of service standards are included in the licence issued by the regulator.

The principles governing interconnect charges are contained in a three-year Convention agreed to among the government, the regulator, and the operators. Leased line charges for mobile operators are priced according to a two-part, distance-sensitive tariff, with distance-related discounts. Charges for conveyance by TOs of switched traffic interconnected to the mobile operators are based on retail call tariffs, less a 35% discount factor that deducts for termination of one end of each call by the mobile operator. There are no explicit access charges; however, urban area conveyance charges are based on the highest-priced distance band regardless of the location of the caller.

Existing cost studies are considered inadequate to resolve disputes concerning the level of tariffs for leased lines and the related measurement of link distances, and the distribution of mobile calls among urban tariff bands.

5.1.11 Spain

5.1.11.1 Introduction

The main player and public telecommunications operator in Spain is Telefónica de España (Telefónica) which is a private company with the state as the main shareholder (more than 30 %). As last confirmed in December 1991 through a 30 year licence agreement between Telefónica and the Government, Telefónica has the exclusive right to provide voice telephony.

With regard to the provision of public telecommunications infrastructure, Telefónica has no exclusive rights as there are two other operators with special rights for the provision of telecommunications networks, and in particular for the provision of carrier services:

- Retevision, the monopoly provider of carrier services for TV broadcasting, and
- Organismo autónomo de Correos, the monopoly provider of telex and telegram services.

Normally value-added service providers are not allowed to build lines or circuits so that they have to lease them from one of the three operators. According to Article 23.1 of the Spanish Telecommunications Law ("Ley de Ordenación de las Telecomunicaciones", LOT), a service provider who wants to build installations on his own needs a special administrative concession. Such a concession will be granted only in those very exceptional cases when there are no bearer or end-to-end telecommunication services that could substitute the special telecommunications network proposed by the concessionaire.

The Ministry of Public Works, Transport and Environment, the Spanish regulatory authority, has furthermore licensed Telefónica Servicios Moviles (TS-1), a subsidiary of Telefónica, to provide analog mobile and paging services. Two other licences for paging services were given to the companies Sistelcom and Cersa.

5.1.11.2 Status of interconnection

At the moment the most important developments concerning the issue of interconnection can be observed in the markets for data services and GSM mobile communications.

5.1.11.2.1 Interconnection of data service providers

The Royal Decree 804 of May 28, 1993 approved the technical and operational regulation for packet- and circuit-switched data service provision. The main regulations concerning interconnection of data service providers are contained in Article 31 of the Decree:

- Technical and economic conditions for interconnection will be fixed by agreement between the parties. In case the agreement is not reached the General Directorate of Telecommunications (as the responsible department of the Ministry) will fix the conditions for interconnection (regulation by determination).

- Any refusal for interconnection of an undertaking can not be based on technical incompatibility of the systems used when adequate international standards exist. The General Directorate of Telecommunications will be entitled to determine the appropriateness of the refusal, when it is based on technical reasons.

Licences for data service provision have recently been granted to nine companies: Telefónica, Cable & Wireless, Unisource Business Network España, Ingenieria de Gestión y Redes, France Telecom Redes y Servicios, Megared, Sprint, IBM, and TMI Telemedia. So far, however, these suppliers do not seem to have been very successful in the market. A reason for this could be seen in what the Spanish service providers describe as interconnection-related problems:

- As mentioned, service providers are normally not allowed to have their own network facilities (lines or circuits). So they have to lease lines from Telefónica and pay the regulator-approved end-user tariffs which they claim to be too high.

- Telefónica's delivery schedules for access lines are often uncertain and there are difficulties in assuring a certain level of quality of service.

- There are restrictions on the commercial use of access facilities. For example, ISDN D channel access is not available for service providers.

Perhaps some of these problems could be solved by the above mentioned regulatory regime of Article 31 of the Royal Decree 804 but so far there has been no request for an ex-post determination to be carried out by the regulator.

5.1.11.2.2 Interconnection of GSM mobile operators

The second important development concerning the issue of interconnection is the plan of the Spanish Government to award two GSM licences in the course of 1994. One has already been granted to Telefónica. The other one is expected to be awarded after a bidding process in November or December 1994.

The regulatory rules for mobile telephony were fixed in the Royal Decree 1486 of July 1, 1994. Article 17 of the Decree establishes the right of the GSM licensee to get access to the PSTN. Out of 50 cities listed in the appendix of the Decree the licensee can choose the desired points of interconnection which then have to be provided by the public operator within a period of three months.

In Article 18 it is fixed that the GSM licensees may interconnect directly. The second paragraph of Article 18 states that there will be no direct interconnection between a GSM network and a network in another country so that the traffic will have to be conducted over the PSTN. But within certain restrictions the regulator is able to allow exceptions from this rule.

The principles of interconnection charging are regulated in the Articles 19 and 20 of the Decree. The general principle is written down in Article 19 and states that the charges for access to the PSTN have to be cost-oriented and need to be approved by the regulator. Article 20 specifies that the conveyance charges for the usage of the network will be fixed by the regulator himself. These charges also have to be cost-oriented and can contain access charges for financing the obligations of the public operator.[41]

In the Spanish Official Journal of September 16, 1994 the Ministry published the charges for interconnection. The charges were determined on the basis of a fully-distributed costing method. The regulator has not made use of his power to include access charge elements into the charges.

For a 30-channel digital access to the PSTN the interconnectors have to pay the end-user tariffs minus a 35%-reduction on the initial connection charge and on the monthly rental charge. The interconnection charges for the usage of the networks (conveyance charges) were completely defined by the ministerial determination: For a call from the fixed to the mobile network Telefónica has to pay an initial charge of two units of tariffication (4.36 pesetas by July 1994) and a usage charge of 15 pesetas per minute at the normal hours (monday to friday, 8.00h to 22.00h, and saturday, 8.00h to 14.00h). The GSM operators have to pay the same usage charges but no initial charge. Furthermore, they have the possibility to choose the tariff level (between 25 and 45 pesetas per minute) that an end user of the fixed network has to pay for a call directed to the mobile network.

Concerning the direct interconnection of mobile networks, the regulatory determination of September 16, 1994 states the following: If the GSM operators interconnect their networks directly or if there is interconnection between a GSM operator's network and an analog mobile network the parties can develop a proposal of an interconnection charges payment scheme. This proposal has to be presented to the regulator for approval within a time of 3 months. In cases of non-agreement between the parties the regulator has the authority to determine the interconnection charges.

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41 Here is especially meant the universal service obligation of Telefónica which is required to provide a blanket coverage of the telephone service with uniform tariffs all over Spain by 1996 at the latest.

Clause 39 of the call for tender of the GSM licence, published in the Spanish Official Journal of September 27, 1994, contains some further regulatory rules with regard to interconnection. The clause sets out the right of the GSM concessionaire to interconnect its network to the PSTN. It further specifies that an interconnection agreement must be presented to the General Directorate of Telecommunications for its approval within two months after the granting of the second GSM licence. The agreement will include different aspects, such as the mode of interconnection, the criteria for traffic routing, investments into the PSTN, etc.

It can be seen that the interconnection of the GSM networks with the fixed network is regulated in a completely different way compared to the interconnection of the data service providers. Instead of an approach favouring commercial negotiations, with ex-post determinations in case of failure, we find a number of important ex-ante rules from which follows that the regulator plays a more active role in the negotiations between the network operators.

It can be expected that the interconnection issue will become of increasing importance in Spain as there are strong indications that the Government will not use its special 5-year-exemption on full service competition and, like most other Member States of the European Union, will open its markets in 1998. This interpretation was recently - on October 7, 1994 - confirmed by an official communication of the Spanish Government setting out the telecommunications policy during the transitional period up to 1998.

5.1.12 UK

5.1.12.1 Introduction

The U.K. has been one of the world's pace setters in telecommunications policy. Already in 1980/81, the U.K. government formed British Telecom (BT) and abandoned the traditional PTT concept by severing the ties between telecommunications and postal services. At the same time, limited market entry into telecommunications was allowed. In 1983 the first network entrant for fixed link services, Mercury, was protected against further market entry (along with BT) through a seven-year duopoly policy. However, limited entry into telephony by cable TV operators (as network providers to BT and Mercury) and a duopoly for mobile services were exempted from this policy. In 1984 the government converted BT into a plc (public limited company, i.e., a private law company) and divested a majority of its shares. This divestiture was accompanied by an innovative regulatory framework which involved the appointment of an industry-specific regulator with powers to determine interconnection agreement. In 1991, following a review of the duopoly policy, telecommunications markets were opened to additional network entrants.

Having accumulated 10 years of valuable experience with interconnection regulation policy, the U.K. provides the natural yardstick for other European countries.

5.1.12.2 Institutional and legal conditions for interconnection

5.1.12.2.1 Status of interconnection agreements and market structure

A meaningful market for interconnection could, in principle, emerge after the Telecommunications Act 1981 had converted BT's monopoly rights for network services to an exclusive privilege and had allowed the government to issue licences to other network operators.

The first licence, based on the 1981 Act, was issued to Mercury in 1982 for fairly restrictive operations. Based on new legislation, a second and broader licence was issued to Mercury on November 5, 1984. Mercury's first licence was almost immediately followed by an interconnection agreement between BT and Mercury (November 5, 1982), while a second agreement, based on the new licence, took until March 1986 to conclude. The time it took to reach the second interconnection agreement may actually have slowed down Mercury's market entry into public telephone services.

The number of interconnection agreements and potential partners grew rapidly with the full entry of cable TV companies into telephony and with the end of the duopoly policy end of 1991. For example, as of September 1993, Mercury had 43 interconnection agreements with fixed-link operators and 3 with mobile operators, and it expected to sign many more such agreements with new licensees. Even though all licensees (yet) do not have interconnection agreements with each other, the number of interconnection agreements must, by now, have reached several hundred. Interconnection agreements between fixed networks currently exist between TOs, between TOs and cable operators, between TOs and CAPs, and between TOs and service providers. In addition, there are fixed to mobile and mobile to mobile interconnection agreements. Currently, there are no agreements on IN services; however, both the Department of Trade and Industry and the regulator OFTEL (Office of Telecommunications) have taken initiatives in that direction. The total estimated sales under interconnection agreements are currently in the range of 500 million pound sterling annually (our assessment).

The British telecommunications market continues to be dominated by BT. Although BT's share for domestic calls has dropped to about 90% and for international calls to below 80%, BT still has 97% of subscribers. All other telecommunications operators have to use BT's network to complete calls. BT is a vertically integrated nationwide provider of local, long-distance and international services. Therefore, BT directly competes with the same operators to whom it provides interconnection services.

After initially viewing interconnection as an unwelcome activity (at least as far as interconnection with Mercury was concerned, but not necessarily with the mobile operators Cellnet and Vodafone), BT now treats interconnection as a business in its

own right. It has created "BT Carrier Services" as a division catering to the specific needs of the U.K.'s telecommunications operators.

After a slow start, Mercury Communications Ltd. (hereafter: MCL) experienced impressive growth. In 1992/93 MCL had 10.5% market share in telecommunications services by revenues. The largest component of MCL's operating revenues is from business customers with direct fiber-optic or microwave connection to MCL. The second component is from large indirectly connected business customers (using automatic least-cost routing over MCL's network for long-distance and international calls) and the third from indirectly connected residential and single-line business customers. Indirect connections mean that these customers access MCL through the network of other PTOs, mostly through BT. Residential customers mostly use telephones equipped with a push button that directs the call over the MCL network or telephones equipped with a "Mercury Smart Socket" that automatically connects with MCL.

As a result of the Duopoly Review of 1991, cable TV companies had the right to offer switched services and hence to interconnection with BT or MCL. Telephone lines supplied by 13 U.K. cable companies have grown from fewer than 2300 before 1991 to 312,000 by end-1993. This is more than 1% of total direct lines in the U.K. The incremental cost of providing telephone services is low for a cable TV company, provided the twisted copper telephone wiring is done at the same time with installing the coaxial TV cable.

In the area of mobile telecommunications, Vodafone and Telecom Securicor Cellular Radio Ltd. (known as "Cellnet", 60% owned by BT and 40% owned by Securicor) hold licences for cellular mobile radio telephone networks since 1985. They now provide the corresponding services nationally and each has more than a million subscribers (using analog and digital technology). In addition, there are two newly licensed mobile digital PCN operators, Hutchison Microtel, which is part of Hutchison Whampoa of Hong Kong, and Mercury Personal Communications Limited, which is the licence holder for Mercury One-2-One. Until very recently, all mobile operators had to obtain their fixed links from other PTOs. However, Vodafone and Cellnet have, in December 1993 and March 1994, respectively, been licensed to provide certain of their own fixed links and provide land line services, and the PCN providers expect such licences shortly.

5.1.12.2.2 Regulatory framework / licence

The Telecommunications Act 1984 (in the following: the Act) created the position of Director General of Telecommunications (DGT) as the responsible regulator who heads OFTEL. Although licences are issued by the responsible Ministry (the Department of Trade and Industry) after discussion with OFTEL, the DTI has substantial power over the monitoring and modification of licences and can make most decisions single handedly. He exercises these powers within the limits of his statutory duties and objectives and in the case of licence modification is subject to appeal to the Monopolies

and Mergers Commission. OFTEL had 147 employees in December 1993. 12 members of its staff are predominantly engaged in interconnection activities.

The main vehicle of telecommunications regulation is the operator licence. The Act requires that all operators of public telecommunications systems, including BT, must have a licence to operate. Since 1991 (after conclusion of the Duopoly Review) licences can be issued fairly freely for the provision of services over fixed links. As of May 13, 1994, 44 licences had been granted and 38 more applications had been received.

The operator of telecommunications systems can be licensed as a PTO. Being classified as a PTO facilitates acquiring wayleaves (rights of way) and imposes some duties, such as reaching certain penetration levels (MCL) or even providing universal service (BT), and the duties to publish prices, terms and conditions of service and not to discriminate. Less stringent requirements have to be met to gain licences that do not confer PTO status. They are usually quite restricted and apply to private networks (e.g., of public utilities), closed user groups (banks) or simple resale of international private circuits.

When it comes to competition policy in telecommunications, the DGT shares responsibilities with the DG of Fair Trading (Section 50 of 1984 Act) in applying the relevant competition laws. In addition to the Restrictive Trade Practices Act 1976 and the Competition Act 1980, further competition law applying to telecommunications operators is contained in their licences. For example, BT's licence disallows provisions in interconnection agreements that are restrictive (collusive) under the Restrictive Trade Practices Act 1976, unless the DGT, in a determination, has explicitly consented to such a provision.

BT, as the dominant U.K. telecommunications carrier, is subject to a universal service obligation,[42] subject to non-discrimination requirements and subject to price regulation covering about 64% of its revenue. The RPI-X type of price-cap regulation, first introduced in the U.K. in 1984, has allowed BT partially to rebalance its retail tariff structure. However, tariff restructuring has been restricted through an RPI+2 limitation on residential connection charges and line rentals, an obligation to offer low-user discounts and an RPI+5 limitation on multi-line business rentals.

5.1.12.2.3 Legal rights concerning interconnection

Interconnection is addressed in specific conditions of all PTO licences. These conditions, which provide a detailed and sometimes complicated framework for interconnection agreements, are in most respects similar. However, reflecting changes made after 1984, BT's Condition 13 is substantially longer than all the others and

42 The U.K. has no universal service fund for financing such obligations.

contains some items, such as Access Deficit Contributions (ADCs), that are conspicuously absent from the other licences.

BT's licence Conditions 13 establishes a duty for BT to enter into interconnection agreements with other telecommunications operators that wish to do so, provided they can demonstrate that their demands are reasonable. The principle behind the duty is that any customer of any licensed operator should be able to call any customer of any other licensed operator (the "any-to-any" principle). This establishes ex-ante regulation of a general right to interconnection by network operators. BT is not obliged to enter into an interconnection agreement if entering into such an agreement is impracticable to do, or could cause personal or property damage for BT, or would impair BT's network and service quality, or would require network adjustment or modification.

BT's licence specifies a fairly detailed set of terms and conditions to be covered by privately negotiated interconnection agreements.[43] However, interconnection agreements generally do not require regulatory approval.[44] In case no satisfactory agreement has been reached after a reasonable period of time either party can ask the DGT for a binding determination on specific points of disagreement. Also, the DGT can enforce interconnection agreements whether they are based on his determination or reached by voluntary agreement.

The conditions for regulatory involvement in interconnection is specified in about 13 pages in BT's licence. The DGT's powers of determination cover the same set of terms and conditions that are required to be covered by private interconnection agreements. The licence also specifies detailed criteria to be applied by the DGT in most cases. The criteria are particularly specific where they relate to provisions for the determination of interconnection charges covering the conveyance of messages ("conveyance charges"). Such charges include three elements. The first is the fully-allocated cost of conveyance calculated on a historic-cost basis, including a full contribution to relevant overheads. The DGT can decide which are the relevant BT overheads. The second element is the applicable rate of return to relevant capital employed. The third element is a contribution to BT's access deficit (an ADC). The ADC is probably the most controversial part of the licence. Although the licence contains a detailed specification of the procedures for calculating ADCs, the DGT has a fair amount of discretion in their application. In principle, the purpose of the ADC is to compensate for BT's access deficit, which results from regulatory restrictions on increases in residential and single line business rentals. The DGT has discretion to waive ADCs fully or partially within given parameters. The waiver may only apply to market shares of up to 10% for any interconnecting operator, and can only be applied to a market share of 15% for all operators. Only if an interconnector's market share exceeds 25% does the full ADC have to be paid by that interconnector. Also, for BT's financial years 1992 and 1993 the

43 Billing and charging are part of this list which, in a similar form, also holds for mobile operators.

44 However, the particulars of an agreement may have to be furnished to the Director General of Fair Trading, pursuant to the Restrictive Trade Practices Act 1976.

ADC could be lowered if BT did not achieve benchmark efficiency levels (using U.S. RBOC efficiency as a benchmark).

An equal access stipulation was included in BT's licence in 1991, but its realisation is still subject to a satisfactory cost-benefit analysis of its merits. Preselection by ballot is not under consideration. Currently, access through three digit carrier identification code and automatic number identification (blue button) is required and available. Collocation is currently not available but was stipulated by the DGT as part of an earlier agreement between BT and MCL. Condition 13 also specifies general principles on points of interconnection, while the actual points have been established either through private negotiations or through DGT determinations. The same is true for the quality of interconnection services.

In order to deal with interconnection standards, a Network Interfaces Co-ordination Committee (NICC) was initiated by OFTEL, in March 1993, as a consultative forum, in which operators, manufacturers and users can discuss standards and related technical issues associated with the introduction of more competition. The Committee consists of representatives of interest groups with observers from OFTEL, DTI and other bodies with a role in standards, such as BSI and BABT. The objective is to identify current and foreseen future needs for network interface standard and stimulate standards making where necessary. The Committee is also called on to advice the DGT on specific issues (e.g., number portability). For interconnect interfaces, the DGT may designate a standard as "essential" (i.e., mandated) though in practice this has not yet been deemed necessary. Standards must comply with European standards where available, but most interconnection standards are currently set by a sub-group of the NICC (the Interconnection Standards Committee), whose members are drawn from TOs and manufacturers.

To sum up, the provisions on regulatory determinations leave interconnection issues primarily to private negotiations between the parties involved.[45] The DGT only comes in when the negotiations fail. However, in practice the DGT's influence seems to dominate certain aspects of interconnection agreements.

5.1.12.2.4 Private negotiations

The operator licences provide for ex-ante regulation of all interconnection agreements, including commercially negotiated agreements or case-by-case determinations on specific issues. Starting late in 1993, interconnection agreements involving BT are publicly available. The agreement between British Telecommunications public limited company and NYNEX CableComms Bromley Limited (in the following we abbreviate the name for this agreement by B-N) is one of the first interconnection agreements fully

45 For example, interconnection charges paid to other parties than BT need not be cost-based.

in the public domain, and it is one that is almost entirely privately negotiated (except for DGT determinations on ADC waivers for both parts).

Compared to other long-term contracts, such as in international coal trade and ocean transportation of bulk cargo and oil, the B-N, in spite of its 154 pages, does not appear to be overly complicated or overly legalistic. This holds in particular, since telecommunications interconnection is a substantially more complex and less mature commodity/service than either coal or ocean transportation. We understand, however, that, even without a determination by the DGT, it took nearly two years for BT and NYNEX to reach the agreement. However, BT has sought to establish standard agreements with cable companies and is now well advanced in preparing a standard general agreement for all interconnecting operators.

Among the clauses of this agreement most likely to contain lessons for other European countries are the ones on information exchange and on equipment testing. In order to implement an interconnection agreement information has to be exchanged between the parties that is usually not made available by a firm to any outsider, let alone to a competitor. Clause 9 of the agreement describes the types of information to be exchanged and calls for strict separation of interconnection personnel from sales people (Chinese walls) inside the two organisations so that such sensitive information can only be used for purposes of the B-N.

Clause A14 on switch testing is asymmetric, requiring testing of NYNEX switches by BT in order to assure "that the respective Systems can interwork correctly and will not adversely affect the existing services provided by each System." Switches that have already been tested under similar circumstances only need a reduced level of testing. Intermediate level of testing is required for switches of a type that was successfully tested under different conditions of implementation. Full switch testing is required for switches that have not been successfully tested for the same type of interconnection.

Interconnection agreements between MCL and cable TV operators remain outside the public domain. MCL sees a natural alliance with cable operators. They own local loops all over the country, while MCL's network is predominantly long distance (except for London). Agreements between MCL and cable operators therefore include marketing and operating agreements. At least initially, MCL does a lot of the switching.

Between cable TV companies there is competition for the market rather than competition in the market. Cable TV companies are allowed to interconnect directly with each other and to have cooperative agreements.

5.1.12.2.5 Regulatory determinations

The 1986 BT-MCL agreement has been highly influential as a precedent for other agreements. Most of what we know about this agreement comes from the DGT's determination of terms and conditions of October 11, 1985. A very major emphasis of

the 1985 determination is on the timing of interconnection. This was one of MCL's main issues because it wanted to gain access to customers quickly while BT's interest appeared to have been in delaying interconnection. Given the lack of actual experience with implementing physical interconnection, a number of paragraphs in the determination specifically lay out exact time tables for interconnection and threaten consequences for nonadherence to the stipulated dates.

Interconnection prices, under the determination, were not specifically cost-based but rather were set to provide incentives for MCL to build a long-distance network. After their initial determination by OFTEL in 1985, BT interconnection charges for MCL have followed a RPI-3 formula. This was constructed like a price cap but without the rebalancing feature. In 1991 MCL was feeling the effect of a squeeze from increases in BT's interconnection charges relative to its retail prices, which had declined at a much faster rate than RPI-3. Under a specific review clause of the 1986 interconnection agreement, MCL asked the DGT for a determination with respect to interconnection charges, and, as a consequence, from 1990/91 onward, a new (unpublished) adjustment formula, based on BT's actual costs, was implemented.

The Duopoly Review in 1991 resulted in major changes of BT's and MCL's licences and in changed market conditions. Also, the price adjustment clause in the 1986 interconnection agreement had proved unworkable. In March 1992 BT and MCL therefore started negotiations for a new interconnection agreement. The negotiations stalled on call charges and connection payments, and the parties, in June 1992, agreed to ask the DGT for a determination on these issues. A determination by the DGT was published in December 1993. It covers, in particular, conveyance charges to be paid by MCL.

The calculations of conveyance charges are based on component costs and routing factors. Routing factors are derived statistically for each type of call (local, short and long national) based on samples that measure the use of the network. The routing factors represent average usage of each network element by each type of MCL interconnection segment.[46] Current conveyance charges for delivery of local calls amount to between 50% and 60% of BT's local retail tariffs (depending on whether MCL interconnects to local or to trunk exchanges).

ADCs which are paid in addition to conveyance charges are related to the profitability of the service in question. As a percentage of conveyance charges, they range from about 40% for local cheap period calls to about 100% for tandem national calls. The DGT, in his ADC calculations, had made comparisons between BT's and U.S. carriers' efficiency and had found that no adjustment to BT's ADC for 1991/92 was necessary on efficiency grounds. MCL receives an ADC waiver on the first 10% of its local, national

46 A 'segment' is that part of a call from the point where the call is received from a customer or handed over to a network to the point where the network hands the call on again or delivers it to the end user. An interconnected call can use one or more segments, and conveyance charges would be incurred accordingly.

and international market shares, including MCL calls routed over BT's system. The DGT justified the ADC waivers on the basis of the disadvantages of MCL relative to BT, in particular on the lack of number portability. Other factors, such as volume of calls per line and economies of scale, appear to balance each other, and were not invoked to justify the waivers.

5.1.12.2.6 Agreements involving mobile operators

Fixed-mobile interconnection agreements differ from fixed-fixed agreements by their emphasis on private circuits, which play a major role for mobile operators. The agreements provide special conditions for private circuits that deviate from standard price. These special conditions are restricted to the purposes of the interconnection agreement so that the mobile operator cannot, for example, resell private lines at a profit. Due to waivers, mobile carriers currently pay no ADCs to BT.

As far as we know, direct mobile to mobile interconnection currently exists only between Cellnet and Vodafone. It involves no payment of conveyance charges, unless call volumes differ markedly by direction of traffic.

5.1.12.3 Policy initiatives in the field of interconnection

5.1.12.3.1 OFTEL initiative on "Interconnection and Accounting Separation"

Following a consultative document and an intense discussion with the telecommunications industry, in March 1994, the DGT issued a Statement "Interconnection and Accounting Separation: The Next Steps", announcing a three-stage programme. The first stage, beginning immediately, uses the December 1993 BT/MCL determination as a basis for interim charges for interconnection with BT. The second stage envisages a list of standard interconnection charges, a more transparent process of relating costs to charges and accounting separation of BT-Network, BT-Access and BT-Retail. The third stage deals with issues "on which the substance and the timing of conclusions are uncertain".

The use of the BT/MCL determination in Stage 1 comes close to a standard price list by BT. What interconnectors other than MCL would have to do to arrive at their relevant interconnection charges is to adapt the MCL charges to their specific circumstances. The Statement therefore provides a "'Ready Reckoner', based on the costs determined for the BT/MCL determination, from which other operators will be able to estimate the costs they are likely to face in interconnecting with the BT network". What is particularly important is that the routing factors relevant for the conveyance charges are specific to each operator. Hence, routing factors have to be individually estimated. This presents problems for new licenses whose traffic patterns have yet to be established.

In Stage 2, OFTEL intends to proceed with accounting separation between BT-Retail, BT-Network and BT-Access. The purpose is.

- to allocate BT's costs in a way that reflects properly the division between BT's separated activities, and

- to demonstrate in published audited financial statements that BT's network and ADC charges have not resulted in unduly discriminatory behavior (or an unfair cross subsidy).

BT-Network account will include all services offered to interconnectors and to BT-Retail. BT-Access includes the costs and revenues of BT provision of connection, rental and other access services to the business and residential market. It will also show the ADCs received from BT-Retail and other operators, as well as any residual access deficit. BT-Retail will be separated into service categories. It will contain separate financial statements for regulated and non-regulated services (in order to demonstrate absence of cross subsidies flowing to non-regulated activities). The BT-Retail account will also demonstrate that BT charges itself the same conveyance charge as it charges other operators for equivalent services.

For the calculation of standard charges (for about 70 services) OFTEL wants to develop cost allocation principles, cost drivers and details for BT's transfer charging. The cost allocation methodology and transfer charging should conform to several principles which include activity based costing, appropriate statistical sampling techniques, year-to-year consistency, materiality[47], and equal treatment of BT-Retail and other operators.

The main longer term issues (Stage 3) include

- the cost base for interconnection charges. For example, forward-looking economic costs, a form of long-run incremental costs, are to be examined. OFTEL has observed that, if such concepts were to be adopted for interconnection costs and were fed through into interconnection charges, this would have an impact on BT's tariff structure and accounts, although the DGT has ruled out, on the information currently available to him, any early adjustment to BT's current price cap which is due to run until July 1997;

- charging structure for interconnection services. Alternatives to the standard "per minute" unit for charging conveyance charges are to be evaluated, particularly some form of capacity charging;

- the future of ADCs. ADCs reflect the fact that, under its current tariff structure, BT recovers many of its access costs through usage rather than standing charges. In

47 Materiality means a change in bases of allocation only if the effect of the change is likely to be material to the allocation of costs.

order for the ADC regime to be materially challenged, BT's ability to recover its access deficit, and hence the issues of whether BT should be allowed to rebalance its tariffs and the quantification of that *part* of its access deficit caused by the USO, would have to be considered; and

- the addition of new interconnection services.

The statement on Stage 3 is short and open ended, indicating that the DGT wants to keep the issues wide open at this point while at the same time starting an extensive discussion with the industry. This will be taken forward in a new consultation document to be issued in late 1994.

5.1.12.3.2 MCL's litigation on capacity-based pricing

A DGT determination cannot be appealed to the MMC. However, a declaratory ruling from a commercial court is possible. MCL's is the first such legal action in the U.K. against any regulator. MCL claims that the DGT has misinterpreted BT's licence Condition 13 regarding the costs of interconnection. MCL insists that only capacity costs can be used as the basis for "traffic sensitive" network costs and that the cost base should be incremental costs.

5.1.12.3.3 Standard interconnection agreements

As noted earlier, BT has designed a standard interconnection agreement. The agreement could facilitate the administration of interconnection and is BT's best defense against undue discrimination between other operators. For example, there are 130 cable TV companies that want interconnection agreements.

5.1.12.4 Conclusions: The state of the U.K. discussion

The U.K. interconnection area is currently the scene of great activity and wide-ranging discussions. The growth of new providers has produced the benefits of competition but has also led to inevitable strains on the regulatory process. Regulation has to take account of large numbers of participants with a diversity of interests. The U.K. discussion on interconnection currently concentrates on several key issues. They include:

(a) the amount of information about itself that the interconnecting parties (BT in particular) should provide each other and to the public and the transparency of the regulatory system;

(b) the speeding of the process of reaching interconnection agreements (including DGT determinations);

(c) the justification of, amount of and waivers for ADCs and the identification of the cost of the USO;

(d) the definition and utility of alternative costing procedures as a basis for interconnection charges;

(e) the definition of interconnection services, including the unbundling of components and the set of services to be offered.

(f) issues not directly related to costs and charges, such as quality of interconnect services, equal access, number portability and access to number information.

(g) The definition of "service providers" and the form of interconnection regimes that will best advance competition not only in services but also among infrastructure providers.

In addition, there are a number of important interconnection issues that fail to create protracted disputes involving the regulator. These include types of interconnection, technical aspects, network security/integrity, and interface standards.

Cost principles are seen as the most important element in interconnection agreements (interviews). Until now, the guiding principle has been fully-allocated historic costs. This is somewhat surprising, given the openness and economic sophistication with which OFTEL has otherwise addressed interconnection issues. BT may have been a constraining factor here. Current interconnect determinations by the DGT amount to rate-of-return regulation of interconnection charges. A price-cap approach to controlling them has been raised as a possibility. This would raise the question of its relationship to the retail price cap.

The other operators, in a January 11, 1994 meeting at OFTEL, had suggested a list of network components that they wanted separately tariffed rather than having to buy bundled services (OLIST). The OLIST was based on BT's existing network structure and consisted of five categories: (a) basic switching, (b) transport, (c) features and intelligence, (d) services (e.g., NIS databases, directory enquiries and operator assistance), and (e) access to (possibly proprietary) interconnect information.

Based on Baumol's efficient component pricing suggestion, OFTEL has developed the concept of ADCs and has tried to make them workable. This process has resulted in very complicated and uncertain decision making. The current practice of ADC waivers has an uncertain future, due to BT's loss of market share and due to the possible expiration of BT's restrictions on rebalancing of its tariffs. ADC waivers are an important incentive for new entrants. To gain them, they have to submit business plans to OFTEL. If BT's market share falls below 85%, waivers have to be removed from other operators in order to accommodate new entrants. This situation has already been reached in respect of international calls.

Equal access and number portability are among the most critical issues likely to be solved in the U.K. in the near future. At this time, after nearly ten years of interconnection, MCL has no equal access yet. Several suggestions are on the table. Local number portability can be achieved through rerouting (like call forwarding), call dropback (local databases) or IN (further into the future). NYNEX expects to double its penetration rates with number portability. It also expects a specific determination by the end of 1994 for BT-NYNEX on reciprocal number portability and it is confident that local number portability can actually be achieved by then.

The legal and regulatory framework provided by licences and the Act is very extensive and extremely specific. Whenever the circumstances change, they have to be changed, too. In spite of this specificity, OFTEL is a fairly small organisation, indicating that U.K. telecommunications regulation is fairly cheap to operate.

A remarkable feature of U.K. interconnection regulation is the central role of the DGT. The DGT has substantial authority in shaping the overall interconnection regime and specific interconnection agreements

While BT and some of the other operators may feel that interconnection issues are far too technical to be solved by an outside party (such as a regulator), OFTEL is usually called in or steps in only to resolve commercial issues. Technical issues are now largely left for industry representatives to resolve among themselves either through private negotiations or through the NICC or informal work groups arranged by the DGT. It turns out that the remaining controversial issues are mostly of a commercial or organisational nature that can well be adjudicated by a regulator.

The U.K. interconnection regime has evolved since it was first set up ten years ago. During this time, both the relevant licence conditions, interconnection agreements and the practice of interconnection have gone through substantial changes in detail. Many of these changes have been necessary to adapt the regulatory system to new technological and market developments. Any interconnection regime would have to be open to accomodate such changes. Other changes of the U.K. interconnection framework were due to institutional learning. The question is if such learning can at least in part be avoided by other countries, in which interconnection arrangements are only now beginning to emerge as an issue. In addition, the U.K. experience offers useful insights for other administrations of the complexity of issues that need to be addressed as competition is introduced in telecommunications network services.

5.2 Overseas countries

5.2.1 Australia

5.2.1.1 Introduction

Until a few years ago, the provision of telecommunications services in Australia took place within a traditional framework. The Australian Telecommunications Commission (ATC or Telecom) and the Overseas Telecommunications Commission (OTC) were the two (government) entities providing, respectively, domestic and international services. In addition there was Aussat, a provider of satellite services, which was created in 1981 as a government majority-owned public liability corporation. Liberalisation started in 1988 when as part of a general initiative aimed at modernising the country's large public enterprises the government's telecommunications enterprises and with them the whole telecommunications sector were restructured.

By 1994, the restructuring had involved passage of the Telecommunications Acts of 1989 and 1991, the introduction of a general policy of competition for the sector, creation of Austel as regulatory authority, creation of a duopoly market structure for fixed network services by the merger of Telecom/OTC (later named Telstra but still known to be Telecom) as incumbent and the selection of Optus as new competitor, licensing of Vodafone as a third cellular mobile operator, allowing service providers to operate under class licences, and, in sum, putting in place a regulatory framework aiming to guide the sector from a state of monopoly to one of effective competition by the end of the decade. At the present time, government and Austel are preparing for a review of their policies with a view of ending the duopoly environment by the year 1997.

5.2.1.2 The framework for interconnection

5.2.1.2.1 Current status of interconnection agreements

A key place in the development of the interconnection framework is taken by the Austel report on interconnection and equal access asked for by the government in November 1990 and submitted to it in June 1991. The report was to provide relevant information to the bidders for the second carrier licence. Austel carried out a thorough cost study for deriving interconnection charges and access charges on the basis of incremental costs. Points of interconnection (POIs) were determined and many of the technical aspects of physical interconnection specified. The report thus provided a comprehensive set of technical, financial and commercial conditions on which interconnection was to be accomplished between the incumbent and the entrant.

In November 1991, the government selected Optus, a newly created company held 51% by Australian interests and 24.5% each by Cable & Wireless and BellSouth, as the second carrier. At the same time, it was licensed as a general telecommunications carrier. Based on the conditions laid down in the June 1991 Austel report, interconnection between Optus and Telecom was arranged so that in April 1992 Optus was in a position to start operations. The formal interconnection agreement between the two carriers was concluded in August 1992.

In December 1992, a third GSM cellular mobile carrier was selected by the government and given a licence. Before this, the government had given assurances that the new carrier would be granted access to the Telecom and Optus networks on commercially-agreed terms. The interconnection agreement with Telecom was concluded in early 1994. There also exists an interconnection agreement between Vodafone and Optus.

Service providers do not have interconnection agreements. They have access to the carriers' networks, primarily that of Telstra, on conditions that in principle correspond to those offered end users. Telstra has, however, introduced a particular tariff, the National Connect Service tariff, that in some aspects approaches the terms of the existing interconnection agreements.

The current market structure thus comprises Telstra and Optus, both as full service operators, Vodafone as a third operator of GSM cellular mobile services, and more than 100 service providers of domestic and international services, most of them being resellers. Optus, the most important competitor, has primarily been active in the long-distance market and by the beginning of 1994 had captured shares in regional markets of between 15 % and 20 %.

5.2.1.2.2 The legal framework for interconnection

The Telecommunications Act of 1991 guarantees a carrier the right to interconnect with the networks and services of other carriers. This applies, however, only to carriers holding licences as either general telecommunications or public mobile services. The Act further specifies that interconnection should be offered on reasonable terms, that the right of interconnection extends to access to supplementary services, and that the responsible Minister may determine principles governing the calculation of charges relating to interconnection and access (he has done so; see the paragraph on the IRCP below). The Act also provides for the registration of interconnection agreements with Austel in order to exempt them from certain strictures of the Trade Practices Act. In carrying out registration Austel in fact expresses its approval of an interconnection agreement. Further, on registration interconnection agreements become part of the public domain except for sections classified as confidential.

Another important document relating to interconnection is the Telecommunications (Interconnection and Related Charging Principles, IRCP) Determination by the government issued in November 1991. It has essentially two purposes: to incorporate

Austel's determination on initial charges of June 1991 in a government directive, and to provide for a framework of negotiations between Telecom and Optus once the initial terms and conditions cease to apply due to implementation of equal access or due to predetermined market share thresholds that have been passed by the new carrier.

5.2.1.2.3 The reality of interconnection

The discussion below is based on the analysis of the Telstra/Optus interconnection agreement which also covers interconnection of Optus' GSM cellular mobile operations. There are also interconnection agreements entered into between Vodafone and either Telstra or Optus. Their most interesting sections, however, those pertaining to charges, are not in the public domain. The second set of agreements may differ from the Telstra/Optus agreement in as much as they were both negotiated commercially and have not benefited from a prior Austel determination.

5.2.1.2.4 Interconnection between Telstra and Optus

Current interconnection arrangements between Telstra and Optus still reflect to a large degree the determinations of the June 1991 Austel report. The two parties have meanwhile entered into negotiations with the aim of arriving at arrangements on a commercial basis.

The two basic entities of the Telstra/Optus interconnect structure are the POI and the inter-carrier charging area (ICCA). Within a particular ICCA, the same interconnection charges apply. The POI is the geographic point with respect to which the charges for originating and terminating access are determined. ICCAs have been based on Telstra's charging districts. There are 205 charging districts which are again subdivided into about 2000 charging zones. Optus has reportedly established POIs in 70 of the 205 ICCAs, all of them along the East, South and West Coasts of Australia. In Telstra's network, interconnection takes place at the level of trunk switches. Optus is able to install some transmission equipment on the Telsta's premises to connect its switching network to the Telstra gateway exchange.

Telstra's retail prices for local calls hold within a charging zone and between adjacent zones. A charging zone with its adjacent zones is a 'local calling area'. Within a local area calls are normally carried by Telstra, but callers may select their carrier (Optus or Telstra) for calls outside their local area. Having POIs in an ICCA, Optus can collect traffic from (or deliver to) parties within the ICCA at charges pertaining to this particular category of ICCA. If the call originates/terminates within the local calling area in which the POI has been established, a particular set of charges applies; if the calling/called party is outside the local calling area of the POI but within the same ICCA, an additional interconnect charge for carriage applies. These are the charges which are still at levels initially set by Austel and currently in the process of renegotiation. If the call leaves the ICCA, then Optus has to provide for carriage of the call over links that it either has

established itself or leased from Telstra at commercially negotiated charges (subject to the principles of the IRCP). Charges for supplementary services, e.g. directory and inquiry services, are also to be negotiated on a commercial basis.

The usage charges applicable within an ICCA consist of per minute components for switching, conveyance over the trunk network and use of the customer access network (CAN), and of a per call flagfall component. The charges differ according to the kind of ICCA (business district, metropolitan, rural) and the time of the day (peak, off-peak). The time dependent charges at either end (originating or terminating) during peak time average 3.14 cents per minute. This is less than 50 % of Telstra's end-user charge for a local call, which amounts to about 8 cents per minute. There is no explicit access charge included in the interconnection charges. The CAN charge, currently averaging to about 0.5 cent per minute, seems however to be related to an access charge.

As determined by Austel, Telstra is to provide Optus with equal access by offering customers the choice of 'preselecting' their provider of long-distance service. As an interim step, before being able to accommodate preselection, Telstra offers a prefix solution. Preselection facilities have been made available by Telstra ahead of schedule. In order to hasten decisions of users to select either Telstra or Optus as their supplier of long-distance calls, ballots were carried in a number of areas where preselection had been made available. In these ballots, between 10 % and 18 % selected Optus as their supplier.

The interconnection of Optus' GSM cellular mobile services with both Telstra's fixed network and Telstra's own GSM network is accomplished within the same interconnection agreement. In general, the Optus GSM and fixed networks interconnect with the PSTN of Telstra at the same POIs, and it appears that the same charges apply for originating and terminating services supplied by Telstra independently of whether calls relate to Optus' fixed or GSM network. This, however, cannot be said with certainty as the relevant sections of the GSM amendment is in the private domain. Also, the charges for the conveyance of calls via the respective GSM networks are covered in the undisclosed sections of the agreement.

5.2.1.2.5 Telstra's National Connect Service tariff

Telstra introduced this tariff in September 1992. Reportedly, the tariff was designed for the needs of AAPT, so far the most important new operator. Being a reseller and therefore not having the right to interconnection in the sense of the Telecommunications Act, AAPT had successfully lobbied with the Ministry of Communications for arrangements catering to its special requirements.

The service is described as a national access and egress service for service providers with large volumes of long-distance telephony telecommunications. Charges for the service consist of a charge for the establishment of the service, connection charges as well as annual charges for the required ISDN primary rate access nodes and

transmission links, as well as call usage charges. The charges are lower than end-user charges. However, they appear substantially higher than the comparable interconnection charges paid by Optus. As mentioned, AAPT is so far the only user of the service.

5.2.1.3 Special aspects and new developments

5.2.1.3.1 Austel-guided negotiations between Telstra and Optus for subsequent interconnection charges

We have discussed above the role and function of the initial interconnection charges set by the Austel report of June 1991. We have also pointed out that they would cease to apply with respect to the CAN charge whenever Optus customers have the opportunity to preselect Optus as their long-distance supplier; with respect to carriage and switching charges whenever Optus' market share equalled certain threshold values. By late 1993, preset preselection targets had been met by Telstra, and Telstra claimed that Optus had passed the market share thresholds in many of the relevant areas. Telstra thus requested that negotiations be opened with a view to replace, wherever the conditions were satisfied, initial (Austel determined) charges with so-called subsequent (commercially negotiated) charges. The ensuing negotiations were concluded in July 1994 and led to an increase in the average charge for interconnection within an ICCA from 3.14 to 3.5 cents. This increase of about 10 % is the algebraic sum of (a) a decrease of the charge for switching and conveyance from 2.62 to 2.2 cents (-16%) and (b) an increase of the CAN charge from 0.52 to 1.3 cents (150 %). A remarkable aspect of these negotiations is the role that Austel played in them which will be briefly presented in the following.

5.2.1.3.2 Provision of universal service

The Telecommunications Act of 1991 includes specific provisions for a universal service scheme. They aim at geographical areas, so-called net cost areas, for which all relevant revenues do not cover costs. The carrier serving an area designated a net cost area - which in all cases has so far been Telstra - is entitled to recover the deficit (net cost) from a universal service fund instituted for the purpose. All carriers contribute to the fund on the basis of their share in total timed traffic. The total net cost of the universal service obligation reportedly amounts to about 250 million Australian dollars annually. As Optus has by 1994 reached a share of about 15 % of total traffic, its contribution to the scheme is thus about 30 million dollars per year.

Note that this USO is not defined in terms of providing subsidised access to the local network which would call for an access charge. In fact, interconnection carriers are not required to pay an access charge to the incumbent. Despite its similarity with an access

charge, the CAN charge is supposed to be related to the actual attributable costs of using the local network.

5.2.1.3.3 Austel's new interconnect model

Austel so far has worked with two models of interconnection, an 'access interconnection model' and a 'symmetrical interconnection model'. The first model would apply to a situation where a local carrier provides access to a carrier offering long-distance service. The second model was thought to apply to situations where two networks existed side by side, each offering full service including access to local networks as well as local and long-distance calling. While in the former model the selection of the long-distance provider is a conscious decision of the caller, in the latter the cross-over into another network would happen without such a decision if the B-party just happened to be a customer of the other network.

Austel has for some time been dissatisfied with the two models as they seem to cover two specific cases and neither seems general enough to be able to cover other configurations. It has now presented the principles for a new model. The principles define general buyer/seller relationships among the producers of different components along the value chain of an end-to-end telecommunications service. It also defines the relationship of carriers and service providers (both considered to be Service Deliverers) with the customer, of which the one between the Prime Service Deliverer and its Contracting Customer is the most important. It is the relationship consciously decided upon by the customer. It exists for example in the case of a subscription for an exchange line, a preselection arrangement, or a contract for the provision of freephone service. When connections come about under such a contractual arrangement the other Service Deliverers that may be involved, and there may be several, would be defined as Supporting Service Deliverers (SSDs). Among the latter, Access Service Deliverers would take a special position as almost all services need originating access to be supplied by such a deliverer, and many also terminating access. Other SSDs would provide carriage and switching services for part of the way taken by a communication; these SSDs are referred to as Transit Service Deliverers.

Important consequences are expected to follow from the principles of the model. They would clarify the relationships between customers and users on the one hand and the deliverers of services on the other as well as interconnection and 'connect' relationships (see below) between carriers and service providers. Services with non-geographic numbering, in particular information services, could more easily be handled under the principles of the model. For services to be provided by service providers, the Austel endorsed process envisages

- a Service Definition Document in which the functional definition of the service as well as its place in the National Numbering Plan would be provided;

- a Network Interfaces Co-ordination Forum, encompassing suppliers, operators, users and others with an interest in the matter that would develop specifications for new or enhanced interfaces; and

- Commercial Negotiations Arrangements commensurate with those provided for in the Telecommunications Act for carrier interconnection relationships.

The model in particular also deals with the gap in the Telecommunications Act whereby service providers (SPs) are not entitled to interconnection that network carriers, for their part, are entitled to obtain from each other. In the model, SPs would be able to 'connect' with carriers and with other SPs, presumably on conditions that are to be overseen by the regulator but that would not necessarily correspond to conditions applying to carrier interconnection. For SPs, there would thus be 'Points of Connect' (instead of Points of Interconnection) providing more functionalities than normal end-user connections but fewer than provided by Points of Interconnection between carriers.

The model foreshadows the advent of a much more variegated market structure, especially after 1997 when the duopoly market structure is to be abandoned. It is specifically intended to assist in the development of a common perception of the issues of a Multi Service Deliverer Environment. In September 1994, the public consultation process before finalising Austel's report on the model was still under way.

5.2.1.4 Evaluation

Part of the Australian government's strategy had been to sell to the highest bidder the right to compete with Telecom in the telecommunications market. To enhance the prospect of favourable bids the government felt that it had to give bidders orientation with respect to the environment in which they would have to compete. Austel worked out in detail a framework of interconnection before the tender process was started. As regards future regulatory policy, many of the uncertainties that a market entrant would face were thus cleared away beforehand. It involved writing into law the right to interconnection and putting into place rules and charges applying to it. This strong regulatory action effectively opened the market and led quickly to vigorous competition.

Currently there is a clearly discernible movement towards giving the law of the market more leeway. The regulatory agency encourages market entrants and the incumbent to face each other as they would if genuine competitive conditions prevailed. The incentive for the parties concerned is the prospect of a successively reduced degree of regulatory intervention. The rationale on the part of the regulator is the desire to decrease the risk of bureaucratisation and in general have regulatory intervention reduced to a minimum level. This, however, is more an incentive and promise to the former incumbent than to the as yet only competitor in fixed-network services. With the development of its model for a Multi Service Deliverer Environment, Austel is also opting for a greater degree of competition in which deliberations in industry fora and

Austel-guided negotiations between carriers and service providers will assure workable competition and interworking of networks and interoperability of services.

Another important feature of the Australian policy and regulatory framework is the interplay between policy makers and regulatory agency. The policy makers work mainly through the legislative process while the regulatory agency can give directions to regulated firms and has the power to make determinations. In Australia, legislation and other statutes regarding telecommunications are much more specific with respect to the detailed facets of the sector's operations than, for example, in the UK and the US. The regulatory agency's function is to assure that the policies promulgated through legislation and other statutes are implemented. Although there seem to have been some skirmishes on the proper division of labour between the two agencies, the advantage of the arrangement is seen in the more neutral role that the regulatory agency can assume in the policy implementation process. It can more easily take the stance of an honest broker applying a set of regulations that are concretely prescribed in the law. It can act as a facilitator in negotiations more easily than would be the case if it had the power to make decisions of a wider latitude.

5.2.2 Japan

5.2.2.1 Introduction

Since April 1985 all segments of the telecommunications market in Japan have been open to competition. The former monopoly provider of most telecommunications services, NTT, now is facing competition in all market segments. The Telecommunications Business Law of 1985 permitted so called New Common Carriers (NCCs) to provide all types of telecommunications services in any geographical area. The Ministry of Posts and Telecommunications (MPT), the regulatory authority in Japan, however, did not develop a free entry approach in its licensing policy. It strongly managed competition, mainly by structuring the market into various segments and by limiting entry in these segments.

For regulatory purposes the law distinguishes two types of telecommunications carriers. Type I carriers set up their own transmission network and offer their services (wholly or partly) on the basis of their own transmission facilities. Type I common carriers include NCCs specialising in long-distance, local, mobile, international, and satellite service. Type II carriers do not rely on their own physical network infrastructure but offer their services on the basis of transmission capabilities which they lease from Type I carriers. Most of the Type II carriers are offering services which are normally called value-added services, but they also can and do provide voice telephony services. All Type I carriers have to get a licence from the MPT, before they can enter the market.

The new regulatory structure in Japan, furthermore, has set up an asymmetric regulatory regime. The dominant firm, NTT, is heavily regulated in most of its activities while its competitors are significantly less or in practice not at all regulated.

5.2.2.2 Status of interconnection agreements and market structure

In one or the other way there are interconnection agreements between a variety of the 75 new Type I carriers which have entered the market in the last decade. Economically most important as well as most critical in the telecommunications policy debate have been the interconnection agreements between NTT and the three NCCs which offer national long-distance fixed telecommuncations services. These companies are challenging NTT in the voice telephony and the leased line markets. Currently, there is no substantial competition in the local or regional market. Most of the regional carriers are electric utilities which make use of their existing network infrastructure. Their business opportunities currently are restricted by regulatory decisions. They can, for instance, not act as competitive access providers and connect customers directly to the long-distance NCCs for switched voice telephony offerings. Such type of interconnection only is allowed for leased line services. Furthermore, the regional carriers are not yet allowed to interconnect their regional networks to form a nationwide network infrastructure. This restriction currently is under review. Many observers expect the electric utilities to become a major competitor to NTT if they get the right to interconnect their regional networks and to act as competitive access providers to the long-distance NCCs. A regulatory decision on this issue is intended within the framework of the general telecommunications policy review in 1995. The first cable companies also have obtained the right to offer telecommunications services, but they are not yet active in the market.

The market position of the NCCs in the long-distance market is much more challenging for NTT. Although the overall market share of all NCCs in the telephone service still is low, they were able to improve their position within three years from 3.1% in 1989 to 7.8% in 1992. These figures still underestimate the position of the NCCs. They concentrate their activities on long-distance. In this market segment they are more successful in some lucrative areas with highly concentrated route traffic patterns. In the most interesting areas between Tokyo, Aichi and Osaka, the NCCs' market share already amounts to more than 54%. The market for inter-prefecture calls makes the principal area of competition between NTT and the three NCCs and can be identified as long-distance. Their market share of this market was 26.8% for the year ended March 31, 1993.

5.2.2.3 Regulatory framework for interconnection

The Telecommunications Business Law generally assumes that Type I carriers agree commercially on interconnection or facility sharing. Before entering into an agreement with other carriers on interconnection they have to obtain authorisation from the MPT. Where negotiations between or among carriers fail to take place or to result in an agreement, the MPT can, at the request of a concerned party, order them to enter into such an agreement if interconnection is necessary and appropriate to promote the public interest. Furthermore, where negotiations fail with regard to conditions and prices, the MPT may even act as an arbitrator. Type I carriers are obliged to provide interconnection. Therefore, implicitly there is a right to interconnect for new competitors. The legal provisions seem to limit the role of the regulator to an arbitrator. In the regulatory practice, however, MPT as the regulator has played a much more active role. MPT set the basic framework for interconnection and had a strong position in determining interconnect charges, including access charges.

5.2.2.4 Interconnection to the telephone network

Interconnection in Japan started for the first years of competition with a regime which was not regarded as convenient for customers, NTT and the new competitors. Users could reach the NCCs' long-distance network by dialing a 4-digit access code on a per-call selection basis. The users and not the competitors had to pay standard telephone tariffs to reach an originating and terminating point of interconnection (POI) of the new competitors. In most cases these „interconnection charges" were in effect local telephone tariffs.

In that regime, the new entrants were handicapped in so far as they could not set end-to-end call charges. They could only charge their customers for their own network part of the connection. NTT on the other hand claimed that local calling tariffs were subsidised and that competitors were not contributing to NTT's local access deficit.

The main problem in the Japanese environment came from the distorted price structure in voice telephony and the regulatory impediments to NTT's rebalancing of prices for local and long-distance services. Unlike the UK and partly the US situation, local tariffs are more or less frozen by the MPT. British Telecom could more than double local calling tariffs before competition became effective and could even significantly increase rental charges. NTT still has to subsidise local and some other voice telephony services from its high profits in long-distance traffic. The NCCs, on the other hand, initially concentrated their business activities on the most lucrative parts of the long-distance business and challenged the profit capabilities of NTT in these market segments. Furthermore, they did not contribute to meeting the local services' deficit of NTT by paying access charges but used this service at a subsidised price.

It is obvious that this situation could not be stable over a longer period, in particular if the NCCs were able to increase their market share significantly. Sooner or later NTT as

a corporation would face negative implications for its financial viability. This is one of the reasons why the original system came under pressure directly after it was introduced, even though it stayed unchanged for about eight years before it was finally adapted.

As a reaction to the problems of interconnection and tariff distortions, in autumn 1991 the Japanese MPT formulated new regulations concerning interconnection by long-distance carriers to NTT's local exchange networks. The new interconnection rules go hand-in-hand with an organisational restructuring of NTT. In April 1992, NTT divided its network operation groups on request by MPT into one nation-wide "Long-Distance Communications Sector" and eleven "Regional Communications Sectors". The new interconnection rules will be implemented in 1994 together with the introduction of a new exchange concept. Beginning in 1994 a Local Access Transport Area concept will be applied to the Japanese prefecture administrative areas, a system similar to the US LATA regions. Altogether the country is divided into 54 prefectures. These new local exchange areas will be much larger than the current ones. In the new structure one point of interconnection in each prefecture will be established where NTT's and the NCCs' long-distance networks will be interconnected to NTT's local networks.

The process for revising the old interconnection regime started in August 1991 with the issuance of some regulatory guidelines by the MPT. The major principles set by the regulatory authority have been the following:

- one POI per prefecture;
- interconnection charges should be cost based and cost covering;
- interconnection charges should be uniform nationwide;
- interconnection charges should be based on cost information provided by NTT;
- the NCCs should obtain the right to set end-to-end customer charges.

Initially, it was the intention of the MPT to include local access loss contributions into the interconnection charges to compensate NTT for costs for connecting customers to the local switch which were not covered by connection and rental charges. After lengthy discussions with NTT, the MPT changed its mind with regard to local access loss contributions. In the end it preferred more of a first-best oriented price-rebalancing approach: NTT shall get the freedom to rebalance its tariff structure such that no need or no basis for local access loss contributions exists anymore. The only exception was made for directory assistance service charges. Given the huge deficit in this service, no cost covering price arrangement was regarded as suitable.

To obtain a more favourable arrangement for information and data services, NTT had to provide a breakdown of revenues and expenses for each telephone service. The MPT set rules on how to calculate these profit and loss statements. According to these figures losses occurred with exchange access, public telephones and directory

assistance. The losses in directory assistance were higher than even the local access loss in absolute terms. These figures have convinced the MPT that cost covering connection and rental charges are justifiable and necessary.

The overall structure of interconnection charges corresponds to a two-part tariff. The basis for the fixed monthly charge is the costs for interconnecting gateway switches and the modification or remodelling costs of local and toll switches to take care of interconnection. These costs now have to be covered totally by the NCCs and are calculated individually for each NCC according to the capacity it requests. Therefore, there is an element of capacity-based pricing in the interconnection charge structure.

The major part of the interconnection charges are paid for by the conveyance of calls from (or to) the POI to (or from) the subscriber or public phone. Uniform interconnection charges have to be paid per 3 minute for each originating and terminating end of a call. Interconnection charges in the new structure are differentiated according to three types of access to the network: (ordinary) subscriber phones, public payphones and ISDN access. The charging differences should represent cost differences. The price difference for ISDN calls amounts to about four times the level of calls from ordinary phones.

The access charge component in the interconnection charges is intended to contribute to the directory assistance loss and will also be collected in proportion to traffic volume on a per-minute basis.

Interconnection charges are renegotiated year by year. There is no price-cap type rule-oriented approach to bring the real tariff level down over time. The carriers have to negotiate on the basis of profit and loss statements provided by NTT for the various service elements. These results are controlled by the MPT as well as new interconnection charges.

NTT Long-Distance has to pay its Regional Divisions the same interconnection charges as the NCCs. Because they are not (yet) different companies, the charging mechanisms are realised by the way of internal transfer prices by the accounting system which means a "virtual" payment system. Technically, interconnection for NTT is realised in a different way than for the NCCs. The NTT Long-Distance network is not separated by POIs from the intra-prefecture networks. These networks are much more integrated. This means that NTT Long-Distance is burdened with interconnection charges which are higher than the corresponding costs of the actual network interconnection within the NTT network. This transfer price mechanism transfers the (cost) benefits of NTT Long-Distance interconnection to the Regional Division of NTT and, of course, to its users.

With the exception of the directory assistance contribution, interconnection charges are now structured overall in a cost-based manner. Parallel to the new interconnect charging regime, NTT made an attempt to rebalance, namely to increase tariffs for the

loss making telephone services. Although originally intended for overall political reasons the tariff increases were not accepted and were postponed.

5.2.2.5 Equal access

The revision of the interconnection regime in 1993/94 did not include a step in the direction of equal access. Customers still have to dial a 4-digit access code when they want to reach one of the NCCs. There is no institutionalised process in which customers can preselect a long-distance carrier. Most of the residential customers use this way of getting access. Most of the business users get access to the NCCs in a different way. Normally, the NCCs provide business users with so-called least cost routing adapters. They are installed at the customer premises and automatically route long-distance calls to one of the NCCs.

It is interesting to observe that in Japan the positions towards equal access have changed over time and now appear to differ from preferences in the rest of the world. It is no longer the competitors who are requesting equal access, but NTT (and the regulator) which want to go into that direction. The competitors are reluctant to change and seem to be satisfied with the current situation. They have the feeling that they can get much more customer loyalty under the current arrangements. The competitors fear that they might lose customers if an institutionalised preselection process were organised by the regulator.

5.2.2.6 Equal access for service providers and intelligent network issues

Service providers - or Type II carriers as they are called in Japan - lease private lines and other telecommunications services from Type I carriers and have developed their own network using those leased facilities. The most important services to be provided in competition to NTT are voice message storage, packet-switching data transmission, facsimile communications, videotex, and other information services. Since there is competition in the provision of leased line service between NTT and NCCs, service providers are (at least to some extent) protected against anticompetitive behaviour regarding the provision of leased lines by NTT.

If the service providers need access to the exchange lines between customer premises and the wire center, they are, however, in the same position as the NCCs; they have to rely on services which are provided by NTT in a de facto monopoly position. NTT, on the other hand, provides all services including local access and does not depend on other carriers in the provision of its services. The same issues of securing fair and effective competition between NTT and Type II carriers in the provision of value-added services arises as in other parts of the world.

Up to now, the MPT as the regulatory authority has not dealt too much with the issue of fair competition and equal access for service providers. There are some rules against

cross-subsidisation by Type I carriers and required accounting rules to identify revenues and expenses of value-added services. The value-added service sector of a Type I carrier has to report its own separate financial statement and has to purchase its network facilities from its basic service sector on a tariffed basis.

Furthermore, the MPT is relying on further network digitisation, SS7 and intelligent network elements as efficient means for Type I carriers to provide adequate network services and functions to service providers. It is also up to now relying on NTT to fulfill the request to implement necessary measures to ensure equal access with regard to network services and functions.

The MPT is currently reviewing its open network policy and is identifying potential shortcomings in the existing policy framework. In particular, it is considering broadening the opening of NTT's network to accommodate the specific needs of Type I carriers. Furthermore, the MPT is not satisfied with the rules and outcomes of the process in which NTT and its competitors interact. NTT just responds to requests from Type II carriers, and is not required to react to these specific requests. Therefore, stricter rules or stronger regulatory involvement and decision making are under consideration.

5.2.2.7 Evaluation

Competition in Japan started in an environment where the incumbent's tariff structure was quite unbalanced. Local tariffs and some other telephone services were not cost covering. The regulator, however, did not give NTT the flexibility to rebalance tariffs. On the other hand, access charges were not introduced to share the burden of regulatory constraints. This initial policy approach was not too consistent. It caused significant financial pressure on NTT and strong pressure to improve productivity. The policy approach might have induced some degree of inefficient entry. The initial interconnect regime thus was not beneficial for entrants, NTT or end users.

The policy approach towards interconnection has become more rational in the last two years. The structure of interconnection charges has now become more cost based. For pricing the more first-best policy approach of rebalancing was chosen, with access-charge contributions explicitly excluded from that process.

The Japanese interconnect policy has not yet stabilised. Several issues still have to be addressed properly. The lack of equal access and presubscription has not yet stabilised the market structure. The same effect results from several restrictions which market entrants still are facing. Competitive access provision or bypass is not yet allowed. Long-distance carriers cannot properly interconnect with local or regional carriers. For these reasons, Japanese interconnect policy will develop further over the next few years and will soon change several of its characteristic features.

5.2.3 New Zealand

5.2.3.1 Introduction

Deregulation of the New Zealand telecommunications sector started in 1987 with the separation of the telecommunications activities from the Post Office and its incorporation in the Telecom Corporation of New Zealand (Telecom). The Telecommunications Act of 1988 then completely deregulated the sector. From 1989 on, anybody can enter the market, establish and operate telecommunications networks, build own facilities or interconnect with other carriers. Two additional regulatory measures were passed, the Telecommunications (International Services) Regulations Act of 1989, to protect against interference from dominant carriers abroad, and the Telecommunications (Disclosure) Act of 1990, to provide for transparence of certain operations of the incumbent carrier. No specific regulatory authority has been set up to oversee the sector. This oversight is left to the application of competition law by the Commerce Commission and the courts.

Since the time the deregulation process started, Telecom has been sold to a consortium led by the US carriers Ameritech and Bell Atlantic and two competitors for network services have entered the market, Clear as fixed network operator and BellSouth New Zealand as a GSM network operator, as well as a number of service providers and resellers. There is now vigorous competition, but with the question of interconnection having emerged as the central issue.

5.2.3.2 The framework for interconnection

5.2.3.2.1 Current status of interconnection agreements

When in 1991 Clear entered the market, it started with offering long-distance services. The necessary interconnection agreement with Telecom had to be negotiated on purely commercial terms and was concluded in March 1991. The agreement provides for Clear to obtain originating and terminating access to customers that are connected to the PSTN via Telecom's local networks. Clear has so far no direct interconnection with Telecom's cellular mobile services. There are negotiations in process which have not yet come to a conclusion.

Soon after starting to offer long-distance services, Clear also announced plans to offer direct connections to business customers and the possibility to make local calls over these lines. For this it requested a different type of interconnection from Telecom than it had negotiated for its long-distance offerings. The two parties have been unable to reach agreement on this matter, and in August 1991 Clear took the case to court with the allegation that Telecom was abusing its dominant market position and attempting to keep Clear from entering the market. Although, in the meantime, Clear has started to

offer long-distance service, the case has not yet been finally decided, having currently been referred to the Privy Council in London.

There has also been an interconnection agreement signed between BellSouth New Zealand and Telecom which took effect in March 1993. Besides granting BellSouth access to Telecom subscribers, it also provides for Telecom to carry out billing and collection function for it. The agreement has been concluded for a term of three years after which it may be renegotiated. Like Clear, as of March 1994 BellSouth had no direct interconnection with Telecom's cellular mobile operations.

There is little information on arrangements between the carriers and service providers and resellers not having their own networks, all these arrangements not being in the public domain.

5.2.3.2.2 The legal framework for interconnection

Given the policy of the government, to treat telecommunications no differently than other sectors, specific legislation is kept to a minimum. In particular, there is no reference to interconnection in the Telecommunciations Act of 1990.

The basis for interconnection is an undertaking by the chief executive of Telecom New Zealand in 1989 that interconnection will be provided to market entrants on a fair and reasonable basis. The undertaking is backed by strong ministerial statements to the effect that government expects this undertaking to be honoured. Given that anybody can freely enter the market, no licences are issued that would contain rules and/or prescriptions with respect to market behavior in general and interconnection in particular.

The Commerce Act of 1986 is the primary statutory instrument through which conditions of effective competition are secured. The Act is particularly relevant to conditions in the telecommunications sector in that it provides for the possibility of price control (Part IV) and prohibits abusive trade practices (Part II). Price control appears to have been an acceptable government instrument in the years prior to 1985 but is currently not being used. With respect to telecommunications services it is the government's policy not to introduce price controls. As regards restrictive trade practices, the Act prohibits collusive arrangements between competitors and the use of dominant market position for the purpose of restricting, preventing or deterring entry or eliminating a supplier from the market. When in 1991 Clear brought before the High Court its case on local interconnection, it alleged that Telecom was in breach of this prescription (Section 36). The Ministry of Commerce administers the Commerce Act relying on the Commerce Commission as its enforcement agency. The Commission has the primary function to act as a sort of prosecutor but its powers seem in fact to be limited. When in 1992 it sought to evaluate the state of competition in the telecommunications market in order to determine whether there was a need for it to

intervene, a court action was initiated by Telecom in which it was found that the Commission had overstepped its authority when carrying out this investigation.

There is a universal service obligation (USO) placed on Telecom. When the government sold the company it retained a golden share in the company, the so-called Kiwi share. This share gives it special rights which it used to enter a special provision into the company's articles of association that aim at maintaining certain service standards. The provision specifies that the local free calling option will be maintained for residential customers, the residential line rental will not increase in real terms (i.e., it will rise nominally with inflation only), rural line rentals be no higher than the standard rental, and ordinary telephone service will continue to be as widely available as in 1990.

5.2.3.3 The reality of interconnection

5.2.3.3.1 Interconnection between Clear and Telecom

The agreement lists 15 locations at which interconnection can take place. A point of interconnection (POI) is defined as a point within a local network with reference to which interconnect charges apply. Physical interconnection takes place at Telecom's trunkside level with the interface being located on the premises of Clear. The agreement requires Clear to strictly comply with Telecom's technical standards. Any additional features requested by Clear are subject to negotiations and would call for extra charges.

In general, interconnect charges paid by Clear correspond to Telecom's retail prices as they applied in 1989. There is one important difference in that the charge for local access (originating or terminating) is lower than the retail tariff for a local call. The charge amounts with 3 cents per minute, or 85% of the retail price of 3.55 cents per minute. For automatic number identification (ANI) that Clear needs to be able to bill its customers it must pay Telecom 4 cents for each ANI requested. Clear is entitled to a 6% rebate provided total purchases per annum exceed 15 million NZ dollar. This rebate must, however, be contrasted with tariff packages offered large business customers by Telecom that reportedly provide for rebates of up to 27 %.

Clear obtained equal access facilities from Telecom (in the form of preselection) only after long drawn-out negotiations. Clear claimed that Telecom wanted to install 'a gold-plated type' of equal access and was asking too high charges for its implementation. The difficulties were finally resolved in an arbitration to which the two parties had agreed to submit. Until the availability of equal access, customers must use a two-digit carrier identification code if they want Clear to carry their calls. Clear must rely on its marketing efforts to induce customers to preselect it as their long-distance carrier as there was no government sponsored ballot by which customers were asked to express their preference.

Also under litigation has been the request by Clear for additional POIs. Clear wants them to be able to carry long-distance calls close to their destinations. For the provision of these extra POIs Telecom has asked charges that at least in part compensate it for the loss of business and margins associated with Clear carrying more traffic via its own network. These negotiations came to a conclusion in March 1994. The charges for local access passing through these additional POIs are 3.5 cents per minute at the peak higher than the corresponding charge of 3 cents for traffic over the POIs covered in the interconnection agreement.

The question of contributions by Clear to the costs of Telecom's universal service obligation (USO) was not addressed in this interconnection agreement which gives Clear access to customers for the purpose of long-distance calls. It is, however, the central issue in Clear's local interconnection case currently in litigation before the courts (see Section 5.2.3.4.1). The stance taken by Telecom in response to Clear's request for additional POIs has largely been influenced by the policy Telecom has developed in that court case. By mid-1994, an agreement on these issues had been reached on terms whereby, for non-code access, clear pays Telecom 1.8 million NZ dollars for up-front investment and 11 dollars for each customer that is using it.

5.2.3.3.2 Interconnection between BellSouth and Telecom

In most respects, the interconnection agreement between BellSouth and Telecom contains terms and conditions that correspond to those contained in the Clear/Telecom agreement. The agreement lists 17 locations at which interconnection can take place; as of March 1994, BellSouth had been using three of them.

BellSouth generally also pays charges that correspond to Telecom's retail prices; as regards charges for local access, however, they have actually been higher than the corresponding retail price for the first two years of operations and will equal that price starting in 1995. BellSouth also pays a 7.5 cents per minute so-called commercial charge as the price for services rendered by Telecom for the billing and collection of charges for calls from its fixed network to the BellSouth network. The agreement contains a statement, not contained in the Clear/Telecom agreement, to the effect that charges payable by BellSouth to Telecom are calculated in a way that they also cover an adequate contribution by BellSouth to the costs of Telecom's PSTN. At the agreement's renewal time, the amount of the contribution will be reviewed with reference to the then established pricing principles on the basis of the court decision in the Clear vs. Telecom local access litigation.

5.2.3.4 Special aspects and new developments

5.2.3.4.1 The dispute between Telecom and Clear regarding local interconnection

As regards Clear's plans to offer local calling to its directly connected customers, Telecom is on record that it is prepared to provide Clear the requisite interconnection at the local exchange level. The parties have, however, so far been unable to agree on the commercial terms at which it is to be provided and after several months of unsuccessful negotiations Clear brought the case before the High Court claiming that Telecom breached the Commerce Act and was using its dominant market position with the intent to prevent Clear's entry into the local telephone market. In its judgement of December 1992, the Court found Telecom abusing its dominant market position. However, in an important subsidiary decision it vindicated the Telecom position and in so doing ruled that Clear would be required to pay for interconnection according to the Baumol-Willig rule (ECPR), because Telecom had based the application on its unconstrained monopoly prices rather than on Ramsey efficient prices. Clear's appeal was sustained by the Court of Appeal by its decison of December 1993. It rejected as inappropriate the application of the Baumol-Willig rule. Furthermore it found, in contrast to the High Court, that as a package Telecom's terms for interconnection were more onerous than would have been supported by a competitive market, that they were not justified and that insistence on them was use of dominant market position. The Court declined to give specific advice on how the terms should be determined, however, and referred to the broad principle that they should correspond to what would be recoverable in a competitive market. At the time of this writing, the case is being appealed to the Privy Council in London where it is still pending.

5.2.3.4.2 An initiative by Clear

Clear has addressed the Ministry of Commerce as well as the interested public with an initiative which aims at prodding the government towards a more active role in guiding competition in the telecommunications sector. Its position is that the government should provide clear direction in terms of a set of rules within which the market players must operate. It would not be enough for the judiciary applying general competition law to be the arbiter of all disputes. As had been found out, the judiciary would not be timely in its decisions nor would it seem to be able to use the powers which it has in an effective manner. The judiciary itself would require further direction as to what is required of it.

Government should provide for clear prescriptions on issues such as pricing, collocation, bundling of services, equal access, numbering, dispute resolution procedures, penalties, and technical standards. Most of the issues addressed by Clear are familiar from other environments where they have been dealt with in terms of arguments that are very similar to those used by Clear. The emphasis placed on

dispute resolution procedures is specific to the New Zealand environment.[48] It reflects the absence of an industry specific regulatory machinery. It also reflects the position taken by Clear that such a regime can be made to function successfully. Clear is on record that a regulatory regime like the one in the UK or the USA is too expensive, cumbersome and bureaucratic to be a desirable option. Clear's position certainly reflects an aversion to regulation, perhaps also the conviction that once established Clear might find it easier to come to terms with a dominant competitor than with a regulator that keeps pushing for still more competiton.

5.2.3.5 Evaluation

New Zealand is the only country where a heretofore monopolistic telecommunications sector was liberalised completely, as it were, with one stroke of the pen. No regulatory machinery was put in place to manage the transition to competition, let alone stand ready to guide competition also at a later, more developed stage. For this process almost exclusive reliance is placed on general competition law and the institutions that in general enforce its provisions.

In all discussions surrounding the restructuring of the sector since 1987, there has hardly been any recognition of the effects of economies of scale and scope, of sunk costs or the existence of barriers to entry. The incumbent's advantages stemming from its past privileged position have been admitted but they have apparently been taken relatively lightly. Ignoring or implicitly denying the importance of these technological and structural aspects, government does not see the need to institute explicit sector regulation to help to establish competition. In contrast, it associates with a regulatory machinery substantial burdens in terms of bureaucracy and possibly ill-informed decisions. An observer more familiar with the environment where regulation is the norm might wonder whether the possibility that there might be more scope for government policy to structure the process has been given all the attention it deserves. One might want to ask whether in opting for this general approach the government has weighed sufficiently the economic cost of the litigation it implies as against the cost of regulatory intervention.

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48 There is in New Zealand an active discussion going on about alternative dispute resolution processes. Spokesmen of government as well as of the new competitors are taking part in this discussion. Representatives of incumbent Telecom have also expressed a preference for this kind of proceedings. As orally reported to the author, there has been the successful application of a court-supervised arbitration proceeding regarding the provision by Telecom to Clear of non-code (equal) access for the latter's long-distance service. Generally, this kind of arbitration involves the following. The contending parties entrust the exchange of sensitive information to their legal representatives who in turn call in experts (technical, economic, management, accounting, as the case may require) to evaluate on the basis of this information the parties' respective claims. Legal advisers and experts are then in a position to relay to their clients an assessment of the soundness and probability of success of the claims. The legal representatives as well as the experts are bound to confidentiality by the court overseeing the arbitration process.

A judgement on New Zealand's radical approach depends on the frame of reference within which one makes the evaluation. New Zealand policy makers consider it a success. They point to price decreases, the modernisation programme of Telecom, Telecom's performance in comparison with operators abroad, the success of new market entrants, the emergence of new services, success of New Zealand technology abroad, and more. If these achievements correspond to their expectations then they are consistent with their assessment.

But there is the other side of the coin. Telecom is still by far the dominant market player. There are strong indications that it accords its competitors interconnection on terms that are less than fair and reasonable. Agreements that market entrants need with the incumbent require negotations that are long drawn-out and costly, in particular for the newcomers. Telecom has been found on several occasions to be abusing its dominant market position in attempting to prevent entry or restrict development of services. In the end one should expect that some sort of tight oligopoly situation will evolve. Whether it will be as competitive and to the benefit of consumers as possible may be strongly doubted.

5.2.4 USA

5.2.4.1 Introduction

The US study is more complicated than the other country studies because US telecommunications policy is subject to complex and sometimes conflicting tripartite authority. Provision of local telephone service is regulated in each US state by a state Public Utilities Commission (PUC). At the same time the Federal Communications Commission (FCC) exercises national jurisdiction over radio-based service and interstate services. In addition, the antitrust laws deal with issues of market power. As the prime example, antitrust proceedings in federal court govern the divestiture of AT&T and set limits and conditions on AT&T (the largest interexchange carrier) and the regional Bell Operating Companies (AT&T's former local exchange carriers).

The general principle behind the division of labour between state and federal regulation in the US is the distinction between "intrastate" and "interstate" commerce. Following this principle, state regulation is responsible for intrastate commerce and federal regulation for interstate commerce. Consequently, a single regulated firm may be regulated by a state PUC for its intrastate transactions and by the FCC for its interstate transactions. Since transactions and the use of capital equipment and other common cost elements can rarely be classified as purely interstate or intrastate, the division of labour between state and federal regulation is frequently complex and contentious. It is guided by some principles, the main one being that of federal preemption, according to which the FCC can declare that federal regulation supersedes state regulation if interstate telecommunications are materially affected. In areas where dual regulation

occurs, costs are separated into federal and state jurisdictions, using a fully-allocated cost methodology.

Since interconnection affects both interstate and intrastate telecommunications, it is regulated on both levels, sometimes with conflicting outcomes. In particular, the same type of interconnection service can be priced differently, depending on whether interstate or intrastate access is being purchased. State commissions are taking diverse approaches to issues of interconnection and local exchange competition. A few urban states, such as New York and Illinois, have been the first jurisdictions to require local interconnection for special access and are actively deliberating policies for competition in basic telephone service. Most, however, have to date kept local markets closed to entry.

5.2.4.2 Common topics

5.2.4.2.2 Market structure

The US telephone network was vertically dis-integrated by the 1982 divestiture of AT&T into an interexchange carrier and seven regional Bell Operating Companies that provide local and short-haul trunk services. The interexchange market is judged moderately competitive, with three large national carriers and dozens of smaller ones and many resellers. Local exchange markets for business customers are experiencing competitive entry in large urban areas, but most markets remain monopolies. All urban markets have two mobile carriers; a third is beginning service in a few large cities.

5.2.4.2.3 Interconnection arrangements and equal access

Interexchange carriers interconnect with local carriers for access to final consumers. Equal-access arrangements, required by the competition policy that split up AT&T, have been fully realised. During the period when switches were upgraded carriers with inferior access quality received substantial discounts on access charges. There is no direct interconnection between interexchange carriers; instead, traffic may by arrangement be rerouted at an interconnecting local carrier.

Under federal regulation, mobile carriers are entitled to any of several technical arrangements for interconnection to local networks. The mobile subsidiaries of Bell Operating Companies are, by court (but not regulatory) decision, required to provide equal access to interexchange carriers. In contrast, the competing mobile carriers do not offer equal access to their customers and instead negotiate bulk tariffs with a single long-haul carrier.

Other local access carriers - competitive access providers and cable television operators - have negotiated interconnection with local exchange carriers in a few states, encouraged by state regulators.

5.2.4.2.4 Public access to interconnection agreements

Generally speaking, interconnection arrangements subject to federal regulation are public information. Interexchange carriers purchase access to final users from local exchange carriers under published tariffs. Service providers purchase access services and intelligent network service elements under tariff. The availability of the terms of negotiated interconnection arrangements under state jurisdiction varies.

5.2.4.2.5 Interconnection charges and cost standards

Local carriers collect revenues from subscribers and from interexchange carriers for access to interstate telephone services. About two-thirds of the fixed costs of local plant that are allocated to the interstate jurisdiction are paid by end users in monthly common line charges, and the balance is collected from interexchange carriers in per-minute charges. Traffic-sensitive access charges for conveyance of switched traffic to interexchange carriers are levied for switching, common transport, and dedicated transport. The charges of the major local carriers were originally established using jurisdictionally-separated, fully-allocated costs. More recently, interconnection charges have been subject to price caps and may have moved away from those cost standards.

5.2.4.2.6 Relation to local tariffs

Interconnection access charges collected from interexchange carriers for interstate service average 4 cents per minute.[49] This compares with an average charge for local calling of about 9 cents per minute in cities where local calling is priced per call.

5.2.4.2.7 Regulatory approval

Most types of interconnection arrangements have been reached as an outcome of regulatory or antitrust court proceedings. Consequently, the major terms of interconnection have regulatory approval. Carriers may file tariffs and charges for individual services within the frameworks established by these proceedings, and in the case of price-cap regulation charges may vary within established ranges. In addition, voluntarily negotiated arrangements are possible and have been responsible for leading examples of interconnection of other access providers in local networks.

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49 When a call both originated and terminates over local exchange carrier access facilities, total per-minute access charges are approximately 8 cents.

5.2.4.3 Special topics

5.2.4.3.1 Interconnection pricing

In the US an important distinction in pricing and regulatory treatment is made between so-called special access and switched access. *Special access* is essentially a private line (non-switched) arrangement in which circuits are dedicated to a particular user for the distance between the customer's premises and the LEC end office. Between the LEC end office and the IXC POP traffic from a special access customer may be carried on a common line with traffic from other special access customers. Special access is sold on a per-circuit basis for unlimited usage up to the capacity of the circuit.

In *switched access* a LEC switch transfers traffic between local loops and interoffice circuits to an IXC POP. In contrast to special access switched access is, for the most part, priced by minutes of use. From a LEC's point of view, special access retains the long-distance business of large customers. From the IXC's point of view, it allows partial bypass when no direct line is warranted from the customer all the way to the POP. Because of its close relationship to facilities-based bypass the charges for special access contain no or only a minimal contribution element to the LEC's deficit from local services. In contrast, switched access tariffs are a large source of cross subsidies.

In the last two years both special access and switched access tariffs have been unbundled and switched access tariffs have become more cost-based, although the contribution element has been retained for the time being. Before the change, carrier common line tariffs for switched transport had been under an "equal charge per unit rule" and under a distance-equalising "five mile rule" that were imposed in 1983 as a result of AT&T's divestiture. Both were an effort to even out access costs for AT&T and its competitors, giving AT&T less of a scale advantage from more traffic and less of a location advantage from the multitude and LEC-proximity of its POPs.

Switched transport charges, in 1993, were unbundled into four components. The first two components - (a) for dedicated transport between the IXC POP and its designated LEC central office and (b) between that office and the end office serving the customer - are priced according to circuit capacity with limited discount for higher capacity lines. The third component is shared tandem-switched transport that is priced per minute of use and is subsidised. This is the component most likely to be used by small IXCs who do not have enough traffic to lease dedicated lines between LEC end offices. The fourth component is the residual interconnection charge. It has to be paid for all switched IXC traffic that interconnects through LECs. The residual interconnection charge has been priced to make the change from the equal charge rule to the new charge structure revenue neutral. The FCC also has allowed the LECs to introduce more distance sensitivity than was allowed under the "five mile rule" and some density-related pricing of switched access. The change in access charges over time is governed by price-cap rules for the large LECs, but restructuring among the different charge components is severely limited. The FCC has an ongoing proceeding to

determine a long-run charge structure that is likely to track actual LEC costs more closely than the current one.

5.2.4.3.2 Collocation

One of the most significant developments on interconnection in the US have been the regulatory decisions on collocation taken at the federal and state levels. Two approaches have been put forward. First, under physical collocation, the interconnector extends its existing network into the LEC's central office and establishes a "node" - a location at which its network circuits terminate. This is placed in rented space together with both terminating and other equipment (e.g., multiplexers) owned or leased by the interconnector in the LEC's central office. Circuits terminating at the node are cross-connected to LEC facilites and each party remains responsible for maintaining and upgrading its equipment. Under the second approach - virtual collocation - the interconnection point lies outside the LEC's central office, typically in a nearby manhole to which the LEC extends its network. The interconnection equipment in the LEC central office may be specified and leased by the interconnector but it remains owned by the LEC.

Experience with (privately negotiated) virtual collocation in Illinois was favourable, while in New York one interconnector complained about protracted proceedings on virtual collocation and the arrangement with the other ended with physical collocation, due to difficulties in reaching a satisfactory agreement on virtual collocation. The FCC, in its decisions on expanded interconnection for special access in October 1992 and on switched access in June 1993, required physical collocation, unless the parties voluntarily agree otherwise or are specially exempted. Such exemptions could be given for lack of space or facilites, or if state regulation on virtual collocation was in place by a certain date. Due to legal problems, the FCC ruling on physical collocation was repealed in July 1994 and replaced by virtual collocation. Nevertheless, physical collocation has been realised in many cases and is likely to remain of great practical importance.

5.2.4.3.3. Open Network Architecture (ONA)

US regulators have tried several policies intended to create conditions of equal competition between local exchange carriers and information service providers. Early rulings attempted to split carrier lines of business into telecommunications and computer/information services and required carriers to offer information services through separate subsidiaries. This policy was reversed in 1986-88. Carriers were allowed to integrate information services into other network activities provided they adopted an open network architecture that made basic network access and information service elements available on an unbundled and non-discriminatory basis to other information service providers.

The goal of full unbundling has not been realised in practice. Access arrangements, in particular, continue to combine elements of local transport, switch port, and telephone numbering. A considerable variety of switch-based serving elements, such as automatic number identification and line hunting, are more generally available, but they are not supplied uniformly across all seven geographic regions of the US. High costs of more thorough-going unbundling and limited demand for service elements have also limited the effect of ONA to date.

Development of standards for interconnection between service providers and carriers is facilitated by the Information Industry Liaison Committee that meets regularly to develop and publish information and standards when specific services and types of access are requested of carriers.

In addition to ordering unbundling of service elements, the regulator has instituted several additional requirements. Carriers must offer services of their operations support systems, including service order entry, trouble reporting, and network reconfiguration, to information service providers. Carriers may not discriminate between such providers and other customers in supplying installation and maintenance, and must report performance statistics. And, carriers must establish protective systems for customer proprietary network information that ensure that carriers do not obtain and use information concerning service providers' customers for competitive advantage.

Pricing of ONA services has not been standardised. Regional Bell Operating Companies have variously adopted marginal and fully-distributed cost methodologies, resulting in some large differences in prices for technically similar services in different geographic areas.

5.2.4.3.4 Intelligent Network (IN)

Experience with interconnection to intelligent network services in the US has developed in the markets for freephone services and credit-card calling, driven by carriers competing to offer regional and national services. Federal regulators have required interexchange carriers and regional carriers to offer 800-number freephone service through national, centrally-administered databases, prescribed to promote competition and remove the first-mover advantage AT&T possessed as the primary supplier of freephone numbers. When each 800-number call is dialed, a database is first queried over interconnected signalling networks to determine the responsible carrier, and the call is routed to that carrier for further processing. The database-routing technology thus enables a subscriber to change to a different carrier yet retain a specific freephone number and the value it may have developed in advertising the number to its customers.

The early, ambitious designs of intelligent networks for local call processing have been scaled back as the costs and complexities of managing interactions became clear. Local carriers are nevertheless introducing and upgrading their networks in more

incremental fashion, driven to be less dependent on switch vendors for new features and call processing capabilities.

Federal regulators have sought to extend the principle of open network architecture to the services and components of a future intelligent network. The FCC's inquiry is seeking greatly unbundled access to network signalling, databases, and call-processing intelligence for all types of providers and end users. To date, discussion has focused on the extent to which these objectives can be made compatible with protection of network security and reliability and realising economies of scope of the primary network operator.

The concept of "mediated access" is intended to specify interfaces at which different carriers and users can interconnect to intelligent network components and have access messages validated for compatibility. One form of mediation would place the primary carrier in a gatekeeper role, with access by external users through the carrier's operations and support system software. More far-reaching proposals would expand the intelligent components that are directly accessible and establish the carrier's point of mediation at the core of the essential operating system for the basic call processing switch.

Several local carriers are beginning to test third-party access to service creation and management systems and to offer read-only access to service databases. Attachment of third-party databases to carriers' intelligent networks is also anticipated. In contrast, real-time access to switching-level functions is likely to require much more thorough development of mediation and network-protection mechanisms.

Discussion of intelligent network access and feature development has been successfully assisted by interindustry technical working groups. These voluntary bodies, composed of interested industry and regulatory participants, meet regularly to identify user demands, define requirements, and establish industry standards.

5.2.4.4 Conclusion

Vertical dis-integration created a huge market for interconnection of US telephone carriers. US regulators and courts have used network and service provider interconnection as a tool to actively encourage the development of competition in the telecommunications sector. Equal access, network unbundling and collocation were implemented to achieve this objective. Tariff rebalancing is occurring, but more slowly than the federal regulator had proposed. Interconnection revenues for switched access were used to finance the unbalanced tariff structure. Dual regulation has accelerated the adoption of expanded interconnection but has stood in the way of uniform standards for an open network architecture. The US experience shows that interconnection is loaded with issues of market power, pricing, and negotiation impasses that require regulatory action.

5.3 Cross country comparison

5.3.1 Facts about interconnection in country studies compared

5.3.1.1 Different stages of evolution

The presentation of the country study results in Sections 5.1 and 5.2 brings out the different levels of experience with interconnection of the 16 countries considered. It is useful to classify the countries correspondingly, especially also as a backdrop for the comparisons on the various issues that follow.

Basing our ranking on an overall evaluation of the experience gained by the various countries, we classify them as follows:

Much experience:	USA, UK
Some experience:	Japan, Australia, New Zealand
Little experience:	France, Germany, Denmark, Portugal, Greece
No actual experience:	Belgium, Ireland, Italy, Luxembourg, The Netherlands, Spain

The USA and the UK take a position apart as interconnection has in the two countries been part of the telecommunications markets for ten years or more and has undergone steady further development. As regards Japan, although interconnection has been a fact there for almost as long, the development in this country has stagnated and only lately have there been adjustments and the regime been put on a sound basis. In contrast, while the introduction in Australia and New Zealand of competition and therefore of interconnection dates to only three to four years ago, developments in these two countries have been so sweeping that by now some considerable experience has been gained. This justifies grouping them together with Japan in the 'some experience' category. The five countries in the 'little experience' category have been placed there as their experience has been limited to interconnection of mobile operations. None of the six countries in the last category have so far had any actual experience in the matter although there are preparations going on in most of them.

The above discussion is reflected in Table 5.3.1.1-1. It shows for each country the realised status of interconnection for the relevant kinds of interconnection relationships (the countries are grouped according to above classification and the groups are set off from each other by differing shadings.)

Table 5.3.1.1-1: Status of interconnection in 16 countries

Interconnection / Country	Fixed/Fixed				Fixed/Mobile	Mobile/Mobile	Intelligent Network
	TO/TO	TO/Cable Operator	TO/CAP	TO/Service Provider (Special Network Access)			
United States	I	P	I	I	I	I	P/I
United Kingdom	I	I	I	I?	I	I	P
Japan	I	P	N	P	I	I	P
Australia	I	N	N	I	I	I	P
New Zealand	I	N	N	?	I	P	N
France	N	P	N	I	I	I	N
Germany	N	N	N	P	I	P	P
Denmark	N	N	N	?	I	N	N
Portugal	N	N	N	N	I	N	N
Greece	N	N	N	N	I	I	N
Belgium	N	N	N	P	P*	N	N
Ireland	N	N	N	N	P	N	N
Italy	N	N	N	N	P	N	N
Luxembourg	N	N	N	N	N	N	N
Netherlands	P	P	?	N	P	?	N
Spain	N	N	N	P	P	P?	N

I Implemented

P In preparation

N Not under consideration

* Agreement between TO and its subsidiary supplying mobile services

For the US and the UK we note that they have interconnection actually realised or at least in preparation for each of the kinds of relationships considered. This indeed reflects the already very variegated structure of suppliers of telecommunications services in these two countries, not only in respect of services for end users but also of intermediate product type services such as from competitive access providers. The US is the only country that so far has had any experience regarding interconnection with intelligent networks.

The second group of countries - Japan, Australia, New Zealand - differs from the first primarily because of the few positive entries regarding interconnection in the 'fixed/fixed' categories concerning interconnection between TOs and cable operators, TOs and CAPs, TOs and service providers. The lack of positive entries for service providers, however, is also a consequence of the fuzziness of the term 'interconnection' as applied to service providers. Their use of the network is in many instances not identified as interconnection.

The countries in the third group - France, Germany, Denmark, Portugal, Greece - have in common that they all have competition in mobile communications and therefore corresponding interconnection arrangements but no fixed network competition. Since

there is no competition in the fixed network there is also no related interconnection (with some minor exception in the case of France). For all these countries, changes in relevant national legislation would have to occur before competition to the incumbent in basic telephone service could be possible. As will become apparent below, although their experience with interconnection is still limited, they also contribute important insights regarding the terms and functioning of interconnection arrangements.

The last group of countries - Belgium, Ireland, Italy, Luxembourg, the Netherlands, Spain - have so far not had any actual interconnection experience on which one could draw. In all but one of them, there are currently active preparations for at least the introduction of mobile competition with attendant attention to interconnection. In the Netherlands, the introduction of competition also in the fixed infrastructure is under consideration and the corresponding conditions of interconnection are under active study.

The following discussion concentrates on countries with actual interconnection arrangements in place. In the discussion on equal access (Section 5.3.1.4), the focus is on the five countries where there is fixed network competition and corresponding interconnection, for which equal access is an issue.

5.3.1.2 Regulatory involvement instrumental in bringing about interconnection in most countries

We need not dwell on the fact that whenever a telecommunications market is liberalised and there are competitors to the incumbent, the newcomers seek interconnection with the established network, otherwise they would hardly be able to start business in a meaningful way. Of interest is, however, what action was considered necessary to bring about interconnection in the relevant cases. The evidence from the ten countries where there have been interconnection arrangements is shown in Table 5.3.1.2-1.

Table 5.3.1.2-1: Approaches to the realisation of interconnection

Country	Approach	Regulation			Competition law	Commercial agreement (no regulatory involvement)
		Ex ante	Mediation/ Arbitration	Case-by-case determination (ex post)		
United States	F/F	Y	Y	Y	Y	Y
	F/M	Y	?	N	Y	N
	M/M	N	N	N	?	Y
UK	F/F	Y	N	Y	N	Y
	F/M	Y	N	Y	N	Y
	M/M	N	N	N	N	Y
Japan	F/F	Y	Y	N	N	N
	F/M	Y	Y	N	N	N
	M/M	N	N	N	N	Y?
Australia	F/F	Y	Y	Y	N	N
	F/M	Y	Y	Y	N	N
	M/M	N	N	N	N	Y
New Zealand	F/F	N	N	N	Y	Y
	F/M	N	N	N	N	Y
France	F/M	Y	N	Y	N	N
Germany	F/M	Y	N	Y	N	N
Denmark	F/M	N	Y	N	N	N
Portugal	F/M	Y	N	N	N	N
Greece	F/M	Y	Y	N	N	N
	M/M	N	N	N	N	Y

Y Yes
N No

The terms used in the table have the following meaning:

- *Ex ante:* The regulator determined essential aspects of interconnection beforehand. (In the following section it is referred to as EAR.)

- *Mediation/Arbitration:* The regulator stood by as a mediator - and possibly intervened as an arbitrator if things did not move ahead - but in essence the parties negotiated interconnection on their own. (MA)

- *Case-by-case determination (ex post):* The regulator intervened in the specific case after negotiations failed. (EPD)

- *Competition law:* There was no involvement of a regulatory agency but application of competition law brought about interconnection. (CL)

- *Commercial agreement (no regulatory involvement)*: The parties negotiated interconnection completely on their own. There was no involvement of a regulatory authority nor the need for judicial action to enforce competition law. (CA)

We leave the detailed examination of the many entries in the table to the reader. Some summary observations, however, are of particular interest. Ex-ante determination by the regulator was used in four countries with respect to interconnection between fixed networks and in eight countries with respect to fixed/mobile interconnection. This does

not preclude that in some of the same countries the other approaches have been used as well, i.e., with respect to other cases. In fact, in the US all five categories identified above have been applied in at least one case. (This again testifies to the particularly diverse competitive environment in this country). We observe that mediation/arbitration has been used in three countries with respect to fixed/fixed and in four countries with respect to fixed/mobile interconnection. With seven occurrences we also note a relatively frequent occurrence of case-by-case determination (ex post) by the regulator. Thus, for fixed/fixed and fixed/mobile interconnection, regulatory intervention of some kind can be regarded as the predominant influence in bringing about the required arrangements.

This is different in the cases of mobile/mobile interconnection. The five such cases that we observed are the outcome of purely commercial negotiations. It should be realised, however, that they have less impact on the development of competition than the ones involving fixed networks.

New Zealand is the one important exception in the sense that, as we remember from the country study, it is the only country where as a matter of explicit government policy interconnection is left to negotiations between the parties subject only, if negotiations fail, to competition law as applied by the courts. As shown in the table, agreements have in fact been reached there just by way of negotiations but there have also been cases that were brought before the courts.

5.3.1.3 Ex-ante regulation also predominantly applied to individual interconnection issues

Besides asking by what kind of regulatory action interconnection was brought about in general, it is of interest to ask by what kinds of different approaches the individual issues surrounding interconnection have been handled. Tables 5.3.1.3-1 and 5.3.1.3-2 address this question, the first one for the cases of fixed/fixed interconnection in respect of nine issues and the second for the cases of fixed/mobile interconnection with respect to eight issues. Table 5.3.1.3-3 provides summary statistics (percentages apply each time to total number of occurrences which is greater than the number of cells because of double and triple entries).

Table 5.3.1.3-1: Approaches to various interconnection issues (fixed/fixed)

Country / Issue	Right to interconnect	Points of interconnection	Quality of service	Principles for interconnection charges	Interconnection charges	Numbering	Standards	Billing and charging
United States	EAR/CL	EAR/CL	EAR/CL	EAR/CA	EAR/CL	EAR	CA/MA?	CA/EAR	EAR/CA
United Kingdom	EAR	EAR	EAR/EPD/CA	EAR/CA	EAR	CA/EPD	EAR	MA	EPD/NA*
Japan	EAR	MA	EAR	CA	EAR	MA	EAR	CA	NA
Australia	EAR	EAR	EAR/CA/MA	CA	EAR	EAR/CA/MA	EAR	CA	EAR?
New Zealand	CL	CA/CL	CA/CL	CA	CL	CA/CL	CA/MA/CL	CA	NA

EAR Ex-ante regulation
MA Meditation/Arbitration
EPD Ex-post determination
CL Competition law
CA Commercial agreement (no regulatory involvement)
NA Not available

* Collocation was part of OFTEL's determination regarding Mercury's interconnection in 1985. In the 1993 determination, collocation has not been addressed, and it is currently not used.

Table 5.3.1.3-2: Approaches to various interconnection issues (fixed/mobile)

	Right to interconnect	Points of interconnection	Quality of service	Principles for interconnection charges	Interconnection Charges	Numbering	Standards	Billing and Charging
United States	EAR/CL	EAR/CL	MA/CA	EAR/CA	EAR/CA	CA/MA	CA/EAR?	?
United Kingdom	EAR	EAR/CA	EAR/CA	EAR	CA/EPD	EAR	MA	CA
Japan	EAR	EAR	CA	CA	CA	EAR	CA	CA
Australia	EAR	EAR?	CA	EAR	CA	EAR	CA	CA?
New Zealand	CL	CA/CL	CA	CL	CA/CL	MA	CA	CA
France	EAR	EAR/CA	EAR/CA	EAR	CA/EPD	MA	EAR	CA
Germany	EAR	EAR/CA	CA	EAR	EPD	EAR	CA	CA
Denmark	EAR	CA	CA	NA	CA	EAR	EAR	CA
Portugal	EAR	EAR	EAR	EAR	EAR/MA	EAR	CA	EAR/CA
Greece	EAR	MA	MA	EAR	EAR	EAR	EAR	EAR

EAR Ex-ante regulation
MA Meditation/Arbitration
EPD Ex-post determination
CL Competition law
CA Commercial agreement (no regulatory involvement)
NA Not applicable

Table 5.3.1.3-3: Frequency of use of different approaches

	Fixed/Fixed (%)	Fixed/Mobile (%)
EAR	39	44
CA	30	39
CL	15	6
MA	11	8
EPD	5	3

We observe that ex-ante regulatory intervention (EAR) is by far the most frequent approach - for 'fixed/fixed' it applies in 39 % and for 'fixed/mobile' in 44 % of cases (where we have not bothered to eliminate from the total numbers the entries for New Zealand where the EAR approach is ruled out as a matter of principle). The next most

frequent approach is the one by commercial arrangement (CA) with 30 % respectively 39 %. The application of commercial law (CL) is with 15 % for the fixed/fixed cases of some importance (primarily because of New Zealand). The approach relying on mediation/arbitration (MA) has, with 11 % and 9 %, some importance, while ex-post determinations (EPD) occured in only a few cases.

The issues to which EAR appears most often to be applied to are:

for fixed/fixed and fixed/mobile:	right to interconnection, points of interconnection, and principles for interconnection charges;
for fixed/fixed in addition:	equal access; and
for fixed/mobile in addition:	numbering;

while the issues for which CA is most often observed are:

for fixed/fixed and fixed/mobile:	quality of service and standards; and
for fixed/mobile in addition:	billing and charging.

Of some interest is that EAR applies to issues of standardisation in four out of the ten fixed/mobile cases (because of GSM) but only once in the five fixed/fixed cases. Here predominant reliance is placed on commercial arrangements.

Finally, we look at the frequency with which the different countries rely on the EAR approach for dealing with the various interconnection issues. The US, the UK and Australia apply it in the majority of cases while Japan, somewhat surprisingly, appears to use it relatively infrequently. Remarkable is that in two of the countries with so far less experience in interconnection matters, i.e., Portugal and Greece, the EAR approach has been applied to the majority of issues, to six and seven respectively out of the eight considered.

5.3.1.4 Equal access as a question of costs and benefits in different environments

Equal access has been considered an essential concept in all five countries with fixed network competition. As a regulatory concept, equal access is defined from the customer's point of view. Concerning the predominant interconnection case, that of access to the local network, equal access gives customers the opportunity to use without any bias ('equally') the trunk carrier of their choice. The choice of trunk carrier may be made call-by-call, on a more permanent basis or by a combination of the two. Besides these general aspects of customer choice, equal access requires the same type of access, the same quality and the same price.

The practice of interconnection so far shows that access to the existing telephone network has at the beginning been provided in a different way than under equal terms described above. This resulted from the fact that traditional telephone networks have not been designed for a multi-carrier environment. Equal access cannot be incorporated into an existing network without costs and transition periods. Therefore, a decision has to be reached that the benefits outweigh the costs. Reaching such a decision may take time. And there is the need for a transition period during which networks are conditioned to meet the requirement.

Table 5.3.1.4-1: Equal access

	Timing				
	Competition introduced	Regulatory requirement of Equal Access	Realisation period	Arrangement prior to Equal Access	Preselection by ballot
United States	~1974	1982	1984-88	CIC/PIC	Yes
United Kingdom	~1983	1991	1995-	CIC/ANI/ Blue Button	No
Japan	1985	1990	1994-97	CIC/PIC/ANI	Open
Australia	1992	1991	1992-1995	CIC/ANI	Yes
New Zealand	1989	NA*	1994-	CIC/ANI	No

NA* Not Applicable. Equal Access was outcome of negotiations, finally decided through arbitration under court supervision.
CIC Carrier identification code
PIC Personal identification code
ANI Automatic number identification

Table 5.3.1.4-1 shows the time paths taken by the implementation process for equal access in the five countries. In three countries - the US, the UK and Japan - it was more than five years after opening of the market before regulators required that the incumbent(s) provide equal access. In the US, it was actually ordered by the Modified Final Judgment which divested AT&T in 1984. It then took several more years for the implementation actually to get under way. Consider, in contrast, Australia, where the new entrant was assured equal access as part of entry conditions and where the incumbent was given inducements to provide it quickly, which then also happened. The most revealing contrast is provided by New Zealand where implementation of equal access was gotten under way five years after opening of the market and only three years after the competitor started business. This case demonstrates that equal access is valued by the competitor more than the price paid for it, in this case a price arrived at by negotiations without the benefit of regulatory intervention (although it required arbitration by an independent industry arbitrator).

Interconnection practice at the beginning of network competition allows for several forms of 'unequal access' with more or less inconvenience to the customer and more or less competitive disadvantage to the new entrants. Table 5.3.1.4-1 shows that in the five countries the most common approach has been the use of a carrier identification code (CIC) in combination with a personal identification code (PIC) or automatic

number identification (ANI). The inconvenience of unequal access has in the UK for Mercury customers partially been compensated on the terminal equipment side. Mercury customers usually use a Mercury telephone handset where they simply have to press the 'blue button' and only need to dial the normal telephone number for making phone calls. The handset compensates the inconvenience of dialing the CIC and the PIC. This solution comes close to equal access from the customer's point of view. From the carrier's point of view, this evaluation depends on the question who has to pay for the added equipment costs of this type of access.

5.3.1.5 Different approaches to finance USOs

Table 5.3.1.5-1 has been constructed to throw some light on the relationship between universal service obligations (USOs), a universal service fund (USF), and access charges.[50]

Table 5.3.1.5-1: Universal Service Obligations and Access Charges

Country	Universal Service Obligation			Universal Service Fund	Access Charges			
	Tariff Structure		Other		fixed/fixed		fixed/mobile	
	In balance?	Rebalancing?	USO		explicit	implicit	explicit	implicit
United States	N	Y	Y	Y	Y	Y	N	N*
United Kingdom	N	Y	Y	N	Y	N	Y**	N
Japan	N	Y	Y	N	Y	N	N	N
Australia	N	Y	Y	Y	N	Y	N	?
New Zealand	Y?	Y?	Y	N	Open	N	N	Y
France	N	Y	Y	N	NA	NA	Y	N
Germany	N	Y?	Y	N	NA	NA	N	Y
Denmark	Y	N	Y	N	NA	NA	N	N
Portugal	N	Y	Y	N	NA	NA	N	N
Greece	N	Y?	Y	N	NA	NA	N	?

NA Not applicable
Y Yes
N No
* Possibly in some states
** In principle, but currently waived

We observe from the table that for all ten countries regulation imposes USOs on carriers. They consist either of the requirement to cross subsidise particular services through an unbalanced tariff structure or to fulfill some other obligations. Only Denmark has a balanced tariff structure.

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50 By USF we mean an approach of funding USOs that does not involve access charges and obtains all its financing from other sources.

A USF exists in two countries, US and Australia. In these countries access charges have, however, also been imposed so that competitors contribute to the cost of USOs. In other words, the USF is not considered to be sufficient to cover all relevant costs. It should be noted, however, that an alternative to access charges is in place in these countries that would at least in principle allow that USOs be completely financed by this route.

As regards access charges independent of the existence of a USF, we note that they are in use in all countries with fixed network competition or are at least under consideration. We make the distinction between explicit and implicit use of this instrument. In Australia the regulator would insist that there is no access charge; the existence of the Australian CAN charge element in interconnection charges is, in our view, the implicit imposition of such a charge under a different name.

Only in three of the ten countries are mobile network operators required to actually pay an access charge component; in two of them it is implicitly included in the interconnection charge. The most interesting instance of this is in the German case where the very method of computing the interconnection charge assured that the access charge was included without even making reference to it (see Section 5.3.1.8). Access charges as an explicit measure for mobile operators exist in the UK but are currently waived. Therefore, according to a recent decision in an arbitration proceeding, France is the only country where mobile operators actually have to pay an explicit access charge.

5.3.1.6 Public accessibility of interconnection agreements

The issue of transparency of interconnection agreements appears to be handled differently according to whether there is fixed network or only mobile network competition. As we observe in Table 5.3.1.6-1, in four of the countries with fixed/fixed interconnection there is public access to at least the regulated part of interconnection agreements. The exception is Japan where only the regulator has access to the agreements. In the countries with only fixed/mobile interconnection, in four cases only the regulator has access to the agreements while in one case, Portugal, the regulated parts of agreements are open to public scrutiny.

Table 5.3.1.6-1: Access to interconnection agreements

Country	None	Only to NRA	Public access	
			only to regulated part	full access
United States			X	
United Kingdom			X	X
Japan		X		
Australia				X*
New Zealand				X*
France		X**		
Germany		X		
Denmark		X		
Portugal			X	
Greece	X***	X***		

* Except certain parts declared confidential

** The regulator may give access to certain parts of the agreements to interested operators.

*** The regulator has access to the fixed/mobile but not to the mobile/mobile interconnection agreements.

The following are some observations on approach and practice in the various countries:

- In the US, all interconnection agreements subject to regulatory review are on file with the relevant regulatory commissions and are open to the public. This is in agreement with the general approach to matters of regulation in this country. Nowhere else in the world are data on regulated firms to the degree open to public scrutiny, and in particular to the scrutiny of competitors, as in the US.

- In Australia, the policy appears to be related to requirements of the Trade Practices Act. Interconnection agreements in Australia can only be signed between operators of telecommunications networks with a particular licence. These agreements violate certain stipulations in the Act on non-discrimination, which therefore have to be waived to some extent. Opening such agreements to the public permits everybody interested to verify that the waiver has been applied correctly.

- In New Zealand, publication of interconnection agreements is required for the express purpose of helping to prevent collusion between the parties to network interconnection. This requirement is one of the very few specific requirements placed on telecommunications network operators.

- In the UK, the regulator has recently instituted the policy of making it mandatory to publish all new interconnection agreements that involve the dominant TO. The explicit intention is to allow every interested party to verify what interconnection terms any other party is getting and to ensure thereby that no undue preferences are given.

- In France, interconnection agreements are on file with the regulator. The regulator is explicitly held to intervene if the agreements contain conditions that are against the public interest. Furthermore, he may give access to certain parts of the agreements to interested operators, especially when these operators have applied for licences.

- There has so far been no explicit policy statement on whether interconnection agreements belong to the private or public domain in Germany. It may be that, if Mannesmann and Telekom had been able to reach agreement on interconnection without the involvement of the regulator, as the licence actually presupposes, these terms would not have been made public. As it turned out, the charges determined by the regulator were ultimately published, precisely to inform potential bidders for another mobile licence about the interconnection terms on which to base their calculations.

5.3.1.7 Evolving cost standards

There is a regulatory requirement regarding the use of a particular cost methodology in four of the five countries with fixed network competition. The exception is New Zealand. In the countries that so far have only mobile network competition, three - France, Germany and Portugal - have a similar requirement. This is shown in Table 5.3.1.7-1. It appears that the closer competition gets to the core of telecommunications services, which are the services over the fixed network, the more the regulator sees the need to impose a requirement regarding cost standards.

Table 5.3.1.7-1: Cost standards prescribed by regulator

Country	Regulatory requirements	What rule?
United States	Y	FDC + Accounting Separation
United Kingdom	Y	FDC + Accounting Separation Benchmarking
Japan	Y	FDC + Accounting Separation
Australia	Y	DAIC, FDC
New Zealand	N	
France	Y	FDC
Germany	Y	FDC, IC*
Denmark	N	
Portugal	Y	FDC
Greece	N	

FDC Fully-distributed costs
DAIC Directly-attributable incremental costs
IC Incremental costs
* The requirement is for FDC. The regulator, however, has entered into a discussion with the regulated carrier regarding a methodology consistent with LRIC.

The fully-distributed cost (FDC) standard is the methodology that the regulator most often requires. The reason for the preference for FDC, despite its demonstrated drawbacks, must probably be seen in tradition and in the fact that regulators have not had experience with other approaches.

One should note, however, that in some countries alternative cost standards have already been applied or are under consideration. In Australia, which in this respect is the remarkable exception, the regulator followed a directly-attributable incremental cost (DAIC) approach when determining initial access charges for the new carrier. In the UK, for the determination of access loss contributions, use has been made of benchmarking whereby the efficiency of the regulated firm is compared with network operators abroad (the efficiency of the US Regional Bell Operating Companies served as a benchmark). On the regulator's agenda of the UK is also consideration to move the regulated carrier to an incremental cost methodology. This is to some extent also true for Germany. The most important competitor in the UK, Mercury, has on its own adopted the approach of Activity-Based Costing (ABC) which comes close to generating long-run incremental cost (LRIC) measures. The use of price caps to control tariffs and interconnection charges, for example in the US, also lessens the distortionary impact of FDC as under this regime the regulated firm is allowed to set tariffs and charges with relative flexibility.

On the other hand, one should also note that for the countries having had little or no experience with competition in the telecommunications sector the question of the cost standard on which to base the calculation of tariffs and hence interconnection charges is an issue which so far has attracted little attention.

5.3.1.8 Relation of local interconnection charges to local call tariff

In the Chapters 3 and 4 of this study, we extensively discussed the various considerations that need to enter an optimal design of interconnection charges. We analysed in particular also to what extent there are grounds to include an access charge component as one of the constituting elements (Baumol/Willig rule).

Here we attempt to get an indication of the extent to which considerations as reflected in the Baumol/Willig rule are evident in the access charges used in the ten countries. For this purpose we have sought to establish ratios of the charges to the relevant end-user tariffs. This could approximately be done for the relationship between the charges for interconnection with the local network and end-user tariffs for local calls.[51] Table 5.3.1.8-1 presents the results that we obtained this way.

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51 More precisely, the single-ended charge for interconnection with the local network (terminating or originating) is compared with the tariff for a local call, both measured as a charge per minute.

Table 5.3.1.8-1: Relation of local interconnection charges to local call tariffs[52]

Country	Approximate per cent of nominal tariff	Charges determined by	Component for access charges	
			Explicit	Implicit
United States	~ 50 %	EAR	Y	Y
UK Mercury/BT	~ 55 %	EPD	N	N
Japan	130 %	EAR	Y	N
Australia				
Initial	< 50 %	EAR	N	Y
Subsequent	~55 %	MA	N	Y
New Zealand				
Long distance	~85 %	CA	N	N
Local calling	?	CL	Open	Open
Mobile	100 %+	CA	N	Y
France	~70 %	EPD	Y	N
Germany	82 %	EPD	N	Y
Denmark	~120 %	CA	N	N
Portugal	65 %	MA	N	N
Greece	?	EAR	N	?

EAR Ex-ante regulation
EPD Ex-post determination
CL Competition law
CA Commercial agreement
MA Mediation/Arbitration

It is possible to provide the following commentary on the percentages shown in the table:

- For six of the ten countries, i.e., the US, the UK, Australia (initial charges), France, Germany and Portugal, the charge for interconnection with the local network is lower than the retail tariff for making a local call. We note from the third column of the table that in each of these cases the regulator was actively involved in determining the charges. One should expect the regulator to aim for this result as interconnection with the local network tends to use fewer resources than a local call.[53] We also note two cases, i.e., Japan and Denmark, where the opposite is true. Here, however, only in the first case was the regulator involved, in the second the result is the outcome of commercial negotiations.

52 We could not compute the ratio for the fixed/mobile interconnection in Greece as the mode of paying for interconnection there - a percentage of the mobile carriers' revenues - does not lend itself to this kind of comparison.

53 In the UK, however, an access deficit contribution (ADC) has recently been imposed on certain calls made by Mercury customers. Including this ADC the UK figure would be ~100%.

- The particularly low ratio shown for Australia under the 'initial' heading may reflect the regulator's use of an inremental cost methodology in the determination of initial interconnection charges. This may change with the entrant's achievement of threshold market shares when the initial charges will cease to apply and new, 'subsequent' charges will need to be negotiated on a commercial basis.

- The entries for New Zealand reflect a complex situation. The 'long distance' entry corresponds to the charge paid by the new fixed network competitor, Clear, for its interconnection for long-distance calls. The corresponding agreement had been concluded with Telecom in free negotiations at a time when Telecom did not yet insist on an access charge according to the efficient component-pricing rule (Baumol/Willig). The question mark behind the 'local calling' entry reflects the fact that, so far (July 1994), no interconnection charge has been agreed upon for Clear's offering of local calling. For this Telecom has demanded access charges which Clear is not prepared to accept. The case is under final review by the Privy Council in London. The 'mobile' entry reflects the interconnection agreement between BellSouth and Telecom concluded at a time when it seemed, after the first court ruling in the local calling case, that Telecom would be successful with its demand for an access charge.

- The method of determining the interconnection charge in the German case perhaps resembles most closely the Baumol/Willig prescription. The charge was arrived at by starting from the actual local call tariff and deducting from this the cost savings attributed to the particular way in which the interconnecting operator interconnects with the PSTN. It follows that the charge determined contains all the elements that are included in the tariff for the purpose of financing infrastructural and other obligations. This would at least in part explain the high value of the ratio shown in the table.

As regards any apparent dependence of the level of the interconnection charge on an access charge component included in it we note (looking at the fourth and fifth columns in which it is shown whether there is such a component, either explicitly or implicitly) that there is none. We observe cases in which there is indeed a relatively high level when there is an access charge (Japan, Germany, New Zealand 'mobile') but also when there is none (Denmark, New Zealand 'long distance'), and we observe a case of a low level when indeed there is no such charge (the UK) but also when there is one (the US, Australia). One is led to conclude that the fact whether an access charge is included or not may not be so relevant in determining the actual level of the interconnection charge.

The actual pricing methods for interconnection charges vary between countries in their sophistication and in their relationship to retail tariffs. In nearly all cases the largest component of interconnection charges are on a per-minute basis. Usually, only the costs of actually establishing interconnections are not priced on a usage basis. Peak-load pricing of usage is rare (UK), and so is pricing of call attempts (Australia).

Where interconnection charges are to be cost-based, regulators and incumbent TOs seem to have some preference for fully-distributed cost pricing of interconnection while interconnectors favour direct costing (no overheads) or incremental costing. However, price caps for interconnection services with the possibility of rebalancing are perceived by TOs as a desirable means of moving away from fully-distributed pricing principles, while they are viewed by interconnectors as a potential source for predatory TO behavior (U.S.).

5.3.2 Lessons from the country studies

In all countries that have introduced network competition in telecommunications, interconnection has been among the most pressing issues. As experienced in the US from the early parts of this century onward, incumbent TOs may simply want to refuse interconnection with competing network operators. Later experiences, for example in the UK and Germany, show that incumbent TOs, even if forced to interconnect by licence or statute, do not voluntarily grant interconnection to competing network operators at terms and conditions that would be acceptable to regulators. Without regulatory interference negotiations often reach an impasse. This experience suggests:

(a) that a right or duty to interconnect is necessary to ensure network entry;

(b) that some form of regulatory interference with private negotiations on interconnection agreements is helpful in reaching outcomes that regulators desire.

The experience also suggests that network interconnection is too complicated and possibly too individualised an issue to be regulated in all its aspects. Thus, a balance between regulation and commercial agreements needs to be reached. Since most interconnection regimes start out with a highly asymmetric market position between the incumbent TO and the interconnector, ex-post regulation has proven to be an effective tool in helping the interconnector's negotiating position. In order to create reasonable expectations about the outcome of ex-post regulatory interference, ex-ante regulation has to establish a set of basic guidelines for the issues that can be treated through ex-post regulatory determination and the criteria to be used by the regulator. The UK framework has created such rules in great detail. It is questionable if the UK level of detail is needed or whether more general rules suffice. The trade-off is between constraining the regulator and requiring frequent changes in the ex-ante regulation on the one hand and regulatory discretion and vagueness on the other.

Most countries use their interconnection regime as an active regulatory tool for promoting competition in the telecommunications sector. The objectives of interconnection regulation as revealed by regulators in our country studies include entry help and the viability of the incumbent. Entry help is provided to the interconnector via low interconnection charges (and/or high prices for retail telecommunications services) that improve their competitive position via the incumbent TO. Entry help is also provided via rules that equalise interconnection charges across interconnectors and

thereby improve the competitive position of small interconnectors relative to large interconnectors (US "equal charge" rule). As appropriate, entry help is most pronounced at the beginning of the interconnection regime (US, UK). While the question of the viability of the incumbent TO is raised at the outset, it becomes a more pressing issue over time, as "bypass" occurs and the incumbent loses market share. A major reason given for this problem by incumbents is the slow speed allowed to rebalance retail rates.

The viability of the incumbent is taken care of through fully-distributed cost pricing of interconnection and through (implicit or explicit) access charges or access deficit contributions. We have not found any satisfactory regime of access charges among the countries we studied. The US is actively searching for a replacement of the status quo approach currently used (which was derived largely from a formula for separating interstate and intrastate costs). The UK approach is much more explicit and rational than the US approach but it requires superhuman objectivity in making waiver decisions as well as complicated and questionable calculations. Access charges have been justified in the various countries by constraints on tariff rebalancing and/or by USOs. While constraints on tariff rebalancing should be lifted to accommodate competition and to promote cost-based pricing, USOs may actually become more desirable under competition. So far, only Australia has a method for establishing and financing the costs of USOs in place. Experience in this area is needed.

The interaction between regulatory bodies and official competition policy in the area of interconnection varies among the countries studied. In New Zealand, competion policy fully dominates; there is no regulation. In the US the two types of policy often compete with each other. Major parts of the US interconnection regime are the result of competition policy, for example, the vertical separation into local and long-distance carriers, the equal-access stipulations and the equal charge rule. In the UK interconnection regime, the regulator seems to actively pursue competition policy, without facing strong constraints from other instruments of competition policy. Our expectation is that active regulation of interconnection will eventually disappear as the market for interconnection matures. Competition policy will then have to take over as the main policy tool for dealing with problems arising in this market. It is therefore imperative that the role of competition policy be established early on.

Most countries have gained their first experience with interconnection agreements through fixed-mobile interconnections. For full-fledged network competition, fixed-fixed interconnections are currently more important. The question is, to what extent countries can learn from their fixed-mobile interconnection experience for the upcoming fixed-fixed case and to what extent they are locked in by their decisions on fixed-mobile interconnections. For several countries a particular emphasis of fixed-mobile interconnection agreements is on low tariffs for private circuits. In the UK, as the only European country in our study with fixed-fixed interconnections, preferential tariffs for private circuits have not been provided under fixed-fixed interconnection agreements. The ostensible reason for this asymmetry has been to encourage facilities investments

by competing fixed-network operators and to discourage similar investments by mobile operators. That there can be ample room for private circuits in fixed-fixed interconnection agreements has been demonstrated by the importance of the US special access regime.

Over time, interconnection moves from something infeasible or difficult to something resembling business as usual. At the beginning of interconnection regimes, there is usually a single entrant that wants to be interconnected to the incumbent TO. The timing to realise interconnection along with starting interconnection charges appear to be the most pressing issues. While timing to realise interconnection remains important for the newcomers, the feasibility of interconnection has long been established, and most parties face other issues. Countries with long experience in network competition (US, UK) are confronted with a diversity of parties that want to interconnect and that have different interests. An interconnection regime that individually takes care of these interests is likely to become cumbersome and complex. Rather, standardisation of agreements on many issues appears possible, leaving fewer issues that have to be solved for individual cases. As the market for interconnection matures, non-discrimination between interconnectors becomes pressing, and the case is made that all potential interconnectors should be treated similarly (as in US expanded interconnection).

How can countries at the beginning of their interconnection regimes learn from the more advanced countries, and what can the European Commission do to encourage that? Clearly, the more advanced countries have gone through stages in their interconnection regimes that might be skipped or shortened by the followers. For example, the technical feasibility of interconnection has by now been demonstrated under various network configurations. There is ample experience with location of interconnection points and with compatibility between different types of networks and line capacities. Similarly, there is a long list of issues that need to be considered for interconnection agreements where the solutions could be adapted from UK interconnection agreements or US interconnection tariffs, both in the public domain. Some issues are not so clear cut but nevertheless learning is likely to be helpful. For example, the costs and benefits of equal access, while possibly different in magnitude across countries, are unlikely to differ much in kind. Methods for cost-benefit analysis of equal access may therefore be transferable.

In the US and the UK the publicity of the contents of interconnection agreements goes along with with an involvement of the whole telecommunications sector in the process that shapes the interconnection regime. Such an involvement and public discussion may slow down the speed of decision making but it is likely to improve the understanding of the issues and trust in the outcome of regulatory decisions.

The US country study is the only one that could be relevant for the relationship between the European Commission and the Member States. The US experience suggests that dual regulation causes problems of jurisdictional cost separation and of conflicts between rules that govern intrastate and interstate transactions. The US has generated

reasonable uniformity of approaches throughout the country where either the federal regulator has preempted state regulation or where competing interstate/intrastate regulation exists and operators can arbitrage between jurisdictions. Translated to the case of the European Union this suggests that the European Commission could either prescribe binding rules on interconnection or establish European standard rules that can be followed on a voluntary basis. Voluntary rules could lead to a unified approach to the extent that arbitrage possibilities for telecommunications services between countries can be realised through facilities-based competition through interconnection.

6. Towards a European interconnect policy

6.1 Introduction

All experience with competition in the European Union and in the rest of the world proves that interconnection is the key for transforming the former monopolistic market structure in telecommunications into a competitive one. Viable competition is unthinkable without interconnection between mainly (but not exclusively) the incumbent's and the new competitors' networks. Economic analysis can show and can give the answer why that is the case. Technical analysis gives evidence that interconnection is feasible and more cost-effective than stand-alone solutions. We have developed the argument in more detail in the previous Chapters. Not only competition in public voice telephony requires interconnection of networks. The status of service competition in the EU proves that viable service competition in other service fields benefits from interconnection to existing networks.

Given the (initial) market structures which exist before viable competition emerges in the telecommunications sector, the supplier(s) and demander of interconnect services will not produce results which make best use of the competitive potential in the market. Market structure asymmetries give incentives on the side of the dominant supplier not to offer the degree and the conditions of interconnection which best serve the public interest. This result can be derived from theoretical economic analysis. Our rich empirical case studies show that this result obviously describes most of the worldwide experience with interconnection in the real world.

The case for policy and regulatory involvement can be made quite easily. This holds on the national as well as on the European level. In the following we will focus our findings developed in the previous Chapters on the necessity and the approach of a consistent and coherent European interconnect policy.

In Section 6.2 we deal with the need and reasons for a European interconnect policy. Section 6.3 summarises and evaluates the elements and steps which form the current European interconnect policy. The final section in this Chapter tries to identify the policy options and approaches which do exist for a fully liberalised environment in the European telecommunications market and develops a set of policy recommendations.

6.2 The need for a European interconnect policy

6.2.1 Liberalisation on the European level

Already in the 1980s, the European Union took the initiative to transform the telecommunications sector from a monopolistically structured to a competitive market. Many (or even most) of the Member States have adopted their national regulatory framework according to the requirements of the Services Directive[54] not earlier than required by the Directive but in line with it. They have accepted and are willing to accept policy formulation on major telecommunications policy issues at a European level. These Member States expect that policy frameworks and measures which govern and structure fundamental policy decisions will also be developed on the European level.

Given the fundamental principles of the Treaty,[55] the interaction between European telecommunications legislation and national telecommunications policy as described above does not hinder any Member State from opening its telecommunications markets to competition earlier than required by European legislation.

In July 1993 the European Council adopted a resolution[56] on the further development of liberalisation in the European Union. Liberalisation of all voice telephony services by and not later than January 1, 1998 is the intended policy goal. In this context the development of a framework for interconnection agreements and the definition of principles for access charges has been regarded as a line of action which has to be worked out.

In May this year the Bangemann group upon request by the European Council made far reaching recommendations on the future liberalisation path in Europe.[57] The report recommends to accelerate the ongoing process of liberalisation and to open up to competition infrastructure and services as soon as possible. Furthermore, the report recommends interconnection of networks and interoperability of services as primary Union objectives. On this basis and other contributions European decisions on a fully liberalised telecommunications market can be expected soon.

Given this status of policy decisions, the Member States expect a framework for interconnection or a European interconnect policy to be developed in the near future.

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54 Commission Directive of 28 June 1990 on competition in the markets for telecommunications services (90/388/EEC), OJ 16 L 192, 24.7.1990, p 10.

55 Treaty establishing the European Community as amended by the Treaty on European Union

56 Council Resolution of 22 July 1993 on the review of the situation in the telecommunications sector and the need for further development in that market (93/C213/01), OJ 16 C 213, 6.8.1993, p.1.

57 Europe and the Global Information Society, Recommendations to the European Council, Brussels, 26 May 1994.

6.2.2 Divergence in national approaches

A common European interconnect policy is easier to implement when Member States have not yet dealt with interconnection in their national regulatory framework. This statement can also be formulated the other way around. When all or most Member States have developed a national interconnect policy, have realised interconnection agreements between networks operators and the approaches chosen vary considerably, the question on the usefulness (or the transaction costs) of a European interconnect policy is more difficult to answer. In any case, if many interconnection agreements are in place a new interconnect policy requiring amendments or changes of existing agreements will be difficult to implement.

Where do we stand in Europe with regard to national interconnect policies and interconnection agreements? The situation differs with regard to the market segments or interconnection scenarios on which we concentrate in this study and is, of course, dependent on the steps towards competition which have already been taken in the Member States.

Overall, the situation in the various Member States is heterogeneous. Some Member States have already developed (elements of) an interconnect policy. In most Member States, however, no substantial steps toward developing a regulatory policy for the interconnection of networks and services have so far been undertaken and many legal, institutional, technical and economic barriers against (viable) interconnection still persist.

Concerning the interconnection between fixed networks, it is only the UK which has experience with that type of competition and therefore such type of interconnection agreements. As the UK country study shows, interconnection evolves to be such a complex issue, that policy development in this field is not or need not necessarily be a one-step decision making process. In some other Member States the first ideas and concepts are emerging of how to introduce competition into the core telecommunications business (network infrastructure, voice telephony). In these countries the first ideas and elements towards an interconnect policy for fixed networks just emerge. A European interconnect policy could fill a gap for fixed network interconnection.

The situation is different with regard to mobile networks. Most Member States have introduced or are introducing competition in mobile telephony. Therefore, they had to develop an interconnection framework or are doing that currently. Several interconnection agreements have been negotiated within these frameworks. The regulatory frameworks and the agreements themselves differ in a variety of details and outcomes. The mobile carriers face quite different points of departure in their competitive position between Member States. A lot of restrictions still hinder them from providing the most efficient mobile networks and services. Many barriers to efficient interconnection still exist for mobile operators, in particular concerning direct

connections between mobile networks in different Member States. A European interconnect policy could harmonise interconnection frameworks and conditions.

Together with developing ONP conditions for the telephone network and setting conditions for access to its (advanced) features, some Member States are making the first steps towards interconnection in an intelligent network environment. These approaches are still at an early stage in most Member States. A European policy in this field could take a lead for innovative and uniform approaches.

6.2.3 European-wide networks and services

The main (but not the only) argument in favour of a comprehensive European interconnect policy consisting of similar conditions of access to networks and network functions under equal terms and conditions in each Member State can be made with regard to the requirements of European-wide networks and services. If network operators or service providers want to run a trans-European network or want to offer a European-wide service, they will have to rely on interconnection to national public networks in many cases. Interconnection can be a bottleneck if it is not provided everywhere. It can also be a bottleneck if the technical, economic and regulatory terms and conditions vary significantly between Member States.

This reason and basis for a European interconnect policy has received the highest legal support in the Maastricht Treaty on European Union. This Treaty has introduced a new 'Title XII' on 'trans-European networks' into the EC Treaty and thereby defined a new field of competence for the European Union. Article 129b sets the legal principles of an interconnect policy on trans-European networks: "The Community shall aim at promoting the interconnection and interoperability of national networks as well as access to such networks". The basic policy on interconnection now has a direct legal basis in the constitution of the European Union.

6.2.4 Harmonising national interconnect policies

As we will show in Section 6.3, the European Union has developed an initial framework for a European interconnect policy, mainly in the proposed voice telephony Directive. As compared to the regulatory and policy frameworks in countries which can already rely on some years of experience with competition and interconnection, the European policy framework as defined so far is consistent with a variety of very different interconnect policies in the Member States. A harmonised approach in the European Union would require a much more detailed approach if that is the intended objective in Europe.

6.3 Current European interconnect policy

6.3.1 The ONP framework

Basic principles of an European interconnect policy have been developed within the ONP framework. When the ONP concept was born in the eighties, service liberalisation and the provision of transborder service offerings was at the center of the Commission's policy approach. The network infrastructure monopoly of the TOs was generally accepted at that time in Europe. Furthermore, most Member States wanted to reserve certain basic services for exclusive provision by their TOs.

In that environment the ONP concept was born: TOs should be obliged to open their network under fair competitive conditions to competing service providers and to interconnect with them. Working out the principles of the provision of the network was regarded as a necessary requirement for a Community-wide competitive market. One of the main reasons to develop the ONP concept was to avoid a series of contentious cases and lengthy conflicts concerning infringements of the competition rules of the Treaty. Besides allowing access for competitive service providers, the interconnection between TOs in different Member States was a concern of the Commission to allow efficient Community-wide communications.

The so-called ONP framework Directive[58] lays down the principles under which service providers and users can get access to reserved services and the public telecommunications infrastructure. The Directive defined ONP as "the harmonisation of conditions for open and efficient access to and use of public telecommunications networks and, where applicable, public telecommunications services". ONP is intended to facilitate the provision of services using public networks and/or public services. According to this aim, ONP is intended to promote fair competition between vertically integrated TOs and service providers which have to rely on services and resources of the TOs to produce and offer their own services. The second goal of ONP is to harmonise technical interfaces, usage conditions and tariffs to facilitate the provision of pan-European telecommunications services. Harmonisation will be realised on the basis of European standards to be adapted by ETSI.

Three types of principles and application criteria define the ONP regulatory framework, namely:

(1) *harmonised conditions,*

(2) *basic principles and*

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58 Council Directive of 28 June 1990 on the establishment of the internal market for telecommunications services through the implementation of open network provision (90/387/EEC), OJ L192, 24.7.1990, p.1.

(3) *essential requirements.*

ONP conditions include, in particular, harmonised conditions with regard to

- technical interfaces, including the definition and implementation of network termination points;
- usage conditions, including access to frequencies;
- tariff principles.

The main emphasis with regard to technical interfaces is their conformity with European standards. For existing services and networks, existing interfaces should be adopted. Also new services should rely on existing interfaces; if that is not possible, new interfaces have to be specified. For new networks, ONP requirements should be taken into account when specifying new interfaces.

Usage and supply conditions refer to a standard set of contractual conditions governing access and usage including, for example, delivery period, quality of service, maintenance, fault reporting, procedures. They may include conditions for interconnection with public and private networks, conditions for resale of capacity, and conditions for shared use.

Tariffs should mainly comply with a set of basic principles defined below. Further general requirements for tariffs are that they are cost-oriented and sufficiently unbundled. Furthermore, tariffs must be non-discriminatory and guarantee equaltiy of treatment.

ONP conditions must comply with a number of basic principles, namely:

- they must be based on objective criteria,
- they must be transparent and published in an appropriate manner,
- they must guarantee equality of access and must be non-discriminatory, in accordance with Community law.

These basic principles apply to all harmonised conditions of ONP.

The general philosophy of ONP is to realise and guarantee open access to public networks and services, and to avoid restrictions on such access. The Directive, however, takes care of a set of "non-economic reasons in the general interest" which give NRAs the right ro restrict access to the public telecommunications services. Access for users and service providers can only be restricted for reasons based on the following essential requirements:

- security of network operations,
- maintenance of network integrity,
- interoperability of services, in justified cases,

- protection of data, as appropriate.

In applying restrictions to access, regulators have to follow the principle of proportionality and they shall not be excessive in relation to the aim pursued.

6.3.2 Current ONP legislation and initiatives

While the framework Directive defined and set the general principles of ONP, the application to specific services remains subject to separate legislative measures. In recent years, the following areas have been addressed for legislative ONP measures:

- leased lines,
- packet switched data services (PSDS),
- ISDN,
- voice telephony.

a) Leased lines

The leased line Directive[59] mainly deals with conditions and specifications on how leased lines should be provided. The Directive contributes to interconnection regulation and service competition insofar as it no longer accepts technical restrictions for the interconnection of leased lines with each other or for the interconnection of leased lines and public telecommunications networks, because they can be replaced by less restrictive regulatory measures.

b) ISDN

Although the Council Recommendation on the provision of ISDN[60] in accordance with ONP principles aims at harmonising the conditions for open and efficient access to and use of ISDN, it does not address interconnection issues very specifically. It is stated that users are requiring further access arrangements such as M- and U-type interfaces which are not yet provided by TOs. This issue still is under study and not yet settled.

c) Packet-switched data services (PSDS)

Similar to ISDN, this Council Recommendations is mainly dealing with supply conditions of PSDS and not with access and interconnection issues.

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59 Council Directive of 5 June 1992 on the application of open network provision to leased lines (92/44/EEC), OJ L165, 19.6.1992, p.27.

60 Council Recommendation of 5 June 1992 on the provision of harmonised integrated services digital network (ISDN) access arrangements and a minimum set of ISDN offerings in accordance with open network provision principles (92/383/EEC), OJ L200, 18.7.1992, p. 10.

6.3.3 The interconnect model of the voice telephony Directive[61]

The ONP rules mentioned above were primarily aimed at the definition of minimum sets of service features and conditions. More precise and detailed rules on interconnection have been developed in the recently adopted Council Directive on the application of ONP to voice telephony.

The Directive aims to "create the best possible regulatory environment for boosting the competitive provision of pan-European services using capabilities and functions of the public switched telephone network and service, whilst safeguarding the ... provision of universal service". Concerning interconnection, the regulatory principles primarily aim at avoiding abuse of a dominant position by TOs. The document deals with the provision of access to the public voice telephony service and the network over which that service is delivered for

- end users,
- competitive service providers,
- public mobile telephony services operators and
- other TOs.

Access to voice telephony includes access to intelligent functions of the public network.

ONP conditions for access to the fixed public telephone network shall apply to all the network technologies currently in use including analogue telephone networks, digital networks and the ISDN. The Directive does not apply to mobile telephony services in general, but it does apply to the use of the fixed public telephone network by operators of public mobile services. It does not apply to the direct interconnection between operators of public mobile telephony services.

In its interconnection provision (Art. 11) the Directive seems to exclude the case for the interconnection of two fixed network operators within the same Member State. The wording in clause 22 is different and seems to regard this interconnection case as covered by the Directive. Perhaps there might be some openess on the scope of the interconnection provisions of the Directive.

Given this little (but important) classification problem, the Directive addresses and is applicable to the following interconnection scenarios:

(1) Interconnection between two fixed public telephone networks from different Member States;

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61 Although the Directive was rejected by the European Parliament in July this year, and although its future is unclear, we regard it as useful to deal with its contents in the same way as before the Parliament's decision.

(2) interconnection between a fixed public telephone network and a public mobile telephony network within the same Member State;

(3) interconnection between a fixed public telephone network and a public mobile telephony network from another Member State.

This classification on the other hand means that the Directive is not applicable to the following interconnection scenarios:

(4) Interconnection between two mobile telephony networks within the same Member State;

(5) interconnection between two fixed public telephone networks within the same Member State;

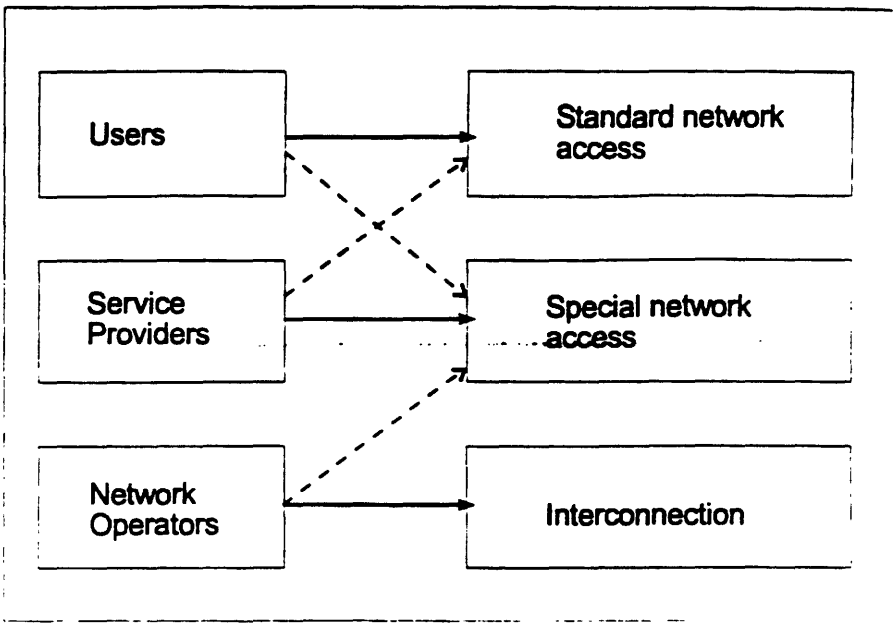
(6) interconnection between mobile networks from different Member States.

Clause 24 addresses scenario (5) where more than one TO operates a fixed telephone network in the sense that although not directly applicable, the interconnection arrangements "should take due accounts of the principles laid down in this Directive". If this distinction holds, there is no systematic criterion concerning the scope of the Directive. It neither totally excludes mobile networks nor concentrates on crossborder interconnection scenarios. The outcome on applicability is more a mixture of these two criteria.

The Directive basically distinguishes three types or ways of accessing the PSTN. The regulations are mainly dealing with standard access, which means interfaces for access at commonly provided network termination points. These types of access are relevant for all or at least major parts of the whole user community.

Beside commonly provided network termination points, the Directive deals with special network access requirements, which will mainly be relevant for service providers but might also have some relevance for some groups of larger users. Finally, the Directive sets regulatory rules for the access or interconnect services which other network operators demand. Figure 6.3.3-1 gives an overview on the three types of access which are handled in the voice telephony Directive.

Figure 6.3.3-1: Types of network access



According to Art. 10, users can request access to the fixed telephone network at other network termination points than those offered for "standard access". TOs shall respond to such requests if they are reasonable (in terms of technical feasibility and economic viability) and NRAs have to ensure that they provide such types of access. A TO can only restrict or deny that access after having gotten agreement of the NRA. Service providers or (larger) users shall obtain special network access to public network resources without waiting for time-consuming standardisation procedures. The Commission can, however, initiate standards for new types of network access within the ETSI process. They can engage in technical and commercial arrangements with the TO. There is no obligation to publish such off-tariff agreements which makes it easier for TOs to discriminate. As a regulatory safeguard against such behaviour NRAs have the right to get access to such arrangements. The NRA may intervene in its own initiative and shall do so if requested by any party. Service providers, however, get no right to collocate such that they can install their equipment on the premises of a TO.

Art. 11 sets up a regulatory framework for interconnection in a rather broad way. The main focus of the Directive is the Community-wide provision of voice telephony services. Therefore, the Directive only deals with the three scenarios of interconnection mentioned above.

The first basic principle of the regulatory framework is the right to interconnect. Operators of public mobile-telephony services in the same Member State and from other Member States as well as fixed public telephone network operators from other Member States have the right to interconnect to the national fixed public telephone network. This right to interconnect can only be restricted with prior agreement of NRAs. Restrictions might be based on essential requirements.

The second basic principle is that regulators should mainly rely on negotiations of the parties involved to get agreement on technical and commercial arrangements for interconnection.

The third basic principle is the right and duty of the regulator to intervene in interconnection matters. Interconnection "should be subject to regulatory oversight in order to safeguard the Community-wide interests of users and ensure compliance with Community law ...". NRAs might intervene on their own initiative and shall do so if requested by either party. The forms and types of intervention are not specified, but they include the right to set conditions on interconnection agreements. The criteria and objectives of regulatory actions are limited to conditions which are:

- non-discriminatory,
- fair and reasonable for both parties and
- offer greatest benefit to all users.

Besides meeting these criteria, NRAs also have to ensure that interconnection agreements

- are entered into and implemented in an efficient and timely manner;
- include conditions about conformance to relevant standards;
- include conditions about conformance to essential requirements;
- include conditions of the maintenance of end-to-end quality.

It is not specified whether and to what extent such requirements should be set ex ante by the NRA or whether negotiated interconncetion agreements should be controlled on their compliance with these requirements. Furthermore, there is no general approval requirement of interconnection agreements by NRAs.

In Art. 27 the Directive sets up some conciliation and dispute resolution procedures which might also be used in interconnection disputes. Thereafter, unresolved disputes with a TO by any party concerning an alleged infringement of the provisions of the Directive can be appealed to the NRA or another independent body. Easily accessible and inexpensive procedures shall be created to resolve such disputes in a fair, timely and transparent manner. When more than one Member State is concerned, the dispute may also be invoked to the Commission.

The fourth basic principle is the possibility of access charges to be included in interconnection agreements. In a complicated language they are introduced as "specific compensation provisions[62] for the telecommunications organisation in situations where different operating conditions, e.g., price controls or universal service obligations, are imposed upon the respective parties ...". Under this provision potentially many

62 The Directive does not use the term "access charges".

situations might give reason for access charges when even the monopolistic price control is regarded as an asymmetric type of regulation which has to be compensated. Only very broad and unspecific criteria are set for the application of these "compensation provisions" or access charges: They shall be cost oriented (which costs?), non-discriminatory and fully justified (according to what objective?) and need approval of the NRA.

The fifth basic principle requires details of interconnection agreements to be made available to NRAs upon request. This principle has more relevance in what it does not require than in what it does require. It does not require that interconnection agreements need prior approval by the NRA before they become effective. Furthermore, it does not require public access in whole or in part to interconnection agreements.

There are no interconnection-specific tariff and cost-accounting principles defined or set, which means that only the general principles on voice telephony as a whole shall apply. These are first of all the principles of transparency and cost orientation as specified in the ONP framework Directive. Tariffs should be "sufficiently unbundled", independent of the type of application which the users implement and may include "tariff constraints (imposed by the NRA) relating to the objectives of universal telephone-service accessibility including town and country planning". Of some relevance for interconnection might be the provision that bulk discount schemes can be offered (Art. 14(1)). The tariff regulations should be supported by suitable cost-accounting systems which are deemed to control tariff principles and restrictions. The cost-accounting rules are formulated according to a typical fully distributed costing approach (Art. 13(3)).

To summarise, the voice telephony Directive favours a 'light-handed' regulatory approach towards interconnection. It does not rely on or require ex-ante regulation of interconnection agreements, but provides regulatory intervention in case that commercial negotiations on interconnection fail. The Directive leaves questions open on its jurisdiction concerning some (relevant) interconnection scenarios and it is not very specific in its provisions on interconnection in an intelligent network environment. Besides referring to the possibility of access charges to be included in interconnection agreements, the Directive does not contribute to the definition of universal service principles and conceptual and implementation aspects concerning interconnection and access charges. The Commission regards the provisions for access and interconnection agreements in the Directive as a sufficient initial framework at the Community level. With phased progress towards increased liberalisation, this framework may have to be reviewed.

6.3.4 Developing universal service and access charge principles

Although interconnection and universal service issues are not necessarily directly interrelated issues of telecommunications policy, in practical terms and in all relevant

experience around the world these issues are directly interrelated. Any coherent interconnection policy has to deal with and has to decide whether or not interconnection charges should also take care of universal service obligations of incumbent telecommunications carriers and how and to what extent they should include access charge elements. A coherent policy in this field has to specify universal service principles, has to identify those operators which have to carry the burden of universal service obligations, if there are any, has to decide on the appropriate financial mechanism how or whether to share the burden with other suppliers in the industry. Only when the final point is reached, the question of access charges arises as compared to other burden sharing principles and mechanisms.

The discussion on universal service in telecommunications has started in the European Union. The overall goal is broadly accepted in the European Union. Some basic principles have been formulated and the debate on financing universal service has started. Basic principles of universal service in telecommunications, which have already been shortly mentioned in the Council Resolution on the review of the situation in the telecommunications sector in July 1993[63], have been further developed and specified in a Council Resolution of February 1994 on universal service principles in the telecommunications sector[64].

The basic objective of the Resolution is to provide "assistance in achieving the goal of universal service in a competitive environment and to the progressive rebalancing of tariff structures ...". Furthermore, major elements constituting universal service at Community level are to be identified. The Resolution refers to the various ONP measures which are assumed to have identified the basic elements for a definition of universal service and does not give a specific definition of universal service itself.

Maintenance and development of a universal telecommunications service is regarded as a key factor for the future development of telecommunications in the Community. Universal service is not regarded as a static concept realised by a set of basic service elements; instead, it is regarded as a dynamic concept that "must evolve to keep pace with advances in technology, market development and changes in user demand".

Universal service implicitly is being defined by a set of principles, namely: universality, equality and continuity. These principles are a basis for such a service to permit access to a defined minimum service of specified quality to all users everywhere and at a reasonable price. Common principles for the provision of universal service should be defined throughout the Community while taking account of specific national conditions.

Concerning financing universal service, the Resolution only refers to a basic voice telephony service and not to other potential candidates for universal service. Under the

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63 Council Resolution of 22 July 1993 on the review of the situation in the telecommunications sector and the need for further development in that market (93/C213/01), OJ C213, 6.8.1993, p. 1.

64 Council Resolution of 7 February 1994 on universal service principles in the telecommunications sector (94/C48/01), =J C48, 16.2.1994, p. 1.

specific circumstances where this service "can only be provided at a loss or can only be provided under cost conditions falling outside normal commercial conditions, that service may, where justified and subject to the approval of the national regulatory authority, be financed through internal transfers, access charges or other mechanisms which take due account of the principles of transparency, non-discrimination and proportionality, while ensuring compliance with competition rules in order to make a fair contribution to the burden which the provision of universal service represents". Thus, access charges as an instrument of financing universal service are not favoured per se. It is one instrument besides others. On the basis of this Resolution, the Commission is invited to elaborate common access charge principles.

The discussion on universal service in the European Union mainly refers to the ONP framework developed so far. The ONP practice so far has developed the following universal service concepts:

- the basic provision of service,
- quality of service,
- tariff principles (including targeted tariff schemes for particular user groups),
- dispute resolution mechanisms,
- special public service features (e.g., emergency services),
- certain Community-wide service features.

The Commission in a related communication considers the principles provided in the context of ONP as sufficient at this stage to form a basis of universal service conditions.

Financing universal service is seen in the context of tariff adjustment followed by the introduction of competition in the core markets. The adjustment process should be accompanied by a number of factors:

- the costs of meeting universal service have to be identified;
- capacity should be retained to finance unavoidable deficits in local access from more profitable parts of the business;
- gradual tariff rebalancing must be permitted;
- new entrants should make an appropriate contribution to the provision of universal service and to the transfers required to finance it via a system of access charges;
- sufficient national flexibility should be given in line with the principle of subsidiarity;
- social and economic cohesion with regard to peripheral regions should be taken into account.

Internal transfers and access charges are not seen as an alternative to tariff rebalancing and, without explaining how, access charges should not be used as a means of controlling a competitor's cost structures. Access charges should be structured such that necessary improvements in cost efficiency or productivity gains are not delayed by shifting the burden of inefficiency onto new market entrants. Generally,

access charge systems should be based on the principles of transparency, non-discrimination and proportionality.

6.3.5 Interconnect positions in the Green Paper on mobile communications

In its Green Paper[65] on a common approach in the field of mobile and personal communications, which was published in April 1994, the Commission has developed a policy approach towards interconnection between different mobile networks and between fixed and mobile networks. In the Green Paper, which has the character of a policy paper, the Commission has proposed positions for legislative measures and other lines of action. The positions and recommendations of the Green Paper are now in the stage of public comments.

The Commission emphasises the vital importance of fair and efficient interconnection agreements with the fixed network for mobile operators. Payments to fixed network operators for the conveyance of calls and the provision of leased lines account for 30-50% of total revenues of mobile network operators and, therefore, determine to a large extent the economics of such networks. The Commission is criticising restrictions on direct connections to other mobile operators, both within and between Member States, which do exist in some Member States. Such restrictions hinder Europe-wide roaming and the establishment of trans-European networks.

Although the Commission identifies a lack in the definition of interfaces, it does not regard as necessary to establish further specific Directives concerning these interfaces and related interconnection conditions at a Community level. Instead, the framework provided by the ONP framework Directive is regarded as sufficient provided that interconnection is subject to strict supervision by NRAs.

To facilitate interconnection and interoperability substantial progress is required in the definition of European standards. Standards are required for the following most essential interfaces:

- the interface between mobile networks and fixed network infrastructure, as far as it is not covered by the current standards work;
- the interfaces, functionalities, and service elements made available by mobile network operators to independent Service Providers;
- the interfaces made available to access the intelligent functionalities of the public fixed network(s);

65 Towards the Personal Communications Environment: Green Paper on a common approach in the field of mobile and personal communications in the European Union, COM (94) 145 final, CEC, Brussels, 27.4.1994.

- the interfaces to be offered to mobile networks operated for own use or for use by a closed user group (private mobile networks) to allow interconnection with the public fixed network(s);

- interfaces allowing direct interconnection of mobile networks based on either the same or different technologies.

The Commission intends to initiate a programme of standardisation mandates to ETSI to accelerate standard development in this area. Those standards should, in general, be voluntary. Only in cases necessary to ensure basic interoperability, references to standards should be made binding.

In its proposed position towards a European interconnect policy in the field of mobile communications, the Commission basically regards the existing framework on the European level for interconnection agreements, as developed by the ONP framework Directive, the voice telephony Directive and the Treaty competition rules, as sufficient. To facilitate interconnection, however, the establishment of technical standards concerning interconnection interfaces should be promoted and published.

The ONP framework might have to be adjusted to guarantee mobile operators the right to directly interconnect with other mobile network operators, both within and between Member States. That seems to be the only legislative measure the Commissions has in mind to change or to adapt the existing legal framework for interconnection in the field of mobile communication. No further specification of the economic terms and conditions of interconnection agreements seems to be intended.

6.3.6 Evaluation of current European interconnect policy

The fundamental principles for open network provision which have been developed within the legislative ONP framework are a sound basis for a comprehensive European interconnect policy. Although developed for and within an environment of monopolistic provision of voice telephony and network infrastructure harmonised conditions, basic principles and essential requirements are also fundamental regulatory conditions in an environment of competitive provision of voice telephony and network infrastructure.

As compared to the regulatory framework and the regulatory rules concerning interconnection in countries which have introduced competition in the core business of telecommunications, however, the current elements of a European interconnect policy are too broadly defined and do not address all relevant regulatory challenges and problems. They are consistent with quite divergent national approaches in the European Union and therefore neither lead to harmonised conditions for interconnection nor facilitate or foster the development of European-wide networks and services.

Major policy decisions on the transition to a fully-liberalised telecommunications market environment are to be expected soon in Europe. This progress increases time pressure to develop a more comprehensive and detailed European policy approach towards interconnection and its regulatory implementation. Efficient competition requires the appropriate interconnection regime to be available in advance. This analysis leads to our first recommendation:

Recommendation 1:

Binding European legislation dealing with all the major interconnection issues should be available and effective before full-scale competition is introduced in 1998.

6.4 European interconnect policy in light of voice telephony and infrastructure competition

6.4.1 The future competitive environment

The importance of interconnection as well as the scope and the necessity of regulatory action in this field strongly depends on the competitive environment which is set by the general telecommunications policy. That is the reason why nearly all interconnection experience in the European Union with the exception of the UK comes from competition in mobile communications. Without further decisions on liberalisation it will mainly be service providers who will ask for access to the intelligent functions of the TOs' telephone networks to get special access solutions which enable them to compete against the TOs on a fair and efficient basis.

It is obvious that the most important pressure for sufficient interconnection solutions will come from those new operators who want to offer a nation-wide voice telephony service. Also the liberalisation of infrastructure provision for liberalised services will create new interconnection cases because new operators will be able to set up nation-wide networks. Any meaningful decision on liberalisation therefore has to give answers to challenging interconnection issues.

6.4.2 Subsidiarity

According to the European Union's constitutional order, the Council and the Commission cannot set up a European interconnect policy and a regulatory framework for interconnection which deals with all (potential) aspects of interconnection and all forms of regulatory intervention. The Treaty of Maastricht requires that the Community shall act according to the principle of subsidiarity in all areas which do not fall into the exclusive responsibility of the Community. Only when policy goals cannot be achieved

on the level of Member States, shall the Community institutions formulate policy. Although we argued in favour of the need for a European interconnect policy in Section 6.2, it is also obvious that not all aspects of a coherent interconnect policy have to be developed and directed on the European level; many can efficiently be handled at the Member State level. Given the constitutional principle of subsidiarity, any European line of action with regard to interconnection has to draw at least implicitly a line between national and European regulatory responsibility. To get some reference we will analyse in more depth the division of labour between the federal and state regulations on interconnection in the U.S. to draw some conclusions to the European environment from this experience.

Excursus: Interconnection responsibilities within the regime of dual regulation in the U.S.

The U.S. is the only country in the world holding a long tradition with a regime of dual regulatory responsibility between the federal and the state level in telecommunications. The regime of dual regulation is also materialised with regard to interconnection regulation. It might be useful to give some observation and insight into the division of labour between the federal and state regulations on interconnection.[66] Before looking into the interconnection practice of the interaction between the federal and the state level of regulation it is essential to have a look at the overall regulatory structure and the guiding principles of the U.S. regulatory system in telecommunications.

U.S. telecommunications is subject to complex and sometimes conflicting tripartite (regulatory) authority. Provision of local and intrastate telephone service is regulated in each U.S. state by a state Public Utilities Commission (PUC). At the same time the FCC exercises national jurisdiction over radio-based services, interstate and international services. In addition, the antitrust laws, executed by the Department of Justice, deal with issues of market power.

The general principle behind the division of labour between state and federal regulation in the U.S. is the differentiation between "intrastate" and "interstate" commerce. State regulation is responsible, in principle, for "intrastate commerce" and federal regulation for "interstate and international commerce". Consequently, an individual regulated firm will, in principle, be regulated by state regulators for its intrastate transactions and by federal regulators for its interstate transactions. This straightforward principle is hard to apply in practice, since transactions and the use of capital equipment and other common cost elements can rarely be classified as purely interstate or intrastate. The dual regulatory system has separated responsibilities by imposing a complex cost separation mechanism.

66 For details we refer to the U.S. country study of this report and to Vogelsang (1994).

Besides cost separation the guiding principle of separating responsibilities between the state and the federal level of regulation is that of federal preemption. According to this principle the FCC can declare that federal regulation supersedes state regulation if interstate telecommunications are materially affected. This principle of federal preemption has over time increased the weight of the FCC as a federal regulator relative to state regulation. In the U.S. it is not only the FCC which can preempt state regulation. Preemption can also be initiated by a federal court[67] or by Congress through legislation.

What has been the actual division of labour and responsibilities of regulatory authorities in U.S. telecommunications with regard to interconnection? We will not go into the history of early interconnection provisions and arrangements, but concentrate on the industry structure that has been generated through the divestiture of AT&T in 1984. In these last ten years major interconnection policies have been developed and this industry structure is more comparable to the European industry structure than the old uniform Bell system.

Since interconnection affects both interstate and intrastate telecommunications, it is regulated on both levels. The basic arrangements for interconnection rely on the divestiture of AT&T realised by the MFJ, a measure based on U.S. antitrust laws. Until then interconnection charges between the Bell system and independent operators were part of the separations and settlements process while new long-distance competitors had major battles with AT&T over these charges. The fundamental pricing arrangements for interconnect charges for interexchange carriers have been set by the FCC in its access charge proceedings in 1982. Although access is provided as a local service from the LECs to the IXCs, the conditions for access have been set at the federal level. This includes access charges for a portion of the costs of the local loop placed on end users. With its 1982 decision the FCC also mandated that the LECs provide the new long-distance competitors with equal access. With its ruling of an equal-charge-per-minute-of-use requirement based on the MFJ provisions the FCC realised uniform interconnection charges despite regional or LEC-specific cost differences.

State regulators in the U.S. regulate access charges for intrastate long-distance traffic. In many states LECs compete with IXCs on intraLATA long-distance services. Intrastate access charges can differ quite significantly from interstate access charges although the access services are quite the same. This structure has produced arbitrage possibilities for interconnectors who try to use the most favourable jurisdiction. Regulators have reacted by monitoring the jurisdictional distribution of traffic and by rate adaption.

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67 This has happened, for example, through the Modified Final Judgement by the U.S. District Court for the District of Columbia that created LATAs within states and excluded the Bell Operating Companies from providing interLATA intrastate services even if state regulators would be willing to permit them (United States and American Telephone & Telegraph Co., 552 F. Supp. 131 (1982)).

One basic conflict has emerged in this structure between the federal and the state regulators: Many states want to get higher contributions for universal service obligations than the FCC is willing to accept. These states have tried to preserve higher intrastate access charges than those prescribed by the FCC for interstate services. Because of arbitrage and bypass, state regulators are unable to implement their policy approach to the extent they would like to do. The contribution element also has produced incentives and opportunities for operators to arbitrage between states exploiting the large variation across states in intrastate access charges. That structure causes potential conflict between states.

The most interesting case of the interaction between state and federal regulator with regard to interconnection can be observed in the field of expanded interconnection to the LECs' local networks. Expanded interconnection aims at promoting competition at the local exchange level. Some innovative state regulators made the first initiatives. They arranged collocation agreements between competitive access providers and LECs in several metropolitan areas. Those innovative states influenced the FCC which in turn homogenised state approaches. In 1992 in its expanded interconnection decision, the FCC adopted rules for special access within the local network for interstate services. In that decision legally the FCC did not preempt the states on intrastate collocation. Rather, the FCC has imposed its collocation rule for interstate interconnection only. However, for all practical purposes it is probably too costly for carriers and service providers to differentiate between interstate and intrastate access arrangements.

A second constitutional principle has to be kept in mind. European policy can predominantly provide the legislative framework and provisions in a particular area. The administrative control and implementation remains with the Member States' institutions. We have no regulatory institution at the European level which can directly make a regulatory determination in an individual interconnection case. Such kind of regulatory action can only be executed by a Member State's national authority. There is one major exemption from this European constitutional principle which has some relevance in our interconnection context. The EU competition rules as formulated in Articles 85 and 86 of the EEC Treaty apply directly and throughout the Community. The competition rules of the Treaty can be applied directly by the Commission and by national administrative and judicial authorities. The competition rules have direct relevance to interconnection. According to their character, they are not deemed to regulate ex ante but to control and prohibit anticompetitive behaviour and abuse of dominant market positions. The relevance, range and consequences of applying the competition rules on interconnection issues will be considered in more depth in Section 6.4.3.3.

6.4.3 Policy instruments

Any European interconnect policy has to be developed in the current constitutional framework of the European Union. According to Art. 189 (1) EEC Treaty the Community institutions may exercise their regulatory powers by the following instruments:

> "in order to carry out their task the Council and the Commission shall, in accordance with the provisions of this Treaty, make regulations, issue directives, take decisions, make recommendations or deliver opinions".

Regulations are binding and directly applicable in all Member States (Scherer 1990), have the force of law without the need of transformation or confirmation by national authorities. *Directives* also create secondary Community law. Unlike regulations, however, they require transformation and implementation on the national levels before they become materially effective. *Recommendations* and *opinions* legally have a significantly different character. They do not have a binding force and therefore have more the character of policy declarations.

6.4.3.1 Directives as legislative instruments

In practice, European telecommunications policy has essentially been implemented by means of Community law directives. This holds for the regulatory approach of harmonising as well as liberalising the telecommunications sector. Community directives have either been based on Article 100 (a) of the EC Treaty or Article 90. The Commission has used its regulatory powers under Article 90 (3) to abolish exclusive rights of TOs. European legislation on interconnection can either be based on Article 100 (a) or the competition rules of the Treaty or on both. A priori there is no specific argument which excludes one way or the other. Any European interconnection legislation includes an element of harmonising national approaches and at the same time any interconnection legislation sets conditions for competition or regulates competition.

These considerations lead to our recommendation:

Recommendation 2:

European legislation on interconnection could be based upon both Art. 100 (a) and the competition rules of the Treaty. There is no a-priori reason why one or the other legal basis should be excluded or preferred.

Although Member States are obliged to implement Community law directives within the time schedule and limits imposed by the directives themselves, there is some weakness in this legislative approach to regulating the dynamics of competition in the sector. Directives are addressed to and binding upon the Member States. They do not

directly regulate the market behaviour of dominant TOs. Member States have to take care of the adaption of national laws. Member States, however, have a lot of discretion to decide which national authority will be in charge of the implementation, the implementation procedure and the legal quality of the national measure implementing a directive. Nevertheless, failure of a Member State to implement a directive as a whole or in part (within the time limit) constitutes a violation of the Treaty. This situation then can lead to an infringement proceeding, which in itself is a complicated procedural issue. The practical example of the services Directive which is not yet totally implemented in all Member States exhibits the shortcomings and weakness of the European legislative process in dealing with dynamic market and competition developments. This handicap of the European legislative process is of particular relevance in the context of interconnection regulation. As our empirical analysis shows, the way in which interconnection is regulated determines to a large degree the type, structure and success of competition in its initial stage. Proper interconnection regulation therefore is time-sensitive and should be provided in a reliable legal structure right from the beginning of competition. Furthermore, the regulatory regime should be able to react quickly and flexibly to shortcomings and problems.

6.4.3.2 Direct regulatory action

What has been described as a shortcoming or weakness of the current legislative approach in European telecommunications policy can only be overcome by some direct regulatory action on the European level in the current constitutional European environment. Direct administrative control and regulatory action is limited to measures implemented by the Member States' institutions. The Commission has no direct administrative regulatory control over TOs or other regulated entities. Whether or not this division of labour is going to change is a matter which cannot be addressed in the specific interconnection context. This has to be done in a broader context. However, interconnection, in particular in the context of Europe-wide carriers, is a regulatory issue which will call for direct regulatory intervention at the European level at some stage of development.

There is an ongoing debate in Europe whether or not there is a need for establishing a regulatory authority on the European level. The most significant contribution to this discussion in recent months has been made by the Bangemann expert group "Europe and the Global Information Society" which made its recommendations to the European Council on May 26, 1994. Besides pushing and arguing in favour of a more competitive environment in European telecommunications, the group also addresses the future organisation of regulation and recommends "... the establishment at the European level of an authority whose terms of reference will require a prompt attention". Concerning the scope of this authority's responsibility, the group states: "The authority will need to address: The regulation of those operations which, because of their Community-wide nature, need to be addressed at the European level, such as licensing, network interconnection when and where necessary ...". We fully support this view. The

implications of a constitutional change in the direction of establishing a European regulatory authority with direct administrative responsibility and power on the proper division of labour between the Community and the Member States needs further analysis and is not covered in this study in a comprehensive way. We do, however, feel in a position to recommend:

Recommendation 3:

If the upcoming discussion on the organisation of regulation in Europe leads to the creation of a European regulatory authority for telecommunications, then this authority should predominantly deal with all regulatory aspects of interconnection.

In this context of direct regulatory action on the European level the new provisions of the Maastricht Treaty on European Union (the Maastricht Treaty) on trans-European networks need specific consideration. As referred to in Section 6.2.3 the Maastricht Treaty gives a high priority to interconnection on the objective level. Article 129c also requires from the Community to "... implement any measures that may prove necessary to ensure the interoperability of the networks, in particular in the field of technical standardisation". This Treaty provision makes no explicit reference to the traditional regulatory legal instruments of the EC Treaty.[68] Further legal and political analysis should clarify whether the more unspecific term 'measures' might include direct regulatory actions and measures on interconnection.

6.4.3.3 Applying the competition rules

At present no regulatory authority exists at European level with jurisdiction to directly implement and enforce EC telecommunications law. The European Union can provide the political concept and the legislative framework, but the administrative control and implementation remains with the Member States. There is one major exception from this European constitutional principle. According to Art. 89 of the Treaty Establishing the European Community (EC Treaty) and pursuant to Council Regulation no.17 the Commission is entrusted with the supervision over and the effective implementation and enforcement of the EU competition rules as formulated in Articles 85 and 86 EC Treaty. These competition rules are directly applicable. They are not only invocable against Member States but also between private persons. Even though the EU competition rules are first of all directed towards undertakings, they also have to be respected by legislative, administrative and judicial authorities of the Member States.

As the competition rules in principle cover all areas of the economy, they are fully applicable to telecommunications. Nevertheless the application of EU competition law to undertakings in the telecommunications sector is a relatively new phenomenon. The

68 See Scherer (1993).

first formal decision was made by the Commission in 1982 in the *British-Telecom* case.[69] A prohibition in the satellite sector was issued in the *Astra* case in December 1992.[70] Further violations of EU competition law in the telecommunications sector have been resolved through the intervention of the Commission without formal decision.[71] In addition a series of cooperation agreements have been exempted from the prohibition of cartels by the Commission.[72]

A particularity of the telecommunications sector are the "Guidelines on the Application of the EEC Competition Rules on the Telecommunications sector" published by the Commission in September 1991.[73] It was the first time such guidelines have been drawn up for a specific economic sector. The Guidelines aim at clarifying the application of EU competition rules to market participants in the telecommunications sector. Of course, the guidelines do not create legally binding rules; however, they indicate the general legal and economic principles followed by the Commission in the application of the competition rules to undertakings in the telecommunications sector.[74] In the Guidelines the Commission comments on the relationship between the application of competition rules and ONP rules. Herewith ONP rules might harmonise and specify access conditions but they do not substitute competition rules in that field which means in the Commission's words:

> „ONP rules cannot be considered as competition rules which apply to States and/or to undertakings' behaviour. ONP and competition rules therefore constitute two different but coherent sets of rules. Hence, the competition rules have full application, even when all ONP rules have been adopted."

Theoretically the EU competition rules, being directly applicable, regulate the behaviour of market participants through their mere existence. Unlawful cartels and abuses of dominant positions are per se prohibited by Articles 85 and 86 EC Treaty without the need for any administrative decision. However, effective control and enforcement by the Commission are important to put the competition rules in concrete terms and into practical effect.

6.4.3.3.1 Elements of Articles 85 and 86 EC Treaty

Agreements between undertakings, decisions by associations of undertakings and concerted practices which may affect trade between Member States and which have as

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69 OJ No L 360/16, 21.12.1982, confirmed by the ECJ in case 41/83, Italy v. Commission, 20.3.1985, ECR [1985] pp.873 seq.

70 OJ No L 20/23, 28.1.1993.

71 For a short overview with further references see Ehlermann (1993), pp.134 seq. (141).

72 *ibid.*

73 Guidelines on the Application of EEC Competition Rules in the Telecommunications Sector (91/C 233/02) OJ No C 233/2, 6.9.1991.

74 See points 8 and 10 of the Guidelines.

their object or effect the prevention, restriction or distortion of competition within the common market are prohibited under Art. 85 EC Treaty.

According to Art. 86 EC Treaty the abuse by one or more undertakings of a dominant position within the common market or in a substantial part of it is prohibited in so far as it may affect trade between Member States.

a) Common prerequisites for the application of Art. 85 and 86 EC Treaty

Both Articles require that the behaviour may affect trade between Member States. Accordingly it is not necessary that the behaviour has in fact affected the trade between Member States. The potential of having such an effect is sufficient. As long as the potential effect is limited to the trade within the territory of a Member State the EU competition rules do not apply. However, if a cartel affects the whole market of a Member State, the import opportunities from other Member States will in general be influenced by this fact and thereby affect the trade between Member States.[75] It is not necessary that trade between Member States is directly affected. For the purpose of Art. 86 EC Treaty it is sufficient to show that there will be repercussions on the competitive structure of the Common Market.[76]

The EU competition rules are geared to the effect an anticompetitive behaviour will have on the Common Market. Hence, it is neither important whether the seat of the involved undertakings are within the territory of the EU or in a third country, nor whether the anticompetitive behaviour is aimed at markets within or outside the EU territory.[77]

Furthermore the effect of the anticompetitive behaviour on the trade between Member States must be noticeable.[78] Hence, according to the view of the Commission agreements of minor importance are not prohibited by Art. 85 EC Treaty. This constitutes an unwritten element of Art. 85 EC Treaty. To be considered as of minor importance the volume of the affected goods or services has to be no more than 5% of comparable goods or services in the Common Market and at the same time the cummulative annual turnover of the involved undertakings shall not exceed 200 Mio. ECU.[79]

To determine whether the effect of the anticompetitve behaviour under Art. 85 EC Treaty is noticeable or one or more undertakings hold a dominant position within the Common Market or in a substantial part of it within the meaning of Art. 86 EC Treaty it is necessary to define the relevant market with respect to its object and its geographical and temporal extension. It is often difficult to determine the relevant market with regard to the economically comparable products and its territoral

75 See e.g. ECJ, case 246/86, *Belasco v. Commission*, ECR [1989] pp. 2112 seq.
76 Guidelines, point 121.
77 Bieber(1993) pp. 348 and 361.
78 See ECJ, case 5/69, *Völk v. Vervaecke*, ECR [1969] p.295; case 209-215, 218/78, ECR [1980] p.3125; case 42/84, *Remia v. Commission*, ECR [1985] p.2545.
79 Announcement of the Commission of 3. September 1986, OJ No. C231/1986, p.2.

delimitation.[80] To hold a dominant position in a substantial part of the Common Market it is not necessary that the dominant position geographically extends to more than one Member State. Single, even small Member States are considered to form a substantial part of the Common Market. Parts of bigger Member States may also constitute a substatial part of the common market.[81] A product market comprises the totality of the products which are only to a limited extent interchangeable with other products in terms of price, usage and consumer preference. The competitive conditions and the structure of supply and demand on the market have to be taken into account as well.[82] In a context of fast-moving technology like telecommunications the relevant market definition is dynamic and variable.[83]

b) Art. 85 EC Treaty

The behaviour addressed by Art. 85 EC Treaty are agreements between undertakings, decisions by associations of undertakings and concerted practices. In general agreements between undertakings and decisions by associations of undertakings have contractual character,[84] but can also consist of gentleman's agreements.[85] By contrast, concerted practices are not based on any formal or informal agreement. They can be described as behaviour based on a voluntary deliberate correspondence of intention, and which in fact appears to be uniform.[86] An indication for concerted practices is a market behaviour of a competitor which does not correspond to the behaviour usually required by market conditions or the behaviour of competitors, but oriented at information about the future behaviour of competitors.[87] Not only those behaviours which take place between undertakings at the same economic (horizontal) level are covered by Art. 85 EC Treaty, but also those between undertakings at different economic (vertical) levels like producer and retailer.

Agreements or concerted practices must either have as their object the prevention, restriction or distortion of competition or must have such an effect. The aim to restrict or distort competition, even if not successful, is prohibited as well as to cause a restriction or distortion of competition, even unintentionally.[88] Examples of agreements and concerted practices capable to prevent, restrict or distort competition within the common market are given in Art. 85 para.1 lit. a-e EC Treaty.

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80 E.g. for the market of vitamin products the Commission considered every vitamin group as a separate market (see decision of the Commission, OJ No.L223/1976, p.27, confirmed by ECJ, case 85/76, *Hoffmann-La Roche v. Commission*, ECR [1979] p.461); concerning the territorial limitation of the relevant market the Commission considered the Netherlands as a substantial part of the common market in the field of supply with oil (see decision of the Commission OJ No. L223/77, overruled by ECJ, case 77/77, *BP v. Commission*, ECR [1978] p.1513; see also ECJ, case 247/86, *ALCATEL v. NOVASAM*, ECR [1988], p.5987).

81 See N. Koch(1950), Art. 86, No 41 with further references to CEC and ECJ practice.

82 Guidelines, point 26.

83 Guidelines, point 25.

84 R. Bieber(1993) p.347.

85 ECJ, case 41/69, *Chemiefarma v. Commission*, ECR [1970] p.661.

86 R. Bieber(1993). at p.347.

87 ibid.

88 ibid.

In principle interconnection agreements are agreements within the meaning of Art. 85 EC Treaty. Interconnection agreements could have the potential to avoid or restrict competition; on the other hand they are necessary to allow competition and to ensure interconnectivity and interoperability. This means that interconnection agreements cannot be prohibited per se. Only specific provisions can restrict or distort competition. Hence, in entering into an interconnection agreement, the parties are not allowed to include clauses which are designed to or may have by their content a negative effect on competition. They are therefore not allowed to agree on prices which they will charge to their respective customers (Art. 85 para.1 (a) EC Treaty), to agree upon conditions of use designed to limit or control production or technical development (Art. 85 para.1 (b) EC Treaty), to share the market of supply for their respective services (Art. 85 para.1 (c) EC Treaty), to discriminate other competitors (Art. 85 para.1 (d) EC Treaty) or to provide unbundled services only (Art. 85 para.1 (e) EC Treaty).

c) Art. 86 EC Treaty

The behaviour addressed by Art. 86 EC Treaty are abuses of a dominant position by one or more undertakings. According to Art. 86 lit. a-d EC Treaty such abuse may, in particular, consist in directly or indirectly imposing unfair purchasing or selling prices or other unfair trading conditions; limiting production, markets or technical development to the prejudice of consumers; applying dissimilar conditions to equivalent transactions with other trading parties, thereby placing them at a competitive disadvantage; and making the conclusion of contracts subject to acceptance by the other parties of supplementary obligations which, by their nature or according to commercial usage, have no connection with the subject of such contracts.

What constitutes a dominant position is not defined by Art. 86 EC Treaty. A dominant position is not only dependent on the market share, but also on other factors like number of competitors, market behaviour, access to raw material, technical know how, capital resources , etc. One can say that undertakings are in a dominant position if they have room for independent behaviour which enables them to act with no consideration for their competitors, customers or suppliers. In particular this is the case if their market share, the availability of technical know how, raw material or capital enable them to determine the prices for a major part of the products or enables them to control production or distribution. An absolute domination is not necessary. It is sufficient that the undertaking is in a position to prevent an effective competition. The reason for the dominant position does not matter. Therefore Art. 86 EC Treaty applies even if the competition on a specific market is excluded because of legal reasons.[89]

Insofar as TOs hold exclusive or special rights for some telecommunications services, they hold a dominant position with respect to those services.[90] They will not lose this

89 ibid.

90 See Guidelines point 79, with reference to Commission Decision 82/861/EEC in the 'British Telecommunications' case, point 26, OJ No L 360, 21.12.1982, p.36, confirmed in the Judgement of 20.3.1985 in Case 41/83, Italian Republic v. Commission [1985] ECR 873.

dominant market position at least in the first phase of competition independent of whether or not they lose their exclusive or special rights. Applied to the interconnection problem this means that holders of national network monopolies always hold a dominant position as far as access and conditions of access to the network are concerned. Even after the elimination of those exclusive rights, TOs may keep or other firms may acquire alone or collectively important market shares which either in themselves suffice to constitute a dominant position or could do so in combination with other factors, like technological advance and the holding of the information concerning access protocols or interfaces necessary to ensure interoperability of software or hardware.[91]

Examples of abuses of a dominant undertaking are refusal to supply, discrimination, restrictive tying clauses, unfair prices or other inequitable conditions.[92] The refusal of a dominant network operator to interconnect would, in the case of bottleneck facilities, make it impossible or at least appreciably difficult for others to provide telecommunication services. Such a behaviour would lead to a limitation of services and of technical developments within the meaning of Art. 86 (b) EC Treaty, and, if applied only to some service providers, result in discrimination (Art. 86 (c) EC Treaty). The imposition of unequal interconnection charges to service providers, which includes the incumbent network operators themselves, can be considered as imposing unfair prices or trading conditions and thereby constitute an abuse under Art. 86 (a). The refusal to unbundle network services could be seen as imposition of supplementary obligations within the meaning of Art. 86 (d) EC Treaty.

6.4.3.3.2 Exemptions

a) Legal exemption under Art. 90 para.2 EC Treaty

Pursuant to Art. 90 para.2 EC Treaty the rules contained in the EC Treaty including the competition rules do not apply to undertakings entrusted with the operation of services of general economic interest insofar as their application does obstruct the performance, in law or in fact, of the particular tasks assigned to them and the development of trade is not affected by the non-application to such an extent as would be contrary to the interests of the Community.

b) Administrative exemption under Art. 83 para.3 EC Treaty

Exemptions from the prohibition of cartels can be granted by the Commission under Art. 85 para.3 EC Treaty, either in the form of individual exemptions or in the form of group exemptions. Pursuant to Art. 85 para.3 EC Treaty such exemptions can only be granted if the otherwise prohibited behaviour contributes to improving the production or distribution of goods or to promoting technical or economic progress, while allowing

91 Guidelines, points 80 and 81.
92 Guidelines, points 85 seq.

consumers a fair share of the resulting benefit and which does not impose on the undertakings concerned restrictions which are not indispensable to the attainment of these objectives, and does not afford such undertakings the possibility of eliminating competition in respect of a substantial part ot the products in question.

Whilst a specific group exemption has not yet been granted in the telecommunications sector, there has been a series of individual exemptions. Examples are the exemption of the cooperation between Alcatel and ANT in the satellite sector,[93] the exemption of the joint-venture Eirpage in Ireland founded by Telecom and Motorola[94] or the comfort letter for Infonet in which inter alia participate five European telecommunications organisations.[95] (The Commission has announced in December 1992 to approve the cooperation between STET and AT&T.[96] Most recently the Commission granted an exemption/declared as not prohibited by EU competition rules the joint venture of British Telecommunications PLC and MCI Communications Inc.[97])

From an exemption under Art. 85 para.3 EC Treaty we have to distinguish the negative-test pursuant to Art.2 of Council Regulation No.17 whereby the Commission can declare that a particular behaviour is not prohibited by EU competition rules. Such a declaration was made in the case of the syndicate ECR 900 for the development of a European mobile telecommunications system.[98]

Under Art. 86 EC Treaty no exemption is possible for the abuse of a dominant position. Only a declaration by the Commission pursuant to Art.2 of Council Regulation No.17 is possible (negative-test).

6.4.3.3.3 Legal consequences of violation

According to Art. 86 para.2 EC Treaty any agreements or decisions prohibited pursuant this Article shall automatically be void. This effect follows directly from this Article without any administrative or judicial decision. By contrast Art. 86 EC Treaty does not contain any legal consequences for a violation. However, it follows from Art. 1 of Council Regulation No.17/62 that Art. 86 EC Treaty like Art. 85 EC Treaty has direct effect. Legal consequences from a violation, apart from Commisison intervention, result directly from national law. After a violation of the competition rules has been established, the Commission under Council Regulation No.17/62 is empowered to issue orders of redress and to impose coercive enforcement penalties and fines.

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93 20. Competition report [1990], points 59 and 94.
94 20. Competition report [1990], point 60; 21. Competition report [1991], points 80 seq.
95 Publication according to Art.19 para.3 Council Regulation No. 17, OJ No. C7/3 of 11. January 1992.
96 OJ No. C333/3 of 17. December 1992
97 The Wall Street Journal Europe, 29. July 1994.
98 20. Competition report [1990], point 59 and 94.

6.4.3.3.4 Conclusion

The competition rules of the EC Treaty directly apply to most of the interconnection problems. The advantage of „regulation" through competition rules is their unified application throughout the Community by the Commission. However, their effect is limited by their scope of application and the aim to provide for fair competition. They are not designed to achieve other objectives and are no substitute for establishing a comprehensive set of rules for interconnection equally applicable to all players. As a matter of fact, most interconnection agreements have to meet the criteria of the competition rules of the EC Treaty. This also means these provisions empower the Commission to enforce these rules with regard to interconnection if it comes to the conclusion that specific interconnection agreements violate the competition rules.

We thus recommend:

Recommendation 4:

4.1 The Commission should enforce the competition rules if it comes to the conclusion that specific provisions in particular interconnection agreements violate these rules.

4.2 Enforcement activities should be concentrated on interconnection cases with direct relevance for European-wide networks and services.

4.3 Applying the European competition rules might also be regarded as a European policy instrument in case a Member State has not yet (properly) implemented a European legislation on interconnection.

4.4 Competition policy should act against collusive behaviour of interconnecting parties, the refusal of a dominant network operator to interconnect, discrimination, unfair pricing for interconnection and the refusal to unbundle network services.

6.4.3.4 Other policy instruments

6.4.3.4.1 Standardisation policy

Standardisation, at least the actual development of standards, more and more is leaving the regulatory domain. Industry bodies and institutions (in Europe the ETSI institute) more and more play the central role in standardisation. Three basic functions remain with the regulator. First, there is structuring the standardisation process including standardisation bodies and their decision making process. Second, the regulator must be active in identifying areas where standards are helpful and necessary to support public policy objectives and accordingly he should be prepared to initiate the

development of standards in particular areas, for instance by mandating standardisation bodies to develop specific standards. Third, the regulator should reserve the right to promote particular standards developed by industry organisations. At the margin this responsibility should include the right to make standards mandatory in exceptional cases where there is specific need for such a far reaching policy measure.

All the policy tools and instruments mentioned above are at the disposal of the Commission. Most relevant in the interconnection context is the possibility to mandate ETSI to develop standards which are required for interconnection purposes or which would ease interconnection. We do not see any need for new institutional solutions with particular regard to interconnection.

6.4.3.4.2 Information policy

The more competitive the European telecommunications market becomes, the more numerous interconnection arrangements will emerge by agreement or by regulatory determination. In the UK for example dozens of interconnection agreements have been negotiated. Because the incumbent TOs are at the centre of most interconnection arrangements they are best informed on the content of interconnection agreements. That is one of the reasons why we favour a policy of public access to interconnection agreements.[99] Even if in the future there is public access to agreements, it would be difficult for new competitors to evaluate hundreds of interconnection agreements. The interconnection process could be rationalised and the market asymmetry could be partially compensated if NRAs at the national level and the Commission at the European level would publish information on the structure and content of interconnection agreements.

6.4.3.4.3 Arbitration at the European level

Together with fully opening up the European telecommunications markets and the development of trans-European networks, the number of cases where operators want to get access to networks in other Member States will be increasing. If the European interconnection framework is not specified in more detail, commercial negotiations on such interconnection arrangements might fail. Given the trans-national implications of such interconnection cases, a newly established European arbitration mechanism might be introduced to bring such unresolved interconnection disputes to a fair and efficient outcome.

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99 See Section 6.4.5.11.

6.4.4 Policy options

We see two major policy options that the Commission may choose. The first policy option would mainly rely on the interconnect policy model developed in the proposed voice telephony Directive. Under the second policy option, the Community would develop a comprehensive interconnect policy in the ONP framework.

The first policy option would regard the current elements of a European interconnect policy including the interconnect model in the proposed voice telephony Directive as sufficient for developing a fully-competitive telecommunications market in Europe. Because the current European interconnect framework mainly refers to regulatory principles and commercial negotiations, this approach misses a lot of opportunities to develop quite different national regulatory policy models for interconnection. Network operators may find quite different national environments under which they gain access to other networks. One cannot exclude that such differences cause barriers to fair and efficient interconnection, mainly with regard to European-wide networks and services. A more positive or neutral view of this policy option would regard the existing European interconnect policy framework as an initial framework. That framework might be the regulatory starting point under which interconnection and interconnection agreements are supposed to develop. Under this view, the initial framework might be adapted or detailed according to experience made with it.

The interconnect rules of the voice telephony Directive do not apply to the direct interconnection of different mobile networks within a Member State and between Member States. Concerning fixed network interconnection, the Directive at least leaves some uncertainty as to which interconnection cases it applies and which are not covered. If it really does not apply to the interconnection of fixed networks within a Member State, the most important case for emerging network competition is excluded. Furthermore the Directive only deals with interconnection for voice telephony networks and services. Although these are or will be the most relevant cases, interconnection with or between other types of networks will become a more important issue in the future.

Given the essential importance of interconnection for developing a successful approach towards competition and given the numerous issues which have to be addressed, there are good reasons to develop a comprehensive European legislation towards interconnection. Furthermore, interconnection of networks is a broader issue than interconnection to the voice telephony networks of the TOs.

We thus clearly recommend the second policy option:

Recommendation 5:

5.1 European policy should develop comprehensive legislation towards interconnection which does not only deal with interconnection to the TOs' voice telephony networks.

5.2 Concerning voice telephony, this legislation should include the following interconnection cases not yet covered by the voice telephony Directive:

(a) Interconnection between two mobile telephony networks within the same Member State;

(b) interconnection between two fixed public telephone networks within the same Member State;

(c) interconnection between mobile networks from different Member States.

6.4.5 Elements of a comprehensive European interconnect policy

6.4.5.1 Granting the right to interconnection

In Chapter 3 we developed and supported the position that the externality argument and remaining economies of scale and scope in telecommunications networks require mandatory interconnection to overcome the aspect of interconnection as a bottleneck input and to reach a socially desirable degree of competition. The proper regulatory category to handle this issue is to grant a right to interconnection to interconnectors and correspondingly to oblige operators to provide interconnection (duty to interconnect). Given the essential economic importance of interconnection the right to interconnect should be given the highest legal standard. We therefore recommend:

Recommendation 6:

6.1 European legislation should require the right to interconnect and the obligation to provide interconnection in all relevant cases.

6.2 This legislation should be implemented in Member States, preferably in the national telecommunications laws.

6.3 The right to interconnect should be specified by regulatory rules set by NRAs and/or by the licences which are granted to network operators.

To deal with the complexities of the issue, granting the right to interconnection has to be specified with regard to the following aspects:

- Which operator has a right, which operator has an obligation to interconnect ?
- Under what conditions and circumstances can the right and obligation to interconnect be restricted ?
- At what points should interconnection be required ?

6.4.5.1.1 Which operator has a right, which operator an obligation to interconnect?

Because of the widespread network externalities in telecommunications the interconnection of networks generally is in the interest of telecommunications users. Therefore each network operator should have the right to interconnect its facilities to networks of other operators. Regulators should not erect any general barriers to interconnection arrangements. This should not necessarily mean that each network operator automatically should be obliged to provide interconnection. This obligation should be oriented to market position and the bottleneck properties of the corresponding network or network facilities. This consideration leads to our recommendation:

Recommendation 7:

7.1 There should be no general regulatory barrier preventing network operators and service providers from entering into interconnection agreements with each other.

7.2 Network operators endowed with a special or exclusive right creating bottleneck facilities, or having a dominant market position due to actual control over bottleneck facilities, should be obliged to provide interconnection for these bottleneck facilities to other network operators and service providers.

7.3 If service providers in future gain dominant market positions due to actual control over bottleneck facilities, these service providers should be obliged to provide interconnection for these bottleneck facilities to network operators and other service providers.

7.4 These principles should be set by European legislation, and specified case by case by the NRAs in granting licences to network operators.

It is our view that at the legislative level the right and duty to interconnect should not be formulated according to (case by case) interconnection scenarios but by a general principle as we are suggesting here. The interconnection scenarios as mentioned in the voice telephony Directive undoubtedly are covered by the principle developed here.

6.4.5.1.2 Under what conditions and circumstances can the right and obligation to interconnect be restricted?

In our evaluation in Chapters 2 and 4 we did not find that meeting the essential requirements of ONP necessitates any a priori restriction on network interconnection. There seem to be feasible solutions to deal with essential requirements on a contract basis in particular with regard to security of network operations and maintenance of network integrity. Negotiating parties should only be obliged to find appropriate solutions to meet essential requirements.

In Section 3.2.6 we have developed the case where some user groups may not have an interest to be interconnected with others or with other networks. Such communities of interest not to be (reciprocally) interconnected should be protected in justified cases even if the other criteria as mentioned in Section 6.4.5.1.1 are met. This leads to the recommendation:

Recommendation 8:

8.1 European legislation should permit communities of interest in cases in which there is little or no demand by others for interconnection or in which there is sufficient public interest in not interconnecting to justify an exemption from the general interconnection requirement.

8.2 NRAs should make case-by-case decisions on such requests based on published decision criteria, in particular those based on competition law.

6.4.5.1.3 At what points should interconnection be required ?

In Section 4.2.3.4 we have argued that the regulator is not well positioned to determine the proper location of interconnection points. On the other hand, the right to interconnect only becomes meaningful in direct relation to the level or the areas where interconnection is possible. The overall structure of interconnection also defines the type and structure of competition which is possible. To give an example: If there is only one point of interconnection available for access to a national telephone network, then there might be competition for international traffic to and from that Member State but it is not possible to compete against the TO of that Member State with regard to national traffic. The regulator therefore at least has to define and set a general principle on the structure of the network where to interconnect.

Our empirical analysis of countries who have introduced fixed network competition shows that most regulators have been directly involved in defining the overall structure of the points of interconnection. In the U.S., the LATA concept was developed, in Japan the MFT required one point of interconnection per prefecture, in Australia the regulator required interconnection at the local charging area. Providing efficient interconnection in this context is related to existing and future network structures. If these considerations

were currently applied in Europe quite different national solutions would seem to be optimal. Very different solutions would not favour crossborder competition in Europe. On the other hand, imposing a common solution for points of interconnection could cause significantly different burdens for TOs to implement. This area therefore needs further study.

Summarising, we thus recommend:

Recommendation 9:

9.1 European legislation should require that network operators who must provide interconnection should offer points of interconnection that maximise the benefits to telecommunications users and thereby optimise opportunities for competition.

9.2 The Commission should study whether the introduction of a common structure for network interconnection based on sub-national geographical units is a feasible and useful approach.

6.4.5.2 Develop a framework for negotiation

In Section 4.3 we have developed a model of the proper regulatory involvement in bringing about interconnection agreements. According to this model the NRA should set some ex-ante conditions for negotiations on interconnection agreements between interested parties, leave major issues for negotiation, facilitate negotiations, arbitrate if negotiations are in danger of failing and be prepared to make a determination if negotiations have totally failed. Most of these regulatory actions are case-by-case interventions which therefore typically fall into the responsibility of the NRA. However, it makes sense to harmonise those interconnection issues which should be ex ante determined by the NRA and which function as a framework for negotiation.

We thus recommend:

Recommendation 10:

10.1 European legislation on interconnection should identify those issues which should be determined ex ante by the NRA.

10.2 Ex-ante determinations should deal with the following interconnection issues:

- The right to interconnection of network operators and service providers to designated telecommunications networks.
- Principles that the NRA applies for the determination of interconnection charges as well as of access charges if they are used.
- The cost accounting methodology to be used by the TO so that the relevant cost standard can be applied.
- Provision of equal access and collocation.
- Conditions of numbering.
- Rules regarding publication of all or a selected range of the terms in interconnection agreements.
- Technical standards for interconnection if applicable.

Most of these issues are covered in more detail in the following. This approach gives the necessary flexibility for NRAs to set those conditions which follow directly from the specific national requirements. On the other hand, the structure and conditions of interconnection arrangements will have some major common features across Europe.

A further effort to harmonise the structure and content of interconnection agreements could be made by identifying those issues which should be covered by the agreements but which are not determined ex ante by the NRA. Identifying those issues serves as a guide to the negotiationg parties and may serve as a facilitation of negotiating with no legally binding requirement.

We recommend:

Recommendation 11:

11.1 To harmonise the structure and content of interconnection agreements, European legislation on interconnection should give some guidance on issues upon which negotiating parties should agree without being legally binding to them.

11.2 Agenda items for negotiations and agreements should be the following ones:

- Concrete structure and level of interconnection charges.
- Changes of interconnection charges over time.
- Locations of the points of interconnection.
- Concrete technical realisation of interconnection.
- Quality of interconnection services.
- Access to ancillary and supplementary services.
- The precise set of signalling functionalities to be provided by the interconnection providing carrier.
- Network management, forecasting of traffic flow, provisioning.
- Measures for meeting essential requirements (network security, network integrity, interoperability of services, protection of data).
- Intellectual property rights.
- Liability and indemnity.
- The method of dispute resolution procedure to be used before a determination by the regulator could be requested.
- Dates and time periods for carrying out agreement, duration and renegotiation of agreement.

6.4.5.3 Define a set of regulatory interventions to make the negotiations approach successful

Besides making the ex-ante determinations referred to in 6.4.5.2 we strongly support the approach that regulators rely on negotiations to bring interconnection agreements about. The (typically) asymmetric market and negotiation position between incumbent TOs and interconnectors we have shown in Section 4.3 as well as our case studies in Chapter 5 strongly support the view that regulators should reserve the right to make ex-post determinations on major interconnection issues to make the negotiations approach successful. We therefore recommend:

Recommendation 12:

European legislation should require that NRAs have the right and the responsibility to make ex-post determinations on major interconnection issues if negotiations between interested parties fail.

One should normally expect that negotiations are successful and lead to interconnection agreements. These agreements will have to meet mandatory requirements set by the RA. The regulatory framework then has to provide a proper mechanism for control. To our mind, interconnection agreements should obtain approval from the NRA before they become effective. This strong regulatory involvement should be limited to the subset of agreements where TOs have an obligation to provide interconnection. All other interconnection agreements should only be subject to ex-post oversight according to competition law criteria. We thus recommend:

Recommendation 13:

13.1 European legislation should require that NRAs, before they become effective, approve all interconnection agreements involving network operators that are under the obligation to provide interconnection. Other interconnection agreements would only be subject to ex-post oversight according to competition law.

13.2 Approval of interconnection agreements should be made dependent on their compliance with requirements set ex ante by the NRA and their consistency with general competition policy standards.

13.3 In case it refuses to approve an interconnection agreement, the NRA should provide for a mechanism (renegotiation, determination by the NRA) for the elimination or modification of the objectionable clauses.

Ex-post determinations on issues which should primarily be negotiated are the strongest type of regulatory intervention and should therefore only be regarded as ultima ratio. The regulator should be prepared to use „weaker" forms of interventions to facilitate negotiations and to make parties agree on interconnection.

The weaker form of intervention is arbitration. The regulator might, upon request by either party, try to facilitate negotiations by making suggestions of possible solutions. His or her pure presence in the negotiation process might also discipline negotiating parties and therefore facilitate negotiations.

Attempts by the regulator to arbitrate should be seen in the context of making determinations. Determinations should only be made after unsuccessful attempts to arbitrate. Furthermore, the regulator should set in advance a maximum time period within which an interconnection agreement has to be reached. We cannot define a

general and uniform rule on such a time period. This has to be a case-by-case decision of the NRA. The general principle, however, should be that this time period should not technically and economically hinder the network and business development of the interconnectors.

These suggestions define the following model of intervention:

Recommendation 14:

NRAs should facilitate negotiations by using these means and instruments:

(a) The NRA should set maximum time periods for negotiations in advance.

(b) Ex-post determinations should only be made after unsuccessful attempts to arbitrate.

(c) Arbitration should aim at avoiding determinations. The NRA should arbitrate upon request of either party.

We expect the number of interconnection cases to increase where an operator from one Member State wants to get access to the network of an operator in another Member State or where an operator wants to set up a Europe-wide network and therefore has to negotiate with many operators. Given the trans-national or European-wide implications of such interconnection cases we regard it as useful to set up a European arbitration mechanism for such interconnection cases. Either the negotiating parties or a NRA might request European arbitration. We thus recommend:

Recommendation 15:

An arbitration mechanism at the European level should be introduced to solve interconnection disputes

(a) between operators from different Member States,

(b) concerning European-wide network operations, and

(c) concerning national cases with significant European-wide implications.

6.4.5.4 Foster efforts to standardise interconnection interfaces.

We have dealt with standardisation issues extensively in Chapter 2. The availability of standards for interconnection interfaces makes it easier for interconnecting parties to agree on technical issues of interconnection. On the other hand, developing (common) standards is a time-consuming process. If interconnection of competing operators would only be feasible on the basis of European standards, then standards would have to be regarded as real bottlenecks to interconnection and competition.

However, we have seen in our country studies that access to interconnection interfaces can be agreed upon by negotiation. In most cases these access problems could be dealt with without regulatory intervention.

Our view is that mandatory standards for interconnection interfaces should be reserved only for services and technical components of networks for which the benefits of Union-wide harmonisation are very high. This would include communication technologies, such as GSM, designed for high geographic portability; network numbering systems; and emergency and directory services. In most other cases, standards reached through voluntary coordination are more likely to balance the gains from rapid innovation with the widest use of common interfaces. This would be in accordance with the principle of proportionality stated in the ONP framework Directive.[100]

Article 5(3) of the ONP framework Directive does provide for mandatory standardisation; however, present policy[101] of the Commission is that use of this provision should be limited to strictly necessary cases of ensuring basic interoperability and freedom of choice for users, subject to the principle of proportionality. Proportionality suggests there must be gross violations of basic interconnection requirements to justify a requirement for mandatory standardisation.

Thus, the general EU-position on standards regarding interfaces is that establishment of such technical standards should be promoted and published, where required in accordance with the provisions set forth in Art. 5(1) of the ONP framework Directive 9. Interface standards should only be made mandatory to the extent required by the leased lines Directive and the proposed voice telephony Directive. In all other cases, the principle of voluntary standards should apply.

Further specific Directives at Community level concerning interfaces are not deemed necessary, given that these are subject to strict supervision by NRAs to ensure full application of ONP-principles, and to the establishment of suitable dispute resolution and control procedures. The requirement of transparency implies that full access to interconnect agreements be given to the NRA's, and that the agreements be made available to the Commission on request. This allows discovery of cases for timely action of the Commission, as interconnect practices and markets evolve, and in our opinion is preferable to a purely non-empirical approach based on a priori principles of mandatory standardisation.

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100 Council Directive of 28 June 1990 on the establishment of the internal market for telecommunications services through the implementation of open network provision (90/387/EEC), OJ No L192, 24.7.1990, p.1.

101 As developed in the Green Paper on Mobile Communications.

We thus recommend:

Recommendation 16:

16.1 The Commission's policy of leaving most interfaces to be standardised by voluntary efforts strikes the appropriate balance between the gains from standardisation and the gains from innovation. We recommend this policy approach also for standards for interconnection interfaces.

16.2 Regulatory oversight of industry collaboration to develop standards will be required to guard against collusive behavior at the national and the European level.

16.3 For a limited set of interfaces - in principle, those required for Europe-wide services, emergency and directory services - the Commission should encourage development of standards and be prepared to make their implementation mandatory.

6.4.5.5 Favour a strategy of tariff rebalancing in the public voice telephony service.

This study is not dealing with tariff policy in telecommunications and the regulation of telephone tariffs. There is, however, at least one relation between interconnection pricing and voice telephony pricing which any coherent interconnect policy has to establish. One of the most significant competitive burdens for incumbent TOs can be an unbalanced tariff structure which does not prove to be efficient and viable in a competitive environment. Often enough pricing inflexibility is imposed by regulatory action. Typically, unbalanced rate structures developed under the guidance of regulators and/or policy makers emerge in a monopolistic environment and regulators are not able or willing to give incumbent TOs the necessary pricing flexibility in the emerging competitive situation. The main tariff distortion where regulators normally have problems in accepting tariff rebalancing occurs in the pricing of subscriber access to the network. It is a common phenomenon in most countries around the world that connection charges and monthly rental charges do not fully cover the costs of the local loop. These nonrecovered costs cause additional revenue requirements for usage sensitive parts of the tariff structure. We have dealt with this issue in Section 3.5.9. Some regulators do not hinder rebalancing in general but restrict its degree. As a consequence access charges may have to be introduced as a contribution element in the interconnect charges if these subsidies are significantly large and lead to a demonstrable competitive disadvantage of the incumbent.

Here we want to discuss the rationale of this regulatory policy approach to subsidise local access to the telephone network and want to develop our policy recommendation on this issue. The policy of maintaining low prices for network access historically served the objective of encouraging universal service in the sense of getting high penetration

rates of basic voice telephony in particular with regard to private households. With the achievement of nearly universal penetration this transfer policy from long-distance and international traffic loses much if not all of its justification.

Penetration rates[102] of voice telephony range from 25 to 60 in the European Union with an weighted average of about 45.[103] There is no doubt that countries above this average have reached nearly universal penetration and there is no economic need to generally subsidise local access. The only question arises, what will happen in these countries if connection and rental charges are increased to reach their cost covering level. Will subscribers to a significant degree disconnect from the telephone network and will penetration rates go down? All empirical evidence on price elasticities on access prices[104] and in countries where significant rebalancing has occured proves that that is not going to happen.[105] Such untargeted subsidies to inframarginal subscribers are economically inefficient. The universal service goal of regulators and/or their distributional concerns of protecting or subsidising specific user groups (like, for instance, low-income or elderly people) can be reached by targeted subsidies or subsidised prices for specific users at significant lower economic costs. Optional rate structures can be developed which keep the administrative costs of such price differentiation low and are more efficient than uniform tariff structures for local access. The costs of subsidising targeted customer groups, or, in general, particular non-economic services, should be covered by contributions from a Universal Service Fund. For details of a USF model we refer to Section 3.5.9.

Given the often significant tariff distortions, rate rebalancing normally cannot be realised in one step. It often will be more efficient to rebalance in several steps taking several years to be completed. A strategy of gradual rebalancing is, however, not an argument to postpone liberalisation until full rebalancing has been materialised. As pointed out in Section 3.5.9 TOs have comparative advantages over new entrants. If distortions are too significant, the instrument of access charges is available to equalise competitive conditions.

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102 Defined as main telephone lines per 100 population.

103 See: Towards Cost Orientation and the Adjustment of Pricing Structures, Communication from the Commission, SEC (92) 1050 final, 15. July 1992.

104 These elasticities are in the range of -0.05. Additionally, if one takes into consideration the cross elasticity effects between usage of the network and access to the network, then the net effect of rebalancing on total penetration might be negligible or even positive.

105 The UK and the U.S. are quite good examples.

From this analysis and observations we derive the following strong and important recommendation:

Recommendation 17:

17.1 The Commission and Member States should accelerate a strategy of tariff rebalancing and not accept permanent major local access losses.

17.2 Instead of generally subsidising local access, if regarded necessary, NRAs should arrange for social tariffs that provide targeted subsidies to marginal consumer groups. Preferably, social tariffs should be arranged within the framework of an optional tariff structure.

6.4.5.6 Set conditions for pricing of interconnection services.

We have pointed out in Chapter 3, and our empirical analysis strongly supports, that interconnect pricing is a key factor to determine the structure and the intensity of competition in the transformation process from a monopolistic market structure to effective competition. Interconnection charges can not only determine 50% and more of the new entrant's costs; they also to a significant degree determine his network structure and therefore overall competitive strategy. What might or should be done at the European level of regulation to reach an efficient outcome? Incumbents and new entrants often fail to reach an agreement in particular on interconnect pricing. At least for the initial phase of the transition to effective competition where the market positions are very asymmetric we recommended a strong role of the regulator.

First of all it has to be recognised that interconnect charging regimes are arrangements for individual customers. The more complex the market structures become in telecommunications and the more numerous interconnection agreements become the more we anticipate a tendency to standard price lists for interconnect services. Tendencies to regard interconnection as a TO's wholesale business can for instance already be observed in the UK. In the near future, however, the predominant pattern of interconnection will be customer-specific pricing. Interconnect charges therefore cannot be regarded as tariffs but as customer-specific prices.

Despite this main legal and economic difference, we feel that the ONP tariff principles developed in the framework Directive and specified in the leased lines and the voice telephony Directives are also relevant principles for any European regulation on interconnection. As required by the ONP framework Directive interconnect charges should be based on objective criteria, should be cost-based, must be transparent and non-discriminatory and they should be sufficiently unbundled.

Besides these general principles, regulatory guidelines to be set as conditions for interconnection agreements have to be specified in a more detailed way. On the other

hand, as analysed in Chapter 4, pricing in detail should be left to commercial negotiations between interconnector and competitors.

We have dealt with the proper interconnect pricing in detail from the economic perspective in Section 3.5 and from the regulatory perspective in Section 4.2. In summary, there we have given preference to the following pricing model:

1. Interconnection charges should be based on the incremental cost of the service used for interconnection.

2. Markups on incremental costs to cover overhead and common costs should be allowed.

3. Costs of conditioning the incumbent network for competition should not be considered part of the incremental costs of providing interconnection services to a specific interconnector; they should be recovered from the markup on all competitive services offered by the TO that provides interconnection.

4. According to the cost structure, interconnect charges may be differentiated in one-time payments or rentals and usage-related payments.

5. Given the cost structure of interconnect services capacity-based charges and peak-load pricing should be considered as efficient pricing options.

6. Optional nonlinear interconnection charges define an additional option for improving efficiency.

It is not our view that the regulator should a priori prescribe one of the pricing rules mentioned in (4) to (6). It should be a matter of negotiation between interested parties to agree on the pricing rules and structure in detail. The regulator might be forced to make a choice when negotiations fail and he has to make a determination.

As a general guidance we recommend the following regulatory rules towards interconnect pricing:

Recommendation 18:

18.1 European legislation should set the following principles with regard to interconnect pricing: Interconnection charges should be based on objective criteria, be cost-based, be transparent and non-discriminatory, and be sufficiently unbundled and economically efficient.

18.2 To facilitate negotiations NRAs should set upper and lower limits for interconnection charges.

18.3 The lower limit should be the long-run incremental cost of providing services used for interconnection. The upper limit should be the long-run incremental cost plus a markup that, when applied to each service, would lead to revenues sufficient to cover all revenue requirements of a TO.

18.4 If NRAs have to determine interconnection charges they should also set charges within these bounds, with neither the upper nor the lower limit being excluded from consideration.

18.5 Costs due to conditioning the incumbent TO's network for competition in a multi-carrier environment (measures to ensure network security and integrity, particular standardisation, introduction of equal access, changes in the numbering system) should be treated as common costs of all networks/services which are interconnected, including services offered by the incumbent.

6.4.5.7 Set a proper cost standard

When it comes to practice, any economic pricing recommendation has to rely on costs, and this holds in particular for cost-based pricing as we are recommending here. To be meaningful in practice for regulatory purposes the opalescent concept of costs has to be specified by a proper standard. We have dealt with this topic extensively in Chapters 3 and 4 and want to condense our analysis to a clear policy recommendation. First of all, long-run costs should be the relevant standard to be used. This standard has two implications: (1) It is forward looking. Historic costs are relevant only for determining the incumbent's budget constraint. (2) Long-run costs are mainly related to capacity. Depending on the problem to be addressed, two kinds of long-run costs have to be distinguished: stand alone and incremental costs. Although widely used by regulators[106], any fully distributed cost standard based on historic costs is arbitrary and

106 Also the ONP leased line and the voice telephony Directives basically rely on fully distributed cost allocation mechanisms.

inefficient when it comes to pricing. Furthermore, it is incompatible with effective competition.

When it comes to identification and control, not only theoretical correctness counts in regulation, practicability and feasibility in implementation is of equal importance. Activity based costing is the best method currently available to identify incremental costs at a sufficiently acceptable level. This costing methodology may not be available right away and may take time to implement. For this case, it would be advisable to use the information from engineering cost models that are routinely used in TOs for planning purposes.

We therefore clearly recommend:

Recommendation 19:

19.1 The relevant cost standard for regulatory purpose of interconnection pricing should be forward-looking long-run incremental costs.

19.2 This standard can be supported using information from Activity-Based Costing. If the existing costing system does not provide the proper cost information and its adaption requires time, information from engineering cost models (which should routinely be available in TOs) should be used.

6.4.5.8 Regulation of interconnect charges over time

The regulator is not only facing the issue of regulating an initial set of pricing, he or she also has to develop a strategy of price regulation over time. As we have pointed out in Chapter 4 regulation of prices should be a function of the emerging market structure and the effectiveness of competition. The more effective competitors on the retail level of telecommunications services become the more symmetric their market and to some extent their negotiation position towards the incumbent TOs. Such market structure change should more and more enable them to negotiate fair and competitive interconnect charges. Increasing competition in the long-distance retail market does not necessarily reduce the bottleneck or essential facility properties of the local network. The market power of incumbent TOs in this area decreases with alternatives to local access available to new entrants. Alternatives could be direct access to customers (bypass), competitive access providers or full scale competitive alternatives like cable and/or mobile networks. The more these alternatives are available the less the market power of incumbent TOs in offering interconnection. Because there are strong tendencies in this direction the question of a proper deregulation path for interconnect charges emerges.

We have argued in Section 3.5.8 that fixing cost-based interconnect charges should not be a proper regulatory strategy over time because it does not give TOs the right incentive to keep their costs down. With regard to this objective price-cap regulation

has advantages and sets better incentives. Furthermore, it provides more pricing flexibility. To avoid predatory interconnect pricing, this flexibility should initially be restricted. Instead of imposing lower bounds on prices our preferred approach is a separate basket for interconnect services. The more the market for interconnection develops, interconnect charges should be more and more deregulated by giving more pricing flexibility. Flexibility could be increased by setting or accepting a common basket for retail and interconnect services. In the end, interconnect charges should be totally deregulated and only be controlled via competition policy standards.

Summarising, we recommend:

Recommendation 20:

If the NRA has determined (initial) interconnection charges or if interconnection is offered by a TO as a standardised service offering, interconnection charges should be regulated by using a price-cap mechanism to give sufficient price setting flexibility.

6.4.5.9 Develop a universal service and access charge model

In other parts of the study we have already dealt with theoretical aspects of universal service and access charges. The telecommunications policy debate on this issue in Europe normally is broader. In Section 6.4.5.9.1 we will take up this broad discussion on USOs and develop recommendations regarding USOs that should have relevance in the interconnect framework. In Section 6.4.5.9.2 we will develop recommendations on the proper financing mechanisms for USOs. Access charges is only one of them and normally not the best. If access charges are introduced they raise a variety of implementation issues which we address in Section 6.4.5.9.3. In Section 6.4.5.9.4 we will develop and recommend a universal service and access charge strategy for the initial stages of competition. Finally, in Section 6.4.5.9.5 we identify government policy objectives that should not be allowed to give rise to compensation through access charges.

6.4.5.9.1 Identify or set universal service objectives and obligations in justified cases

This report is not so much concerned with the justification and scope of universal service obligations in general. This issue has been covered in more detail by Cave, Milne and Scanian (1994). Any successful interconnect policy, however, has to rely on policy answers on the USO issues to properly deal with the effects of interconnection on the fulfillment of USOs and the effects of USOs on interconnect pricing.

Cave et.al. (1994) found four policy objectives with regard to universal service which help to define the universal service issue:

1. universal geographic coverage,

2. universal residential access at geographically averaged prices,

3. widely subsidised access arising through an access deficit,

4. targeted phone subsidies.

Most of these issues are directly related to access pricing which we covered in Section 6.4.5.5. Despite significant cost differences relating to location, geographically averaged phone prices are a quite common universal service or pricing principle in the EU.[107] If these USOs are imposed on TOs, they are not viable in a competitive environment if they impose loss making services. This need not necessarily be the case. The financial burden of geographic coverage depends on the penetration of voice telephony in a particular country. Geographically averaged pricing for access can be realised at a profitable level of prices for the access service as a whole.

In the real world telephone companies face other obligations or restrictions imposed on them by governments and/or regulators than those regarded as USOs concerning voice telephony. These obligations can produce financial burdens and can bring them into a competitively disadvantageous position.

A few examples may shed some light on such public service obligations. Many telephone companies provide directory assistance services or public payphone services which do not cover the cost of providing those services. Because of regulatory constraints they are often hindered from offering these services on a profitable basis. The same holds for some emergency services. These telecommunications-related public service obligations which imply additional revenue requirements for voice telephony should be regarded in the same way as USOs for voice telephony. If they exceed a certain level of burden there should be contributions by competitors, preferably through the use of a USF.

This analysis leads to our recommendations:

Recommendation 21:

Telecommunications-related public service obligations should be treated as USOs in voice telephony.

107 It also has significant relevance for the U.S. See Borrows, Bernt, Lawton (1994).

6.4.5.9.2 Identify efficient financing mechanisms of USOs

In Section 3.2.7 we have identified different financing mechanisms for USOs and stated that the payment for USOs needs to have nothing to do with interconnection. The major alternatives to financing USOs via a component of interconnect charges called access charges are government subsidies, a levy on all telecommunications retail services and through internal subsidies by all service providers. We also have developed there the argument why access charges are not our preferred solution. In Section 4.2.2.5 we have developed a Universal Service Fund solution as our preferred approach. There seems to be no experience with USF models in Europe. The models put into place in the U.S. and in Australia, however, prove that this approach is feasible not only in theory but also in practice. Therefore we recommend:

Recommendation 22:

In any interconnection legislation the European Union should give preference to financing USOs via a Universal Service Fund system instead of access charges. The burden of proof should be on individual Member States that in their particular environment a USF system is not viable or feasible and other approaches might be necessary.

6.4.5.9.3 In case of financing USOs via access charges, identify access charge principles

If individual Member States decide in favour of applying access charge regimes, the question arises whether or not there is a need to set some common access charge principles across Europe. As we have seen in our international comparison, access charges have a significant impact on the competitive conditions of new entrants. We have seen that in the U.S. access charges for interstate traffic are uniform in the U.S. while access charges for intrastate traffic vary significantly. These differences are causing significant arbitrage problems. If competition on the European level becomes a reality, similar problems will arise in Europe if the national access charge regimes differ to some degree. Europe-wide competition and Europe-wide operators thus require harmonisation of access charges in the Member States. At a minimum, access charge regimes have to be harmonised.

The basic questions to be answered in any access charge regime are the following ones: Who should pay access charges? What is the proper payment structure? Which costs should be covered by access charges? How are these costs to be measured?

We recommend:

Recommendation 23:

23.1 If the European Union and/or individual Member States follow the policy of financing USOs via access charges, some common access charge principles should be set at the European level.

23.2 Access charges for financing USOs should be set in a fair, efficient and non-discriminatory way. They should be fully justified and meet the criterion of proportionality.

In the previous chapters and sections we have dealt with a variety of aspects which we want to summarise here. By paying access charges, competitors should contribute to USOs imposed on incumbent TOs. Some licensing approaches not only impose USOs on incumbents but also on newly licensed operators. It would be unfair and inefficient to impose public interest obligations on new entrants and at the same time force them to contribute to USOs imposed on TOs through access charges. Both approaches are regulatory alternatives. Therefore, new entrants who themselves have to fulfill universal service (or other public interest) obligations should be exempted from paying access charges.

The principle of efficiency with regard to access charges has to be specified because access charges themselves are a non-efficient solution. The adjusted principle requires access charges to be imposed in the least distortionary manner. Our international comparison has shown that access charges are implicitly or explicitly set as a charge per unit of interconnected traffic. In Section 3.5.9 we have discussed that lump-sum payments are more efficient than such traffic-related charges. A proper approximation of that principle might be charges based on the numbers of customers interconnected through presubscription.

6.4.5.9.4 Develop a comprehensive universal service and access charge strategy for the initial stages of competition

When competition is being introduced in the core business of telecommunications in an environment of a long-standing tradition of monopolistic market behaviour and strong political and/or regulatory intervention, a transitional model of regulation is useful and appropriate to deal with the inbalances and inefficiencies of the initial situation and the dynamics of the emerging competition. On the basis of our analysis and the evaluation of international experience the following strategy with regard to universal service and access charges seems to be appropriate: Potentially the major competitive burden for a TO might be an unbalanced rate structure in voice telephony. We have recommended not to maintain this situation but to accept or even foster a strategy of tariff rebalancing. Although rebalancing will take some time we do not recommend compensating TOs for

remaining access losses via access charges in the transition period. Otherwise, they might also lose incentives to increase efficiency in access services. The temporary competitive disadvantage can be accepted because at least in the initial phase of competition TOs are still enjoying advantages that competitors do not have. The same holds with other USOs. In the meantime the NRAs might rationalise their USO policy, develop USF solutions and take away non-telecommunications related burdens from TOs. In the meantime a methodology should be developed and applied to identify remaining costs of USOs and (potentially) resulting competitive disadvantages.

After a period of 3 to 5 years from the introduction of competition the NRAs should review the situation. In particular they should reconsider the decision not to introduce access charges. To our mind the initial decision might be revised if competition has become effective, the financial burden of USOs still is significant, a USF solution is not feasible and the TO is competitively disadvantaged by the situation. These prerequisites for introducing access charges might be different from Member State to Member State and have to be made operational for regulatory purposes. Developing common operational criteria could be done at the European level. NRAs then have to verify and to apply these criteria to come to a final conclusion. We cannot go too much into detail here and only want to give some indication that the criteria are operational and viable. Effectiveness of competition can be measured by the market share of competitors and by movements in market shares and in prices. The financial burden of USOs can be identified by proper cost accounting methodology. Whether or not a USF solution is feasible mainly is a question of political or regulatory decision making. The identification of a competitive disadvantage of the TO caused by the resulting situation seems to be more complicated. If the corresponding TO is financially in good shape and earns an appropriate rate of return on capital then there is some indication that the asymmetric regulatory burden of USOs are outweighed by competitive advantages not enjoyed by competitors. Then no (urgent) need for access charges arises. If the TO is in bad financial condition and earns an insufficient return on capital, the situation is more difficult to evaluate for the regulator. Such an outcome might result from the regulatory asymmetry. However, it might also be caused by poor competitive performance, less customer responsiveness or inefficiency in production.

Our overall recommendation on a European policy on access charges thus reads:

Recommendation 24:

24.1 An imbalanced tariff structure should not be considered as part of USOs.

24.2 Access charges designed to compensate the incumbent TO for the costs of imbalanced tariffs should not be included in interconnection charges initially, as rebalancing eliminates them over time.

24.3 Three to five years after the introduction of competition NRAs should review the situation and reconsider the decision not to provide for compensation for costs due to remaining imbalances of tariffs. Access charges should be introduced if competition has become effective, the corresponding financial burden of a TO still is significant, and the TO is competitively disadvantaged by the situation.

6.4.5.9.5 Reject as USOs certain government policy objectives

Telephone companies in Europe have been used by governments as policy instruments for a variety of policy objectives, none of which serve any telecommunications-related objective. A partial list of such objectives or interventions includes:

- Subsidising postal services.
- Holding of stocks of unprofitable public companies.
- Supporting national production of telecommunications equipment.
- Providing telecommunications services to government agencies or other public entities at no or reduced charges.
- Contributing to R&D and education above the level necessary for the business interest of telephone companies.

This list could easily be expanded. Such non-telecommunications-related burdens all have one common property: They increase the costs and/or the revenue requirements of TOs in the regulated business. TOs can make the argument that their competitors also should contribute to such obligations e.g., by paying access charges.

We recommend that the European Union not follow this line. Non-telecommunications-related financial burdens are from the economic point of view a specific tax on telecommunications services. Telecommunications is taxed for some general economic or political purpose. This approach is economically inefficient and hinders the deployment of telecommunications. Because there is no a priori limit in such type of non-telecommunications-related burdens quite different national attitudes could develop

as we can observe today. Quite different competitive conditions across Europe would be the result. We therefore recommend:

Recommendation 25:

A European interconnect policy should not allow non-telecommunications-related financial burdens to be compensated by access charges.

Telephone companies sometimes claim that asymmetric regulatory treatment (besides USOs and the above mentioned obligations) as compared to their competitors has to be taken into consideration when determining access charges. In this context often price regulation and line-of-business-restrictions are being mentioned. Such asymmetrically applied regulatory measures serve as competitive safeguards against the abuse of dominant market position. By definition it would be counterproductive to compensate TOs in one way or another for such type of asymmetric regulatory treatment.

Recommendation 26:

Access charges should not be used to compensate TOs for restrictions which are imposed on them to control or regulate their dominant market position.

6.4.5.10 Develop a strategy for equal access and collocation

The Commission should study how equal access for new competitors can be introduced in all Member States. In particular it should consider in which time frame a harmonised approach of realising equal access can be followed given the technological status of the telephone networks. The introduction of equal access should be mandatory throughout Europe because equal access is an essential prerequisite to get fair and efficient competition between network operators. This holds in particular given the vertically integrated structure of European TOs. The additional costs for the telecommunications system of introducing equal access capabilities should be kept sufficiently low by providing a reasonable time period to implement equal access. Given the international experiences and the status of telephone network digitisation an implementation period of four years for equal access capabilities for 80-90% of all access lines seems to be an upper bound. It should be subject to further study whether a shorter implementation period is feasible. This study should be undertaken as soon a possible. The sooner there is a binding decision on the European level on the introduction of equal access the sooner this prerequisite for fair and efficient competition can be realised.

We therefore recommend:

Recommendation 27:

27.1 The Commission should study the Europe-wide implementation of equal access. In this context, the standardisation for equal-access arrangements should be considered.

27.2 On the basis of these results a strategy of introducing equal access should be made mandatory for Member States as soon as possible. This strategy might imply different time paths depending on the status of network development in the Member States.

For operators that physically interconnect their facilities to another operator, physical collocation of terminating equipment is usually technically superior to virtual collocation at some distance from the switching point. From the regulatory point of view physical collocation should therefore be the benchmark. If only virtual collocation is provided interconnectors should be compensated for any loss in quality by a lower interconnection charge.

This leads to the following recommendation:

Recommendation 28:

28.1 European legislation should require that the incumbent TOs offer competitors physical collocation of their interconnecting equipment.

28.2 NRAs should accept equivalent virtual collocation as an alternative to physical collocation.

6.4.5.11 Public access to interconnection agreements

Our empirical analysis displayed a variety of approaches towards access of the public to interconnection agreements. These approaches are often based on the general legal regulatory or public policy tradition of a particular country and do not reflect specific telecommunications considerations. In some countries only NRAs have access to interconnection agreements. In others, full access is possible to interested parties. Sometimes not even regulators have access to the agreements.

Two basic principles seem to compete for a general policy approach. Regulatory transparency as well as a fair and level playing field requires full access of interested parties to interconnection agreements. On the other hand there might be proprietary information on a firm-specific basis which has to be protected for sound economic

reasons. One example could be some type of service innovation. A general approach has to bring these basic principles into the right balance. A procedural way of solving this conflict might look like the following: All interconnection agreements have to be registered with the NRA. The register may consist of a public and a confidential part. Network operators may request for material to be put in the confidential part of the register. The regulator defines a set of elements in an interconnection agreement which have in any case to be made public. Furthermore the regulator defines and publishes criteria on his decision on public access. In any case it is obvious to us that the regulator should have mandatory access to interconnection agreements and not only in cases where negotiating parties fail to come to an agreement and he is being involved to reach or determine an agreement. Otherwise he is not able to fulfill his task of controlling whether actual agreements fit with his requirements and whether or not they include elements of collusive or discriminatory behaviour.

Given this analysis we therefore recommend:

Recommendation 29:

29.1 NRAs should have mandatory access to the full text of interconnection agreements.

29.2 Interested parties generally should have access to those agreements.

29.3 Parties of interconnection agreements should have the right to petition for confidentiality concerning specific documents before the NRA. The NRA should decide on such requests on the basis of published criteria.

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