

Interconnecting the Network of Networks

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A. The Breakdown of the Centralized Network and the Emergence of the Network of Networks

For more than a century, telecommunications around the world followed a classic model: a national monopoly owned or controlled by the state, centrally managed and providing a common public network. By their very nature and tradition, these networks provide a small number of standardized and nationwide services, carefully planned, methodically executed, and universally distributed. But over the past two decades, first in the United States and subsequently in much of the developed world, the forces of centrifugalism began to unravel this traditional system. In a series of steps, each controversial and painful, monopoly began to give way to the "network of networks."

The tension between the integrative and pluralistic forces is most pronounced on the front where they intersect: the rules of interconnection of the multiple hardware and software sub-networks and their access into the integrated whole. As various discrete networks grow, they must inter-operate in terms of technical standards, protocols, and boundaries. In the networks of networks, the *interconnection* of networks becomes critical. Control of interconnection by any entity, whether by government or by a private firm, is the key to the control of the telecommunications system itself. And open and competitive interconnection is the mark of truly open and competitive telecommunications markets.

The term "interconnection" covers a wide matrix of relations. On the physical level, that of connective *conduits*, they include linkages within and among various types of entities:

- traditional and alternative local telephone companies

- traditional and alternative long-distance carriers
- mobile and radio carriers
- domestic and international carriers
- dedicated networks of organizational and user groups
- telephone, computer, and video equipment
- computer local area and wide area networks
- cable television and broadcast networks

On the higher levels of *applications* and *content*, interconnection becomes an issue of access and interoperability of entities such as:

- enhanced (value-added) service providers
- data and information providers
- video program channels

B. Why Regulate Interconnection?

The diversity and complexity of the matrix of inter-relations among these participants raises the question why their interconnection should be an issue for public attention, any more than the relation among the various participants in the manufacturing, distribution, and service of automobiles or computers. Need government enter the picture? Is it necessary to mandate interconnection, or to establish markets in intermediate inputs, or to define rights and

obligations? There are two major explanations, each encompassing sub-rationales, which coexist uneasily.

1. The Anti-Monopoly Perspective

The most common explanation for the regulation of interconnection is that of monopoly power by an incumbent. Given the incumbent's head start of a full century, a new entrant cannot hope, it is argued to succeed as a stand-alone entity. Yet, the entrant must reach the customers of the incumbent and, in turn, be reachable by them. Even if the newcomer is more efficient than the incumbent, the inertia of the latter's customers will keep them where they are, thus giving the incumbent advantages of scale, scope, and positive network externalities. An alternative for an entrant would be to replicate a full-fledged, stand-alone, end-to-end rival network and tough it out until it has caught up with the incumbent in size and scope, but this is a much costlier and riskier strategy than gradual entry and roll-out. Thus, if one wants to encourage competition to a strong incumbent, one must accompany it with an assurance of interconnection. And if the survival of fledgling competition is at stake, this rationale can be expanded to justify interconnection on terms that are favorable to the entrant as an "infant company."

The anti-monopoly rationale is similar to the "*essential facility*" doctrine of antitrust cases in which exclusion of a rival from a critical element of service has been deemed an illegal act in restraint of trade. The essential facilities doctrine states that when facilities

cannot be practicably duplicated by potential competitors, those who control these facilities must allow them to be shared on fair terms.¹ Whenever, a company or companies establish a useful facility that is essential for rivals to survive, it (or they) must give access to the facilities on similar terms, if the “the admission of rivals is consistent with the legitimate purposes of the venture.”²

Closely related to the anti-monopoly argument is what might be called the *common carriage* rationale. A common carrier must provide service to any interested customer, even to its competitor. It must carry all traffic brought to it for carriage, whether from a small user or from a large one that aggregates the traffic of several users. The common carriage rationale is similar to that of the anti-monopoly explanation, but it does not logically permit an infant industry treatment of the entrant that is more favorable than that afforded to other users.

The flip side of the anti-monopoly rationale and its common carriage variant is that if a carrier had no market power, it would owe no interconnection or non-discrimination to anybody. In this case, the carrier is a normal commercial entity doing business as it sees fit. This seems quite reasonable, until one recognizes that this means an asymmetrical arrangement among carriers, because a small carrier can interconnect and reach a large carrier's customers, but not vice versa, because only the large carrier has market power. Similarly, the entrant can use the larger carrier whenever the latter has a service element that is cheaper or better, but when the entrant carrier itself has such superior service, it need not reciprocate unless it has achieved bottleneck power itself. This creates a “heads-I-win-tails-

¹Neale, Alan Derret, *The Antitrust Laws of the United States: A Study of Competition Enforced by Law, Second Edition*. New York: Cambridge Publishers, 1970, p.67.

²Areeda, Philip, “Essential Facilities: An Epithet in Need of Limiting Principles,” *Antitrust Law Journal*, 58:844, 1989.

you-lose situation.”

Furthermore, not only does this asymmetry skew competition, but also it is unstable. If there are no more interconnection rights when the bottleneck power of the incumbent is gone, then the determination of that point becomes all-important, and will no doubt be fiercely fought over. The question, after all, is not an easy one to answer conceptually or empirically, and may vary by location, service, customer class, and year. For example, suppose that one carrier has a national market share of 60%. Its rival is much smaller, but has 70% of San Francisco, and 80% of inter-airline communications. Who has market power? Who must grant interconnection to whom?

2. The Anti-Fragmentation Perspective

2. The anti-fragmentation perspective. Next to the anti-monopoly explanation, the other major rationale for the regulation of interconnection might be called the "anti-fragmentation" or the "network of networks" rationale. This view centers on the positive externalities of networks. There is a public interest in permitting customers of networks to link with each other via interconnection. Hence, interconnection is designed to provide an element of integration to the increasingly disparate network environment. Whereas monopoly carriers in the past provided such integration inside their own organizational sphere, now integration must take place across carriers. Information flows across numerous pathways, in a chain of transmission involving half a dozen carriers. Indeed, with packet switched communication, which may be the main-stay of much of future communications (e.g. by fast-

packet or cell-based asynchronous transfer mode(ATM communication), information between two points may travel simultaneously over a wide variety of paths. In such an environment, interconnection rules are a transaction-cost reducing arrangement, and as such are similar to transaction cost reducing arrangements in other parts of the economy, such as legal tender for currency, the law governing commercial paper, or the first sale doctrine. The interconnection rules may reduce some freedom of negotiation, but they also facilitate commerce and transactions. They establish symmetry in the treatment of various carriers, and eliminate continuous market power tests.

Today, the anti-monopoly and the anti-fragmentation views coexist uneasily, partly due to fuzzy regulatory thinking, but they have a very different perspective for the future. In the anti-monopoly view, the regulation of interconnection is an essentially transitional task that will fade away with the emergence of competition. Interconnection regulation will, therefore, become less important with time. In contrast, the anti-fragmentation rationale comes to the opposite conclusion. As open entry permits more and more carriers to offer services, the need for basic rules for their interaction becomes increasingly important if the overall network infrastructure is not to fragment into incompatible part-networks. The anti-monopoly view is asymmetric, requiring interconnection by large carriers, but not by their competitors. In contrast, the anti-fragmentation view is symmetrical, applying the principle of interconnection to all carriers.

The anti-fragmentation perspective is not without problems. Fundamentally, wouldn't competition and markets take care of interconnection by way of commercial agreements? This question is discussed further below.

Part of the problem is its chicken and egg nature: competition may make the regulation

of interconnection unnecessary, but without such regulation competitive market structures may never evolve.

C. Unbundling

Where does interconnection take the network system? It would be naive to imagine interconnection to be merely a convenience to a handful of new carriers without long-term implications.

Interconnection is fairly meaningless without reference to where interconnection would physically take place. If an incumbent network offers an entrant interconnection at a far-off point, little is resolved. For the old AT&T to offer MCI one interconnection point for MCI's total traffic in Miami and only there, MCI would not be left in a competitive position. What MCI wanted was interconnection at many intermediate points of AT&T's network, i.e., to have AT&T's services *unbundled*.

There are at least five reasons why an incumbent would not want to unbundle voluntarily:

1. Bundling forces a competitor to buy unneeded services to get needed ones, thus raising its operating costs.

2. Bundling is a tying action. It means that where market power exists in one component, it can be extended by bundling to a component where market power does not lie. It may be difficult to define whether two separate components in fact exist if markets in the

separate components could not emerge due to a required bundling.³

3. Bundling on the retail level against a competitor using a monopoly input on the wholesale level permits a price squeeze. The incumbent's retail bundled price could be set only a little higher than what it charges for its wholesale monopoly input, and less than the entrant's marginal cost for its own element. Its competitive element, in effect, would be subsidized by its monopoly element.

4. Bundling permits price discrimination based on utilization among users. IBM, for example, used to bundle its machines with a requirement contract for punch cards, which were priced above cost. This allowed it to charge high-volume users of its machines more than low-volume users.⁴

Regulators also have incentives to like bundled service. Among these is the practical preference for averaged rates. This can be done by bundling together the various service components into packages that are equally priced, even though the underlying costs might be different for different customers. Unbundling creates the potential for selective entry.⁵ Similarly, it becomes impossible to price discriminate between business customers and residential customers, which regulators in America have traditionally done.⁶

³Cornell, Nina W., "Economic Efficiency and Unbundling the Monopoly Bottleneck: Incompatible or Indispensable? A Response to the Economic Arguments made by Timothy J. Tardiff, Richard D. Emmerson, and Peter W. Huber on February 8, 1994 on Behalf of Pacific Bell in Docket R.93-04-003 and Docket I.93-04-002 of the California Public Utilities Commission." March 31, 1994.

⁴*International Business Machine Corporation v. United States*, 298 U.S. 131 (1936).

⁵Huber, Peter W. "Competition and Open Access in the Telecommunications Market of California," February 8, 1994, unpublished report.

⁶Huber, Peter W., "Competition and Open Access in the Telecommunications Market of California," February 8, 1994, unpublished report.

Unbundling does not mean that bundling is prohibited, but rather that components would also be available by themselves, where technically feasible with prices such that the sum of the components is similar to that for the bundled services, plus the extra cost of unbundling.

In a competitive environment, markets will determine the extent of bundling and unbundling that firms will offer, with some firms offering elements or a bundled basket (a "prix-fixe" menu), while others offering unbundled service("a la carte"). Since it will be inefficient to have a multiplicity of interconnection arrangements, interconnection arrangements will converge through competition. Interconnection "hubs," and one or more standards, will emerge by market forces.

Bundling is primarily a problem where market power exists.⁷ Absent fully competitive markets, there is room for some regulation of unbundling in order to make interconnection regulation meaningful because there is first the unbundling of the non-competitive network elements from the competitive ones. And second, the unbundling among the monopolistic network elements. Without unbundling requirements, interconnection rules will be undermined.

Among monopolistic source elements one approach to unbundling is to do so in advance. The second approach is to do so in response to requests by competitors. The first case would impose advance costs on the incumbent carrier, without demand for unbundled network components necessarily ever materializing. It would also require government intervention, based on some determination or prediction of what unbundled services will be

⁷Huber, Peter W. "Competition and Open Access in the Telecommunications Market of California," February 8, 1994, unpublished report.

required. It would have to be set administratively, ahead of demand, and subject to the inefficiencies of the administrative process. It is therefore not the preferred solution, outside of very schematic principles for unbundling.

On the other hand, relying on a competitor's request in order to initiate an unbundled service provides an incumbent with advance information about its competitor's plans and provides an opportunity for delay.⁸ In the ideal, unbundling would resemble the outcome of a market, yet without the loss of economies of integration. This, of course, is a tall order.

In America, when requested by interconnecting parties to mandate substantial unbundling, the government preceded at first only cautiously. The California Public Service Commission boldly stated in a proceeding that "Any carrier claim of economic unfeasibility generally will be rejected by this Commission."⁹ The Federal Communications Commission (FCC), in its 1990 order, adopted a demand driven step-by-step approach, arguing that "prudence requires that we permit the Bell Operating Companies (BOCs) network operations to digest Open Network Architecture (ONA)-inspired changes and the Enhanced Service Providers' (ESP) market response before considering any action to order more dramatic unbundling."¹⁰ Similarly, the FCC concluded that unbundling is "not a short term fix," but a

⁸Levin, Stanford "Local Exchange Competition and Interconnection Policy," in Appendix, September 1994, unpublished.

⁹Tardiff, Timothy J. and Richard D. Emmerson, *Economic Evaluation of OIR/OII on Open Access and Network Architecture Development*, Prepared for Pacific Bell. For submission to the California Utility Commission. February 8, 1994, p.61. unpublished report.

¹⁰In Re-filing and review of open network architecture plans, 5 FCC Rcd 3086 (1990).

"long term evolutionary process."¹¹

Local exchange companies have argued against mandatory unbundling where the network elements are not essential facilities.¹² US West, for example, opposes unbundling, arguing that it was tantamount to a nationalization of the network. Mandatory unbundling may lead to potentially expensive and unneeded unbundled service. Some of the debate over unbundling may be largely semantic, with some interpreting it as a requirement that no bundled services can be offered at all and others exaggerating the requirement to every screw and nut.

In some cases, where regulation among competitors is asymmetric, unbundling requirements may skew competition. For example, if a telephone common carrier competes with a cable television private carrier, and unbundling regulation applies only to common carriers, it will find its competitive strength weakened.

In 1996, the U.S. Congress included in its Telecommunications Act a provision requiring unbundling, to be specified by the FC. Later in 1996, the FCC required such an unbundling for the following segments: network interface devices, local loops, local and tandem switches (including all software features provided by such switches), interoffice transmission facilities, signaling and call-related database facilities, operations support systems and information, operator and directory assistance facilities.

¹¹Huber, Peter W., "Competition and Open Access in the Telecommunications Market of California," February 8 1994, unpublished report.

¹²Tardiff, Timothy J. and Richard D. Emmerson. *Economic Evaluation of OIR/OII on Open Access and Network Architecture Development*. Prepared for Pacific Bell. For submission to the California Utility Commission. February 8, 1994, unpublished report.

D. Reciprocity and Symmetry

Interconnection is a substitute for stand-alone provision. It is also a substitute for vertical integration and joint venturing. A vertically integrated firm has an internal interconnection, both in a technical and often a financial sense. However, these interconnection arrangements tend to be outside the regulatory environment. The phrase "tend to" is an important qualification. In the United States, the old vertically and horizontally integrated AT&T was subject to fairly elaborate financial (but not technical) interconnection arrangements, largely in order to maintain low local rates.

Whenever a monopolistic incumbent carrier is challenged by a competitive entrant, the question arises whether the latter should gain access to the monopoly's facilities in order to provide its own service. This is often referred to as *bottleneck access*.

The extent of the bottleneck facilities of a traditional telephone company is subject to dispute, but most people include in it: access to end users; end office switching; and control over operational features, such as numbering, signaling, and data bases that might be important for intelligent network operations. All of these can be duplicated, of course, but at substantial cost.

Bottleneck power does not mean that a company is necessarily huge. A tiny independent telephone company may have bottleneck powers in its service territory, if traffic density is low and duplication uneconomical. This means that the bottleneck can be largely an economic rather than a technical or legal barrier, and may mean simply that a newcomer

cannot enter profitably.

Bottleneck power is important for the issue of *reciprocity* between carriers with bottleneck power and those without it. Reciprocity has to be distinguished from symmetry. Reciprocity means that the same rules of interconnection apply in both directions, from the interconnection to the interconnected network and vice versa. Reciprocity would apply to an interconnection even when it is a small and powerless entrant interconnecting into a monopolistic incumbent. *Symmetry* is a related but different concept. It is an identity of treatment rather than of rules and principles. Thus, for example, the access charges that a network receives from an interconnection can be reciprocal in that both are determined by identical cost and pricing rules. However, the network with the higher cost might have a higher access charge, i.e., the charges might not be symmetrical.

The collaborative arrangement of interconnecting telephone carriers is usually a symmetrical or at least reciprocal arrangement. In contrast, an asymmetric arrangement usually exists where a new competitor wishes to interconnect into an incumbent network. It pays for access, but it is not being paid for reverse traffic. In time, the small newcomers may become sizeable and commercial arrangements may be negotiated between the two carriers in mutual self-interest. This, however, is not necessarily without problems, since one of its historic characteristics of interconnection among national or regional carriers has been a cartel-like behavior. This has been the case internationally through organizations such as the ITU or the European CEPT. It was similarly the case in the United States, within the tight collaborative arrangement of shared monopoly of small independent companies and the large AT&T.

The characteristic of collaborative interconnection is that the interconnection is at a high level of the switching hierarchy, often with a single "gateway" into which traffic terminates. Indeed, international traffic may be brought to the international gateway through a jointly owned and operated transoceanic cable. The trend is a move increasingly down in the hierarchy of interconnection. As discussed elsewhere in this article, a future interconnection point could migrate as low as a customer's "tele-mailbox", a node located on the premises or customers nearby serving several users. This would establish the option for carriers to operate almost completely stand-alone networks, coming together only on the very last segment.

Many disputes over interconnection are premised on the notion that interconnection traffic flow from the small entrants to the large incumbents. The logic is that the incumbents have a large subscriber base and must therefore be frequently accessed by the subscribers of the small new carriers. But this argument is flawed. True, a small entrant network is likely to have more out-of-network calls per subscriber. But the larger incumbent has more subscribers who would "export" calls. Assume, for example, two networks, Incumbent and Entrant, with a subscribership of 1000 and 100, respectively. Assume that each subscriber has an equal calling pattern, making 200 calls a month, with an equal probability of calling each subscriber, regardless of their network affiliation. A network will export calls (x_i), according to the probability of a call being an export call (P_{xi}), times the number of calls made on its network (C_i).

$$X_i = S_i P_{xi} C_i$$

For the incumbent I, this would be:

$$X_I = 1000 [100/(1000 + 100)] \times 200 = 18,889.$$

For entrant E, exports will be, similarly:

$$X_E = 100 \times [1000/(1000 + 100)] \times 200 = 18,889.$$

Thus, there is a perfectly even call "trade-balance" between the two networks. When the out-calling probabilities per out-of-network subscriber are the same, the balance of trade is zero, a wash. This would be true whatever the relative or absolute size of the networks.

There would be no balance-of-traffic equilibrium if:

- (a) The calling frequency of one network is larger than that of the other, leading it to export more calls.
- (b) Callers on one network tend to call each other relatively more frequently than they call members of the other network, therefore exporting relatively less calls.
- (c) There is an asymmetric charge for exporting calls in one direction over the other.
- (d) There is a symmetric charge for exporting calls, and the users of one network are more price elastic.

New networks tend to appeal more to heavy telecom users, meeting condition (a). They export more, though not because they are small, but rather because they are usage-intensive. On the other hand, subscribers on a new network might also be more tied to each other, for example if they tend to be from the same industry, or if they share social links. For the new networks, the price of calling out-network is likely to be higher than calling in-network, for example due to an access charge, and such a higher price is asymmetric in one direction. A symmetric access charge for out-calling does not, by itself, lead one network to export less than the other, unless the price elasticities of its members is different. Conditions (c) and (d) seem more likely to exist for members of entrant networks. They explain why an incumbent would want to set both asymmetric and high access charges.

An even trade balance in terms of calls means that while an entrant may have to pay a large share of its revenues to the incumbent, it is also receiving a similarly large share, in terms of its revenues, from incoming calls from the incumbent's network. But where access charges are paid only to incumbents or where no outgoing calls from the incumbent are permissible, such balance would not exist.

Full symmetry in the interconnection charge in effect establishes the same system as exists in international settlements. The problem with that system is that a net traffic importing carrier will profit from having the other carrier pay high connection fees. The imbalance can be increased by charging one's own customers high prices, thereby discouraging outgoing calls and encouraging incoming calls as a substitute. To improve one's trade balance, one could reduce the out-calling frequencies of one's subscribers by raising the price on such calls. Charging a monopolistic price hence not only maximizes domestic profits but also helps one's international trade balance .

A relatively even balance of traffic makes the access charge less relevant. If it becomes a wash, it could be entirely dropped. However, symmetry is also a problem where cost characteristics differ. Suppose, for example, one carrier's network is geographically relatively compact and therefore operating at lower cost than the second carrier which covers a wide and low density territory. With symmetric access charges, the first network is likely to over-cover its cost, while the second may under cover it.

Furthermore, assuming symmetrical interconnection rules, who would they apply to? Who would have to offer interconnection to others? It seems likely that if there are any rules, they would apply to common carriers. Common carriers serve all willing users, and an interconnecting network can be viewed as just another user, albeit a large one. These common

carriers are also likely to seek interconnection themselves from some other carriers, and should, therefore, be held to symmetrical rules. Such reciprocity is also likely to enhance the quality of the interconnection debate among the various parties, because what one demands, one must also grant, and what one denies, one cannot request and still keep credibility. In today's dynamic telecommunications environment, every traditional incumbent is also a potential new entrant somewhere, and vice versa. Hence, extreme demands for interconnection terms by some parties would be tempered by the cost of having to offer similar terms to others.

It is more difficult to determine the arrangement for non-common carriers, such as private or contract carriers. Why wouldn't a private carrier offer interconnection into itself, assuming that the direct cost of such interconnection would be compensated? Presumably, a carrier would do so in order to restrict its own customers from being reached from the outside, or from permitting a rival network from offering its customers a wide-reaching service. Thus, a landlord owning a 'shared-tenant telephone service' on its premises and who deals with a long distance carrier whose service it resells to its tenants may want to prevent any other long-distance carrier to sign up its tenants.

E. Is the regulation of interconnection and unbundling necessary in a competitive market?

The notion of an invisible hand mechanism, the idea that out of numerous decentralized sub-optimizing actions there would emerge, without any central direction, some overall and

beneficial equilibrium, is perhaps Adam Smith's major insight as a philosopher.¹³ Its importance goes way beyond economics. Can electronic communications function in such a fashion, optimally arranging themselves in the absence of an overall plan or direction?

Applied to the interconnection issue, the fundamental question then is: In a competitive environment, is it still necessary to promote interconnection by government regulation, or will market forces provide it optimally?

Since interconnection regulation is particularly important in the early stages of transition to competition, does this mean that regulation will fade away later, as competition takes hold? This is partly a matter of whether competition fosters optimal interconnection, especially to small market participants. It is also a political matter, whether entitlement of favorable interconnection can be dislodged later. Once protective umbrellas are created, it is not easy to dispose of them even when market conditions have changed. For example, AT&T's long distance competitors, originally received some preferences in interconnection, partly because their interconnection was technically inferior, but also in order to help competition. A few years later, when "equal access" technology was widely deployed these arrangements were nevertheless difficult to dissolve.

The experience with interconnection around the world shows that interconnection is not made available freely by an incumbent to its competitors. On the other hand, interconnection is voluntarily initiated with collaborating carriers with which no competition exists, such as carriers in different countries or areas. Is it therefore possible that market forces would eventually lead to interconnection among competitors, too? To some extent this is a chicken-

¹³Adam Smith, *An Inquiry into the Nature and Causes of The Wealth of Nations*, 2 vols. Edwin Cannan (ed.). London: Methuen & Co., Ltd., 1904.

and-egg problem. Maybe competition among carriers could obviate a need for regulation of interconnection, but such competition may be suppressed by the absence of interconnection regulation in the first place.

Even where interconnection is mandated, if its terms are left to the parties' negotiation, it is frequently necessary for regulatory intervention to occur. This is not surprising, given the asymmetry in bargaining strength and in the urgency of need between the incumbent and the competitive entrant. It is for this reason that regulatory intervention in interconnection almost always occurs wherever a pro-competition policy for telecommunications is implemented. But the goal of such intervention is not invariably to help the entrant. To policy makers, just as important as advocacy of competition is the preservation of affordable service. The financial terms for interconnection charges become part of the universal service support mechanism.

The issues raised by an interconnection agreement are numerous, diverse and complex; providing ample room for disagreement. They include:

- * Points of connection
- * Interconnection links
- * Capacity provided
- * Quality
- * International arrangements
- * an alloy services such as operator and directory assistance
- * payments (connection charges, usage charges)
- * billing
- * numbering
- * force majeure

- * liability and compensation
- * confidentiality
- * review mechanisms
- * duration
- * default
- * dispute resolution

As a matter of empirical fact, interconnection is regulated everywhere competitive telecommunications exist. Even in New Zealand, which ostensibly is without telecommunications regulation, the courts and their interpretation of the laws of general competition are regulatory in everything but name. The difference is one of a general body or a specialized agency, and it is far from clear why a general body should be preferable.

Regulation had been essential to the old system, partly to protect against monopoly, partly to protect the monopoly itself. In the transition to competition, what was left of regulation was seen as temporary, shrinking reciprocally with the growth of competition. In time, it would diminish to nothing. Yet can one expect the network of networks to be totally self-regulating when it comes to interconnection? Economists generally hold that competition leads to higher efficiency and lower cost, in comparison to monopolies. Unchecked monopolies distort prices and provide poorer service than the competitive marketplace. But even to a free-market advocate like Milton Friedman there is a role for government, as the umpire establishing the rules, providing the means for changing them if necessary, protecting

property, and assuring contracts.¹⁴ Friedman recognizes the possible need for intervention in cases where voluntary exchange is either too costly or impossible cases, where externalities prevail, and in the case of "*natural monopoly*". "When technical conditions make a monopoly the natural outcome of competitive market forces, . . . there are only three alternatives that seem available: private monopoly, public monopoly, or public regulation." He writes that, "[the] choice of evils of private monopoly, public monopoly, and public regulation cannot, however, be made once and for all, independently of the factual circumstances. If the technical monopoly is of a service or commodity that is regarded as essential and if its monopoly power is sizable, even the short-run effects of private unregulated monopoly may not be tolerable, and either public regulation or ownership may be a lesser evil."¹⁵ Friedman is more pragmatic on the subject than some of his followers.

The question of a voluntary--i.e., contractual--granting interconnection is not whether it will be granted in the abstract, but rather at what price. There is likely to be an interconnection price high enough to be profit-maximizing to the incumbent. But can a competitor survive at such a price? Conversely, the FCC, in its 1996 Interconnection order, set a pricing principle (future marginal costs of a hypothetical best-practice network) that will make it difficult for incumbents to recover their past costs.

Why would an incumbent with bottleneck power, and in control of the access charge, set it to let an entrant survive? There are several situations:

- (a) When the entrant's efficiencies are great and can be extracted through an access

¹⁴Friedman, Milton. *Capitalism and Freedom*. Chicago: University of Chicago Press, 1962. p.8.

¹⁵Friedman, Milton. *Capitalism and Freedom*. Chicago: University of Chicago Press, 1962, pp. 27-29.

charge

(b) When the access charge can be used to hide high prices. Suppose, for example, that the monopoly price is politically not viable and is regulated to normal return. Instead, by letting a competitor in (which removes price regulation) and charging it an access charge that is high but not fatal, the incumbent in effect can raise the competitive price of the entrant by the access charge, and matches it. The deregulated competitive market price could therefore be *higher* than the deregulated monopolistic one.

(c) The major advantage for an incumbent from having an entrant is when the interconnection adds to its network's value. This is clear in the case where the two networks do not compete, such as with two national monopolies. In that case, collaboration is economically rational.

Other cases lie between the two extremes of full rivalry for the same customers in the same service and territory, and the case of total non-rivalry. A new mobile carrier, for example, competes with the incumbent, but it may also develop the market and bring a base of customers whose interconnection benefits the incumbents, too. Thus, once a new network has achieved a certain size, it becomes viable partner. This is the economic reason, historically, for the accommodation of AT&T with the presence of independent telcos earlier in this century.

Once no network has a bottleneck, or once the respective bottlenecks offset each other, networks collaborate. That is, the market will generate interconnection. The closer two networks are in terms of traffic and cost characteristics, the more incentives they have to interconnect with each other. They gain access to each other's subscribers, thereby making

their network more valuable. Ironically, the presence of interconnection can now create a problem of excessive collaboration. In the extreme competitors could establish a "clearinghouse arrangement", in which various carriers would pass on traffic to joint facilities that would mediate traffic among them. The historic danger of such clearinghouse associations become, in effect, cartel organizations that limit competition.¹⁶ The alternative is to segregate networks and to try to charge their own customers a higher price. But this works only if customers cannot shop among stand-alone networks and drive price down anyway, i.e., customers would have to be captive. Furthermore, one would have to prevent interconnection-firms. If a customer can subscribe to both networks, it is hard to prevent him from bridging them, and to offer such bridging service for a fee. This could be prevented only if the carrier can pick and choose among customers, and therefore prevent service to bridge providers. This means that there is both market power (or oligopolistic cooperation) to a market division in a segment, and no common-carriage rules against use and user-neutrality. If either of those conditions is not met, however, networks would not succeed in self-segregation to maintain high prices over their customers.

The response to excessive collaboration--aside from regular antitrust provisions--is to assure openness to still further competition. The main characteristic of a competitive market is not that more than one company serves it, but that prices and customers are contestable in practical terms. Hence, the presence of voluntary interconnection between carriers A and B cannot become a barrier--a collaborative bottleneck--to the entry and interconnection of C.

¹⁶David Gabel and David F. Weiman. "Historical Perspectives on Interconnection Between Competing Local Exchange Companies." November 1993. Revised June 1994. Columbia Institute for Tele-Information Working Paper Series #671, page 51.

Does this mean that need for the regulatory assurance of interconnection to everyone, even in the presence of multiple interconnecting carriers (because these might jointly like to avoid further entrants)? The answer is no. And the solution is the same principle of third-party neutrality (TPN) discussed before. That is, as long as no carrier can discriminate against its interconnecting partner carrier's customers, an exclusion become difficult and unlikely. All that is necessary is for carrier C to link up with B, and an interconnected D, and it can reach A.

F. Interconnection Under Competition: The Principle of Third Party Interconnection

Instead of the detailed price regulation, two principles suffice to establish rules-connection and thereby maintain integration in the networks of networks. If one carrier obtains interconnection into another as a *right*, as opposed to obtaining interconnection by a voluntary commercial agreement, it should have to offer reciprocal interconnection in the opposite direction. But if the carrier interconnects into another not as a matter of right but because of a contract, there are no 'upstream' interconnection requirements. If one chooses the free market, one gets the free market.

The second and more important principle applies to the pricing of interconnection among carriers. Once a carrier accepts traffic from another to transmit, it should not be able to accept only selected parts of that traffic based on where they originated. It can discriminate against a potential customer by not entering into an interconnection arrangement with it. But it should not be able to discriminate against a customer's customer by carrying traffic only

selectively. Why this principle? In a mixed common-private network system, the present system of common carriage will not survive. The proposed principle of "third-party neutral interconnection" (TPNI) proposed here preserves non-discrimination and free flow features that are of major advantage to society, without making private carriers into common carriers.

The same principle of Third-Party Neutral Interconnection also resolves the need for any regulation of access charges. Under TPNI, arbitrage becomes easily possible, which drives down interconnection charges to the rates offered to large users. i.e. to wholesale prices. These wholesale prices become the interconnection or access price, plus charges for signaling use. And what about contributors to maintain low-priced universal services? The support for any such effort would have to be raised in an alternative way.

G. Outlook

To reconcile the centrifugal pressures with the needs to inter-operate and inter-communicate represents the main challenge to policy makers for the next decade. This means that they will have to provide a competitive system with the tools of inter-operation where they are not self-generating by market forces, and they will have to deal with the institution of integration, namely the systems integrators that will emerge as the central elements of future telecommunications. In the U.S., the past two decades have been preoccupied with market liberalization. This will continue, but it will also be inevitable to move beyond this agenda and to assure the functioning of a network of networks. This is a unique undertaking because it has never been done before.