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REGULATORY IMPLICATIONS OF ALTERNATIVE NETWORK MODELS FOR THE PROVISION OF TELECOMMUNICATIONS SERVICES

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EXECUTIVE SUMMARY

Traditional telecommunications regulation in the United States has focused on maintaining boundaries between services, between service providers, and between jurisdictions. Technological developments, such as wireless services and broadband fiber; emerging services, such as Personal Communication Services; emerging providers, such as Competitive Access Providers; and changing customer needs are breaking down the traditional regulatory boundaries.

A new regulatory paradigm is needed to guide regulators and policy makers. One such new paradigm is the "network of networks" topology. The network of networks has great promise as a regulatory model because it envisions a variety of network providers; it is technology neutral, focusing on services rather than on the technical means of service delivery; it provides ubiquity; and it promises a high degree of customer choice and control, a key element in the success of this model.

The network of networks may be configured in a variety of ways. This study, after first analyzing the traditional regulatory paradigm of separate services and service providers (the Traditional Parallel Services Model), examines two possible network of networks configurations: the Linchpin Network Model and the Intermeshed Network Model. The study also examines the implications of the cable/telco crossownership debate for the network of networks approach.

In a linchpin network the public switched network serves as the central network to which all other networks are connected. The Ameritech and Rochester Telephone plans are examples of linchpin networks. The primary advantage for regulators is that the linchpin network allows "one stop shopping;" that is, rules applied to the linchpin network directly ripple to all other networks. The primary disadvantage is that because of the market power the linchpin network retains, continual oversight is required to ensure that anticompetitive practices do not occur that limit consumer choices or hurt the emergence of competition. The central regulatory question in a linchpin network is "How can LEC and nonLEC interactions best be conducted?"

The second type of network is the intermeshed network. Here, the linchpin network is transitional and all types of interconnected networks emerge. Some networks may face greater oversight than before, and others may experience less. A positive aspect of the intermeshed model is that the net amount of regulation should be less than that required for the linchpin or parallel services networks. Less regulation is possible because the multiplicity of networks, technologies, services, and service providers results in a competitive environment that is advantageous to buyers and sellers alike.

Certain rules are required in order to ensure that competitive outcomes occur as predicted for the intermeshed model and that anticompetitive practices do not occur under the linchpin network model. These rules are intended, on balance, to establish conditions that promote universal service and competition. Rules are needed to assure the existence of equitable interconnection requirements, reciprocity agreements between network providers, effective safeguards against the abuses of market dominance, and clear service standards. It is also important to assure that regulation is symmetrical across networks so that no one network provider is inadvertently advantaged or disadvantaged. A central element in the network of networks model is the maximization of customer choice.

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FOREWORD

In telecommunications, regulators are faced by an array of regulatory options from minor modifications of traditional ratebase, rate-of-return regulation to "no regulation." A key issue that often gets obscured when these options are advanced is the need to identify the actual or hoped for structure of the telecommunications industry before regulatory options are selected or designed. This thoughtful report is brought out as part of our Occasional Papers series and should be especially helpful in helping regulators understand the alternative industry structures and the different regulatory needs associated with each.

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Introduction

Traditional regulation in the United States has been a checkerboard of jurisdictions, regulators, services, and service providers. The underlying assumption has been that there are clear boundaries between services and that services are offered only by specific providers. Telephony has been regulated by state commissions and by the Federal Communications Commission (FCC), depending upon the state or interstate jurisdiction of calls placed. Cable has been regulated by local communities and by the FCC. Telephony and cable have been treated as totally different services with totally different service mandates. Although cellular telephony provides essentially the same type of service as wireline telephony, it is regulated differently largely because of its underlying technology. Broadcast television follows another model, that of federal licensing of scarce spectrum; newspapers and journals are essentially unregulated. Each of these regulatory approaches has its roots in the underlying technology and in the specific set of goals to be achieved. Telephony and cable television are the models which will be examined in this discussion.

Traditional regulation has been based on distinctions between geographical areas defined by local exchange boundaries, LATA boundaries, and state boundaries. These distinctions are made because of differences in technological mode of service delivery (wireless versus wireline, for example), and on distinctions drawn because of the underlying purpose of the services provided (provision of content versus common carriage, as an example).

Maintaining all of these boundaries and distinctions was possible as long as technological limitations made it impossible, or at least impractical, for service providers to expand their range of services. So long as telephone companies were constrained by bandwidth limitations to provide only voice and data, they did not impinge on the provision of video services, the domain of the cable industry. With the advent of fiber optic facilities, however, telephone companies now face the prospect of greater bandwidth and the promise of video services. Telephone companies also face traditional regulatory boundaries.

The network of networks will require new approaches.

Technology has, in effect, called in question the efficacy of the traditional boundaries placed between services and service providers. This presents a significant challenge to regulators. If traditional boundaries no longer pertain, what is to take their place?

As mentioned, the traditional checkerboard approach to regulation is based on a regulatory paradigm which envisions services as being distinct and capable of being pigeonholed into neat regulatory categories, with little or no overlap between service groupings. Regulators, as well as other policymakers and legislators, have begun to formulate a new regulatory paradigm that recognizes technological developments and their impact. One such paradigm that has been widely discussed is the concept of a "network of networks." Rather than a model which regards services as separate, even parallel, the network of networks model presupposes a configuration in which services interconnect with one another at many points and in many ways. Similar services may be offered by different providers. Moreover, providers may offer a range of services which cross former regulatory boundaries.

The network of networks paradigm, because it is such a departure from former regulatory models, will require regulators, legislators, and other policymakers to develop new approaches in order to accomplish regulatory goals. Indeed, this new paradigm requires regulators to assess what those regulatory goals should be, as well as the most efficacious way to attain them. At a more basic level, it is important to decide just how the network of networks paradigm should be configured. There is no one model for a network of networks. The term itself suggests a basic structural approach; the details regarding the components of the network of networks and the specifics of connectivity must still be determined. *The network of networks may be a network of interconnected equals; it may be a network based on hierarchical arrangements.*

While the focus of traditional regulation has been on the preservation of boundaries and on distinctions among services and service providers, the focus of regulatory interest in a network of networks configuration will, inevitably, be on different concerns. In an

environment in which connecting, not separating, services and providers is key and in which customer options are vastly expanded, the basic issues to be considered include:

- Protection of customer choice,
- Open rules governing interconnection,
- Issues of reciprocity between service providers,
- Security of customer information,
- Safeguards against abuse of market power,
- Maintenance of service standards,
- Preservation of universal service, and
- Some degree of regulatory symmetry.

The issue of consumer choice must be the central concern.

Regulators and policymakers, at state and federal levels, must deal with these issues if the needs and interests of customers, service providers, and competitors are to be met within a network of networks configuration. The importance of these issues in any specific network of networks configuration may differ, but these issues must be addressed to some extent in any discussion of network alternatives. Indeed, the issue of customer choice must be of central concern in all of these discussions.

This study will first examine the Traditional Parallel Services Network model and will then analyze two possible network of networks configurations. One configuration presupposes the existence of a "linchpin" or focal point network to which the other networks are connected; the other configuration assumes a network of totally equal components, with no focal network. Regulatory concerns and options presented by each configuration will be discussed, as well as the implications of the cable/telco debate for the network of networks approach. Finally the study concludes with a discussion of regulatory goals and of their desired outcomes.

The Traditional Parallel Services Network

The traditional regulatory paradigm was built on boundaries and parallel nonsubstitutable services. A visual representation of this paradigm is shown in Figure 1 and should be a familiar picture. There are two main networks in this model: the cable television network and the public switched network (PSN). The PSN, as shown in Figure 1, is provided by the telephone industry, by both local exchange carriers (LECs) and interexchange carriers (IXCs).[1]

Also represented in this configuration is the cellular industry, which is connected to both the LEC and IXC components of the PSN but not yet to the cable network.[2] There are also private networks, which as the dotted line shows, may be, but do not have to be, connected to the PSN. It is significant to note that the cellular and private networks are small in comparison to the PSN and the cable network. In the old paradigm, the cellular and private networks are not major components of the total telecommunications picture. Also, the cellular network and the private networks do not connect to one another. Even more importantly for this discussion, the cable network and the PSN do not interconnect. This is a topology predominantly made up of parallel networks and services.

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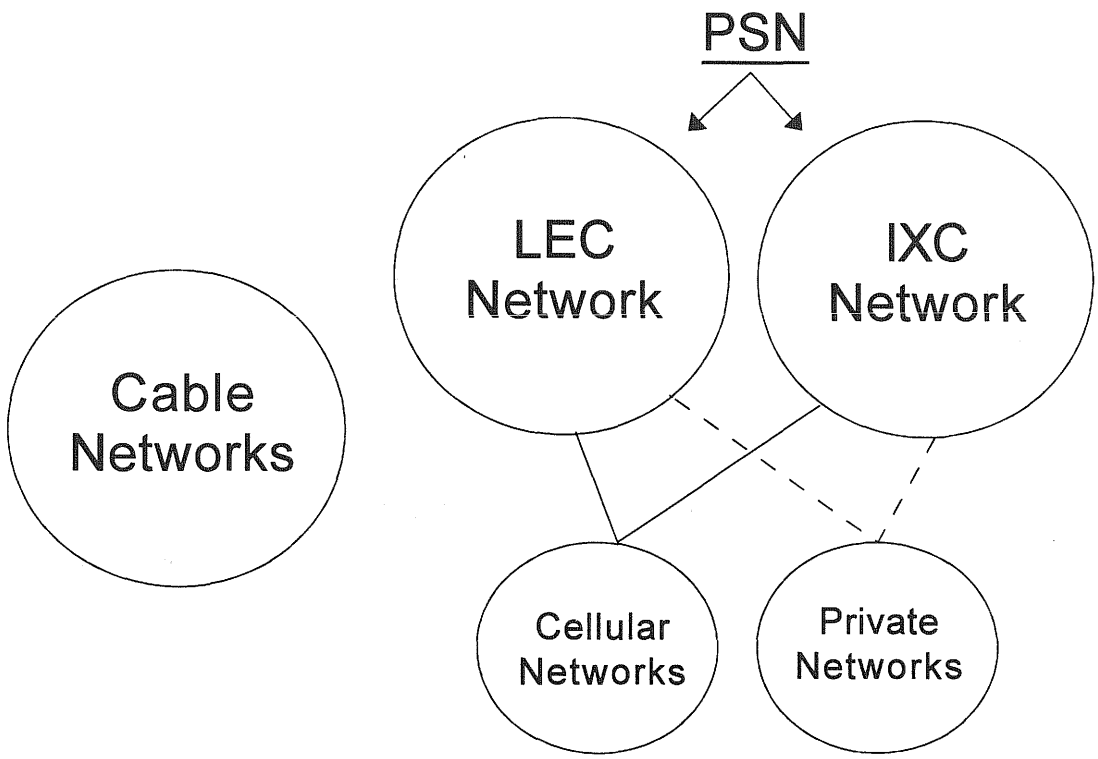
[1] While this representation of the traditional model presents the LEC and IXC networks as virtually one network, later discussions in this report regarding network of network configurations will make a clear distinction between the LECs and the IXCs and will focus on LEC functions. The reasons for this shift in emphasis from the total PSN to the LEC portion of the PSN have to do with the effects of the MFJ, the unique position of the local loop as the "last mile" to the customer, and other issues which will be addressed in some detail.

[2] The increasing number of mergers and joint ventures suggests that this lack of connectivity between cable companies and wireless technology providers will soon be remedied. A Personal Communication Systems network trial in Syracuse, N.Y., announced in July, features the integration of a PCS base station (manufactured by Omnipoint Corp.) with a cable television network. Indeed, this Omnipoint PCS system has been tested by both Cox Enterprises and Continental Cablevision. See "PCS Meets CATV," *Telephony*, July 18, 1994, 12.



Key:
——— Usually connected
— — - May or may not be connected

Source: Author's construct.

Fig. 1. Parallel Services Network Paradigm.

The drawing in Figure 1 is simple but its implications are not. The underlying assumption of this paradigm is that there are two dominant networks, the other networks are small and relatively minor, and the two dominant networks have no need to interconnect or work together. Indeed, in the traditional regulatory model, which Figure 1 represents, the two dominant networks are seen as providing totally different services, as meriting different regulatory treatment, and as embodying two different types of technology.

While the PSN is mostly copper and narrowband, the cable network is coaxial and has much greater bandwidth than does the PSN. The cable network is configured for one-way, broadcast-type service delivery. Information is distributed from a headend to passive subscribers. This is often described as a bus design in which television signals are passengers who get on at the headend bus station and then go in one direction, getting off at homes, or bus stops, along the way. The PSN, on the other hand, is configured for two-way communication, with any calling party able to initiate and complete connections to any called party. The subscribers to the PSN are not passive receivers of information; they are active initiators of messages, the content of which they control. The PSN has a star topology that minimizes the number of lines and switches and optimizes the number of two-way and back-up communication paths.

In effect, these two networks were originally built to accomplish different goals. The cable network is designed to provide information and entertainment. The PSN is designed to provide interactive communication between any calling and called parties. The regulatory approaches and objectives applied to these two networks reflect these very different goals.

A major concern of cable regulation is the delivery of content. Even though the cable industry is a provider of conduit, it does not provide that conduit as a common carrier. Rather, cable has been treated as what Kellogg, Thorne, and Huber have called a "hybrid" service, "not quite common carrier, not quite broadcast."[3] The television and radio broadcast media, because they use a scarce commodity—spectrum—to deliver content, is subject to initial

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[3] Michael K. Kellogg, John Thorne, and Peter W. Huber, *Federal Telecommunications Law* (Boston: Little, Brown and Company, 1992), 713.

licensing, license renewal, and some regulatory oversight of what content is delivered. Cable, because it does not use spectrum, has been able to avoid some of that oversight. Indeed, cable's first amendment rights to free speech have been consistently upheld by the courts.[4]

Cable is also a provider of conduit, and there is a regulatory interest in requiring cable to allow a diversity of information sources to be delivered to subscribers over that conduit. Because cable is not a common carrier, it does not face the major requirement of nondiscriminatory provision of service to all who desire it. Therefore, cable companies can choose to whom to lease conduit. This ambiguous treatment of cable regulation has left federal regulators and local franchisers with the interesting challenge of balancing "first amendment considerations precluding abridgement of speech with the desire to establish structural rules that affirmatively—in at least an aspirational way—encourage a diversity of information sources."[5] Much of cable regulation deals with how much infringement there can be on cable's control over content. The Cable Act of 1992 includes requirements that cable companies lease some access to unaffiliated content providers, and that they provide access for the public, for educational purposes, and for government use. Also included in the 1992 Act was the requirement that cable companies retransmit programming from the broadcast media, the "must carry" rule. The Supreme Court has recently instructed the District Court to reconsider the necessity of these must carry rules.[6]

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[4] Ibid., 717.

[5] Daniel L. Brenner, Monroe E. Price, and Michael I. Meyerson, *Cable Television and Other Nonbroadcast Video: Law and Policy* (Deerfield, Illinois: Clark Boardman Callaghan, 1994), Release #7, 4/94, 2-6.

[6] At issue is whether the must carry rules are content based or not. The FCC, and the lower court, argued that the must carry rules are not content based and that they are necessary to preserve over-the-air broadcasting. The Supreme Court directed the lower court to consider whether they are really necessary to preserve over-the-air broadcasting and whether they do not indeed infringe, unnecessarily, on the cable companies' freedom to determine content. See "Supreme Court: Must Carry Not Content-Based But May Not Be Needed," *Washington Telecom Week* 3, no. 26 (July 1, 1994): 1-3.

Pricing policy has been used to promote universal service.

While the focus of cable regulation usually has been on content issues,[7] the focus of regulation for the PSN has been very much on common carriage. Though Title II of the Communication Act defines a common carrier in a tautological, rather than clear manner,[8] utility theory and historical precedent provide a clearly understood concept of a common carrier as being an entity which provides nondiscriminatory services at just and reasonable rates.[9] Regulation of the PSN, at both the federal and state levels, has focused on assuring that services are offered on a tariffed nondiscriminatory basis at prices which are deemed to be just and reasonable to customers, while also meeting the needs and interests of stockholders and competitors. Much time has also been devoted to assuring that specific standards of quality are attained and maintained by the PSN providers.

A primary goal of PSN regulation has been the attainment of universal service. Pricing policy has been used as a tool to attain that goal. Heavily populated urban areas have subsidized less populace areas through geographical toll rate averaging. Urban telephone users have subsidized rural subscribers through pricing subsidies for local service. Business users have helped keep residential rates lower, by paying, on an average, two-and-a-half times the residential rate for a local telephone line. Elaborate cost allocation rules were developed to allocate a significant percentage of local loop costs to toll services. The provision of

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[7] The Cable Act of 1992 in many ways marks a departure for cable regulation because it moves in the direction of rate regulation. The Cable Act of 1984 deregulated cable pricing; the passage of the Cable Act of 1992 was a response to a growing sense that the cable industry was taking advantage of its monopoly position to raise cable prices to unreasonable levels. It is interesting to note that though cable is not a common carriage service, there has been a movement toward regulation to accomplish "just and reasonable" rates.

[8] Title II defines a common carrier as "any person engaged as a common carrier for hire." Section 3(h).

[9] The FCC provides an interesting and informative history of the concept of common carriage in Appendix B, to CC Docket No. 79-252, *Further Notice of Proposed Rulemaking,* "In the Matter of Policy and Rules Concerning Rates for Competitive Common Carrier Services and Facilities Authorizations Therefor, 84 F.C.C. 2d, 520-534.

services deemed to be necessary has also been a goal of PSN regulation, with regulators mandating the provision of such services as access to emergency operators and the furnishing of one-party service.

A primary feature of PSN regulation has been common carriage; the main focus of cable regulation has dealt with content and diversity of information sources. Different regulatory entities have also dealt with these issues. Different sections of the FCC have treated cable and telephony; local franchisers have dealt with cable; and state commissions have dealt with telephony.

In essence, the two main networks of the traditional paradigm illustrated in Figure 1 perform different functions, have different technical underpinnings and configurations, and are faced with vastly different regulatory agendas. In this paradigm, they are totally self-contained, with no need to interconnect in order to serve customers. Indeed, regulatory policy has very strongly sought to keep the two networks separate, at least for the time being. Telephone companies have been explicitly precluded from acting as a cable provider. In other words, through the cable/telco crossownership rules, telephone companies are not allowed to provide cable service in their own operating territories. A major reason for the crossownership restrictions was the fear that the deep pockets of the telephone companies would enable them to harm the development of the newly developing cable industry. Cable companies were not perceived to represent the same competitive threat to the telephone industry and so were not precluded from offering two-way voice and data communication. They have so far found it impractical, on a large scale, to develop the technical capability to provide those services.[10]

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[10] One reason why this development has been impractical so far is the huge cost involved. The Chairman and CEO of Tele-Communications, Inc, John Malone, recently announced an initiative to purchase the equipment needed for that cable company to provide phone service. The estimated cost of the initiative is $2 billion. This would represent a 5% penetration of U.S. homes passed by the cable company. See "Cable Industry's Plans in Telephony Hinge on Federal Policies, Customer Reaction, Technical Developments," *Telecommunication Reports* 60, no. 33 (August 15, 1994): 8-10.

The paradigm in Figure 1 assumes that most communication needs can be met by two major networks, the PSN and the cable network, and that these two major networks provide nonsubstitutable services. Subscribers are then expected to use these services in parallel, to subscribe to the cable network for entertainment, and to subscribe to the telephone network for two-way communication. Subscribers are expected to deal with two different service providers, both of which are subject to different regulatory rules and requirements. These include significant differences in pricing, quality of service, and content constraints. Subscribers, as a result, have developed different expectations about these two services.

Some of the forces calling into question the continued efficacy of the regulatory paradigm delineated in Figure 1 are not represented in the relationship between the cable network and the PSN. They are present in the cellular component of the model.

The FCC, convinced that there was a need for cellular service, established a cellular industry based on a duopoly structure. The FCC mandated that there should be two cellular licenses granted for each service area, with one license for the wireline carrier (i.e., local telephone company) and the other license for a nonwireline entity. The FCC did not initially consider cellular service an imminent competitor to wireline telephony.[11] Cellular was envisioned initially as basically a different type of service, one more analogous to mobile radio service than to standard telephony. It was service for vehicles, not for stationary structures.

In order to provide a full range of service, cellular had to be able to connect to the PSN. Cellular customers seeking to contact a telephone on the PSN could only get to that telephone by going through the PSN (those on the PSN might also wish to contact a cellular subscriber). A major component of the FCC's cellular proceedings was, therefore, devoted to

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[11] It is interesting to note that the FCC felt that cellular would only represent a competitive threat for local exchange services when a lighter hand-held set was developed and spectrum limitations were overcome. That is exactly what is happening with Personal Communication Services (PCS). (See An Inquiry Into the Use of the Bands 825-845 MHz and 870-890 MHz for Cellular Communications Systems; and Amendment of Parts 2 and 22 of the Commission's Rules Relative to Cellular Communications Systems, *Report and Order,* 86 FCC 2d at 32.)

provisions requiring that local telephone companies provide interconnection for the cellular provider. Cellular providers could request one of two types of connections: a Type I connection in which the cellular company's switch (or MTSO) looked to the PSN as if it were a PBX; or a Type II connection in which the MTSO looked like another telephone company central office, albeit a central office not owned by the telephone company. As part of the Type II connection, the cellular company would also receive, with the help of the telephone company, its own prefix or NXX code.

Because one of the cellular licenses in each service area could be owned by the wireline company providing telephone service in that area, the FCC, in order to preclude anticompetitive behavior against the holder of the nonwireline license, required that telephone companies provide cellular service through a separate subsidiary.

The circle representing the cellular network in Figure 1 appears innocuous enough. However, it represents the creation of rules and problems which continue to be the focus of regulatory attention. The creation of the cellular industry was a precursor for what has to be done in order to accommodate a new network provider, especially one which needs to connect to the PSN. There must be rules governing interconnection, provision for telephone numbers for the new provider, and safeguards to assure that the PSN provider does not take advantage of its position to drive competitors out of the picture. The cellular experience offers valuable rules for what comes later.

Forces of Change

The example of the cellular industry is indicative of the forces which are causing a break down in the traditional regulatory paradigms. Cellular was a new technology which could offer features not available through the PSN; cellular could offer mobility. While cellular was at first perceived as a different service from standard telephony, with refinements in technology it has become, to a degree, substitutable for regular telephone service. Instead of a large expensive installation in an automobile, a cellular instrument is now light and

portable and more readily affordable. With the creation of the cellular industry, the FCC introduced a new set of services and service providers into the telecommunications landscape.

In its personal communication services (PCS) proceedings, the FCC is once again crafting a structure for a new wireless industry. While the closest analogue for cellular was mobile radio, the analogue for PCS, with its closer range antennae and smaller hand sets, appears to be the cordless phone. PCS may prove to be a closer substitute for traditional telephony than cellular has been. Like cellular service, PCS services will also require connection to the PSN. And, as with cellular service, PCS services will entail the creation of interconnection rules, provisions for reciprocity between the PSN and the PCS providers, and safeguards to assure that the PSN does not use its position of dominance to the detriment of the PCS provider.

Other technological developments are creating new services and blurring the lines between service providers. Broadband fiber technology, which is being adopted by both the cable and telephone industries, makes it possible to transport voice, data, and video over one wire or "pipe." New compression technologies are making it possible to provide video over copper. Fiber will make it possible for the cable industry to provide voice and data, as well as to carry video programming. Fiber makes it possible for telephone companies to provide video, in addition to voice and data services. In its video dialtone proceeding, the FCC invited the provision of video by telephone companies. This is a proceeding in which the FCC has encouraged the LEC industry to offer video carriage as a common carrier.[12]

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[12] The FCC has recently reaffirmed its position regarding the provision of LEC video dialtone offerings as being common carrier services offered to multiple video programmers. The FCC also established a regulatory structure and rules and procedures governing video dialtone services. See "In the Matter of Telephone Company-Cable Television Cross-Ownership Rules, Sections 63.54 - 63.58, and Amendments of Parts 32, 36, 61, 64, and 69 of the Commission's Rules to Establish and Implement Regulatory Procedures for Video Dialtone Services," *Memorandum Opinion and Order on Reconsideration and Third Further Notice of Proposed Rulemaking,* CC Docket No. 87-266, FCC 94-269, Adopted October 20, 1994.

Because telephone companies did not respond quickly enough to customer requests for fiber, a whole new industry of competitive access providers (CAPs) developed, which was ready to transmit voice and data for customers willing to bypass the PSN. In many states, CAPs are asking for the authority to provide a full range of dedicated and switched services, at the interstate, intrastate, and local levels. Like the cellular industry, CAPs are seeking interconnection to the PSN. The CAPs are offering direct substitutes for PSN services.

Blurring the lines between services and service providers even further are the increasing number of alliances being formed between industry segments. Long distance providers seek to enter the wireless arena through mergers, such as the proposed AT&T-McCaw merger. Such a merger creates an alternative network to the PSN, with cellular providing LEC-type services. Cable companies buy interests in CAPs; both CAPs and cable companies seek entry into the new PCS market. A cable/CAP/PCS network also can offer an alternative to the PSN.

What all of these developments suggests is the creation of new networks, which like the PSN, are able to offer point-to-point services. *Instead of a paradigm which presupposes the existence of two large, very distinct networks, and a few insignificant peripheral networks, technological advances and industry mergers suggest a need for a new paradigm, one which recognizes the possibility of several robust networks which provide similar services and are capable of being interconnected in order to meet customer needs.*

The customers themselves may also be different than those assumed by the traditional paradigm. The traditional paradigm assumed customers willing to select from a fairly narrow list of basic services. The proliferation of services and service providers suggests that there has been a real widening of the gap among customers. While some consumers may still be satisfied with very basic telecommunications services (POTS) and may be satisfied with the services offered by one main network (most likely the PSN), others may want a variety of advanced services for convenience and entertainment. These customers will purchase those services from whatever network provider, or providers, can offer the services. These customers may also want access to several networks. More importantly, they may expect, or even demand, that those networks interconnect.

Technology, industry mergers, and customer expectations all seem to push for a different regulatory paradigm, one which accommodates a variety of networks, and one which focuses less on boundaries and more on connectivity.

The Network of Networks Concept

The concept of a network of networks is not a new one. Ithiel de Sola Pool provided an early description of the concept over a decade ago:

> To serve the public, there will be networks on networks on networks. . . . Within nations, the satellite carriers, microwave carriers, and local carriers may be—and in the United States almost certainly will be—in the hands of separate organizations, but again they will interconnect. So even the basic physical network will be a network of networks. And on top of these physical networks will be a pyramid of service networks[13]

The network of networks concept seems to have become a prevalent model for more than theorists and policymakers. In announcing its initiative to open its network to competition, Ameritech cited a vision of "a mix of technologies and service providers, and an interconnected network of networks."[14] There are several reasons why this model is compelling:

- A network of networks model acknowledges that there will be **different types of providers** offering network-based services. Not all services and features will necessarily be available on one network. Not all customers will want the same features from the same providers.

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[13] Ithiel de Sola Pool, *Technologies of Freedom* (Cambridge, MA: Harvard University Press, 1983), 227.

[14] "Media Questions and Answers," *Ameritech Announces Sweeping Changes to Expand Customer Choice, Restructure Business*, Ameritech News Release, February 22, 1993.

- A network of networks model is **technology neutral** and all-encompassing. Instead of models which focus on fiber optic services, or on wireless technologies, the network of networks acknowledges that all networks, regardless of underlying technology, will be part of the telecommunications topology, seamlessly available to all consumers. As a result, this model offers the flexibility to accommodate technological advances.

- A networking of networks approach represents the only way to provide the **ubiquity** of the former PSN. The very backbone of the PSN concept was ubiquitous service, the ability of anyone on the PSN to reach anyone else on the PSN with a minimal of time and effort. In the coming environment, services will be fragmented and offered by a variety of providers. Not all customers will necessarily be reachable on any one network. Interconnection is necessary to assure the continued ability to reach a desired person or destination or service.

- A network of networks model promises a high degree of **customer choice and control**. Rather than having to choose among networks or having to subscribe to a series of unconnected networks in order to meet their needs, customers need only subscribe to their network of choice and, by so doing, gain access on demand to other networks and services.

The network of networks model would not be so persuasive if it did not envision a variety of network providers, was not "technology neutral," did not aim for ubiquitous coverage, and did not include a high degree of customer choice. These four factors distinguish this model from the traditional parallel services paradigm. While the traditional model presumes parallel services and few incumbent providers, the network of networks model assumes freedom of entry for a variety of potential providers offering services which may be close substitutes for one another. The regulatory focus of the traditional model has often been on constructing barriers based on technological considerations; notable examples are the barriers between radio and landline services. The network of network model, because it is technology neutral, can focus on issues such as efficient interconnection and innovative service delivery, rather than on technology-based barriers between service providers. In this model, all providers capable of offering a service are allowed to do so, regardless of the technical mode of service delivery.

The traditional paradigm offers one ubiquitous network on which subscribers can reach, and be reached by, all other subscribers. This is a powerful feature, and one which a series of unconnected networks cannot offer. A network of networks configuration can replicate the feature of ubiquity. Any subscriber on any one network should be able to reach a subscriber on any other network. This aspect of the network of networks insures that subscribers, in this new paradigm, do not lose the most significant feature of the traditional model. Finally, the network of networks is compelling because it provides a high degree of customer choice and control; a feature missing from the traditional paradigm. In the traditional model, customers subscribe to parallel networks to meet their communication and entertainment needs. They, in effect, have few options. In a network of networks configuration, customers should be able to pick and choose their network, or networks, and to create the service configurations of their choice. The encouragement of customer choice and control is fundamental to robust competition. It is these four features--variety of providers, neutrality regarding technology, ubiquity, and customer choice--which make the network of networks model a useful one for regulatory policymakers.

As persuasive as a network of networks model may be, it is still a vague concept without further definition. There is certainly more than one possible configuration for such a network. There can be a network of equals, in which each component is of comparable size and influence. There can be a network in which one component is dominant and the other components are reliant upon the dominant member. There can be a network configuration in which all networks connect with all other networks. Conversely, there can be a configuration in which all components connect to one central network but not necessarily to one another.

Each of these configurations, or models, has implications for issues of connectivity, coordination, and reciprocity among network components. For regulators seeking to use this concept as a new regulatory paradigm, it is perhaps most important to determine, for any specific configuration, the relative position of each component of the network. In other words, is there any reason for regulators to treat any of the components differently than any of the others?

Does any one component exercise a position of dominance? If so, safeguards should be put in place to assure that the position of dominance is not abused through predatory or monopoly pricing or through discriminatory provision of services. Should any of the components have any special responsibilities toward the other components? If connectivity is an issue, fair and reasonable interconnection rules should be required. If provision of customer information is an issue, clear rules should be in place regarding the use, and abuse, of customer information. Should any of the components bear any special responsibilities toward their subscribers? If there is a universal service goal, it must be decided whether any one component should shoulder that responsibility, or whether it should be shared by all. Regulators must determine whether it is preferable to have one carrier of last resort, or whether all of the components of the network should share that role. If the provision of E-911 service to all is a desired goal, regulators must decide who should provide that service and how that service will be accessed by all the subscribers to the various components of the network of networks. Given a specific set of regulatory goals, policymakers must decide whether any one network configuration is preferable to another.

In examining these issues, two possible configurations merit closer scrutiny. In one configuration, there is a focal point network, a network which serves as a linchpin of sorts. In this linchpin network, *all networks connect to the linchpin; some, but not all, other networks connect to one another.* In the other configuration, all networks interconnect to all other networks, either directly or through very few intermediary networks. *No one network serves as a focal point.* In many ways, the "linchpin network" configuration is the direction in which current regulation is moving in the short run. Some elements of that network configuration are already in place. The second configuration, what is called here the "intermeshed network," is the logical extension of this regulatory direction. Both configurations, or models, deserve careful consideration because they raise important questions about how a network of networks would function and what the implications of such a configuration would be for competitors and subscribers.

The Linchpin Network Model

The growth of private networks is a significant development.

A model of the linchpin network is shown in Figure 2. In this model, the LEC portion of the PSN serves as the linchpin network. The other networks are connected to it and potentially could use it to reach one another. Some of the other networks are connected directly to one another, without dependence on a connection through the linchpin network. Private networks are again shown in this model, as in the parallel services model in Figure 1. The relative size of the private networks is larger in relation to the LEC network in this model, representing the increasing growth of private networks. The growth of private networks is a significant development. However, because the focus of this study is the regulatory treatment of the public facilities to which these private networks may seek connection, private networks will not be a main theme here.[15] The other components of the linchpin network model are those services and service providers which are in existence today or will be shortly, pending FCC action. Other networks not yet envisioned may develop because of technological breakthroughs. The linchpin network model, indeed a generic "network of networks" model, is flexible enough to accommodate new developments. New technology networks become another module in the network of networks configuration. If older technology networks become uneconomical, those modules drop out of the configuration.

The focus of this discussion is on the LEC component of the PSN for several reasons. Before the break-up of the Bell System and the introduction of long distance competition, the PSN clearly included everything from the local loop to interexchange trunks, and all the switching points in between. It was generally assumed that discussions of the PSN encompassed all of those network elements; that, for all practical purposes, the same entity

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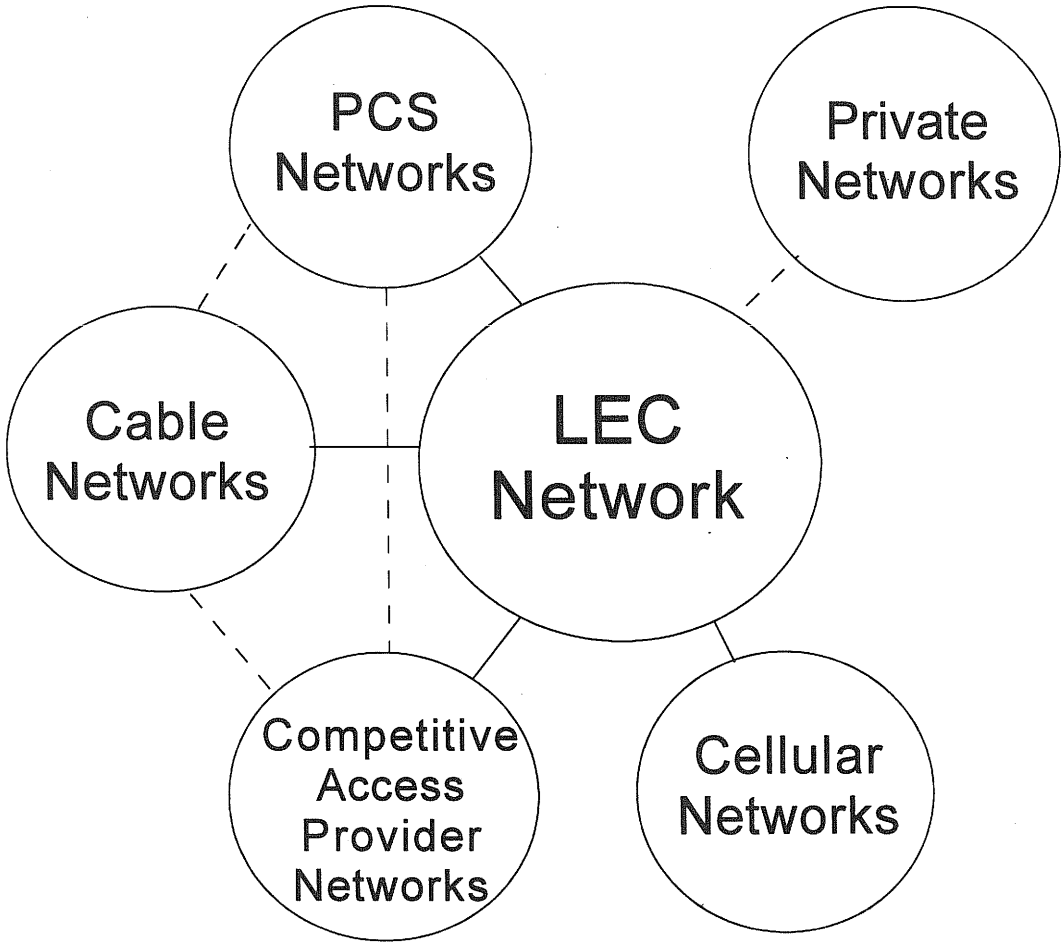
[15] Eli Noam, in his essay, "Private Networks and Public Objectives," in *Universal Telephone Service, Ready for the 21st Century?* (Institute for Information Studies, 1991), 1-28, discusses the proliferation of private networks and their impact on the public infrastructure.



Source: Author's construct.

Fig. 2. The Linchpin Network Paradigm.

owned all of these network components; and that regulatory treatment of all of those elements was fairly consistent across the network. Today, the picture is much more complicated. Interexchange, or interLATA, services are separate from local exchange services because of MFJ requirements.[16] Interexchange toll, both intrastate and interstate, is offered by competing IXCs. IntraLATA toll is primarily offered by LECs, in some states still as a monopoly service. The model in Figure 2 focuses on the local exchange component of the PSN because LECs and IXCs function very independently from one another in a network of networks configuration; indeed, they do not have to function together at all. CAPs already provide IXCs with services equivalent to those the IXCs have traditionally received from LECs; CAPs deliver customer traffic to IXCs. Cable companies potentially will be able to do this also. Since IXCs can obtain connections from CAPs, cable networks, and cellular networks, and so bypass LEC facilities, they are in a sense, on a different plane than the networks in Figure 2. Conceptually, IXC networks can be seen as an overlay to Figure 2, with connectivity equally possible to any of the networks in the linchpin model. This relationship is illustrated in Figure 3. Focusing this discussion on the LEC network is logical because the LEC network includes the final connection to the customer, the so-called "last mile." It is through the "last mile" or its substitutes, that the customer is connected to desired services. In effect, the cable connection into the home, the cellular connection between the cellular phone and the MTSO, and the facilities between the customer premise and the CAP switch are similar to, and potential competitors for, the LEC-provided local loop.[17]

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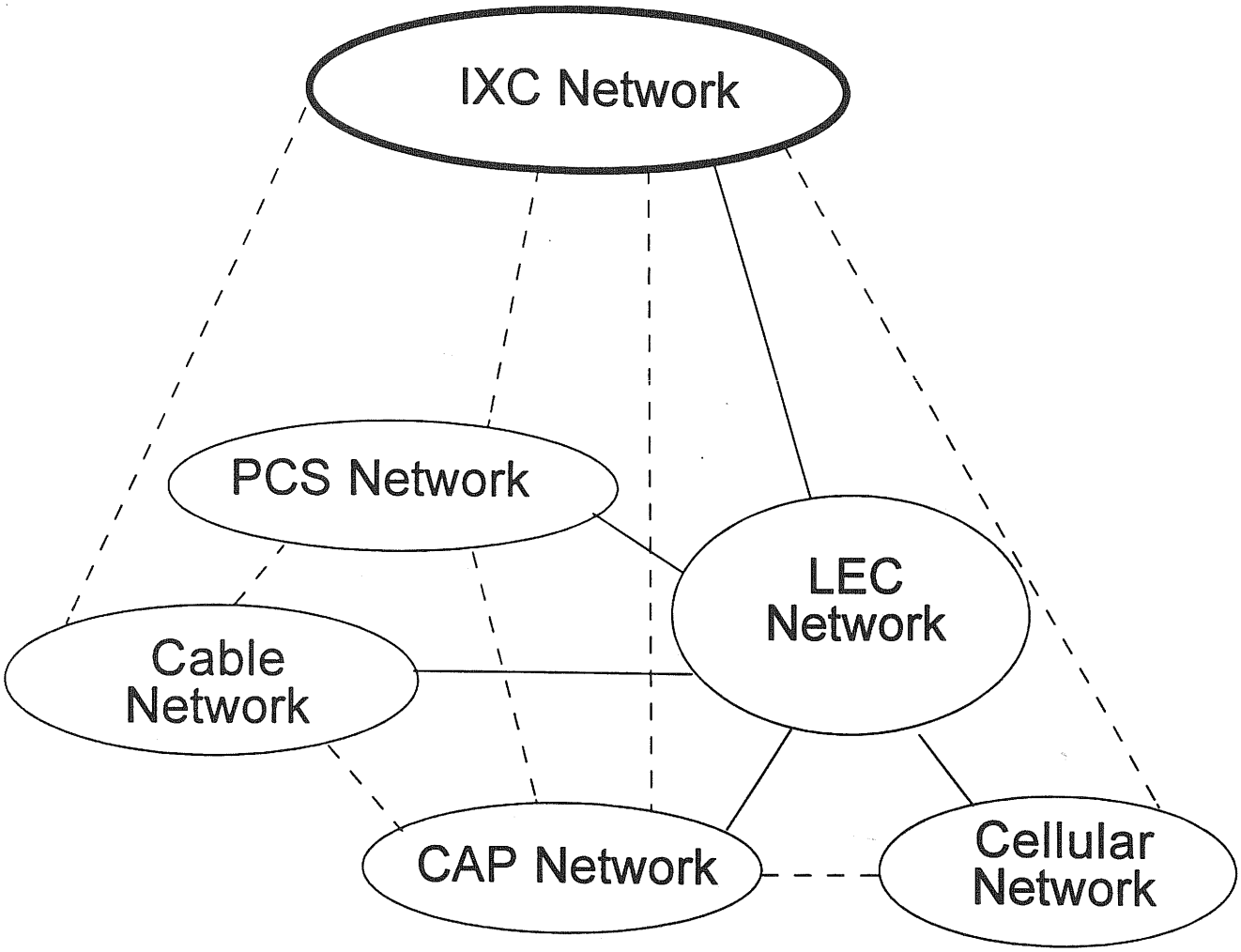
[16] There have been several bills introduced in Congress during the past decade proposing to overturn the MFJ restrictions on the Bell Operating Companies and the Bell Companies have been lobbying in all venues to have the restrictions lifted. Even if these results are successful, the network of networks approach discussed in this report still holds. If the Bell Operating Companies are allowed to provide interexchange services, they will offer interexchange services to cellular, PCS, or cable subscribers, in competition with AT&T, MCI, and other IXCs. Wireless companies, cable companies, and competitive access providers will continue to compete for the local exchange services provided by the Bell Operating Companies and the Independent Telcos.

[17] In the state of New York, competition has gone even further. There are competitors for portions of the LEC-provided facility between the central office and the customer premise.



Source: Author's construct.

Figure 3. IXC Interconnection to Linchpin Network Paradigm.

The local loop is divided into port and link components. The port includes the provision of dial tone and a unique network address, or telephone number; the link is the path from the customer to the LEC switch. The link is open to competition. See New York Public Service Commission, Opinion and Order Concerning Comparably Efficient Interconnection Arrangement, and Instituting Proceeding, Opinion No. 91-24.

Another reason to discuss the local exchange network here is current regulatory activity. Ameritech has proposed a reconfiguration of its services very much in keeping with the notion of a linchpin network. Ameritech proposes to open its network up to connection from customers and competitors, in return for the loosening of restrictions on Ameritech's ability to provide interLATA long distance and to engage in manufacturing. Rochester Telephone Company has a similar plan in which its network, controlled by a separate subsidiary, would be open to competition and interconnection. In effect then, elements of the linchpin network are already proposed, and attempts are underway to move further toward that model.

A feature which should be remembered about this model is that each of the networks offers subscribers services which are basically similar. They offer point-to-point communication. Whether that communication is transmitted through wireless or wired means, through fiber or through copper, between telephones or between personal computers, it is point-to-point communication. This means that the networks, while not direct substitutes for one another, are enough alike that they are in competition. This is nowhere as obvious as in the case of CAPs. CAP services are virtually identical to their LEC counterparts.[18] If these networks are potential competitors, then regulatory attention must be paid to any network which is in a position of power and in a position to behave in a seriously anticompetitive manner. Given its position as linchpin network provider, the LEC is obviously a candidate for such regulatory attention. It may also be the case that other unenvisioned provider alliances could result in anticompetitive practices.

In this configuration, the LEC functions not only as a service provider to its own subscribers but also as a provider of services to its own competitors. This is not a new situation for the LEC industry. In its open network architecture (ONA) proceedings, the FCC sought to create a framework in which the LEC industry could offer information services

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[18] There are, of course, some important differences. CAPs do not provide E-911 services or white or yellow page listings. How important access to those service is, and how to get non-LEC subscribers access to those services, will undoubtedly become an important issue in determining how equal competitive services actually are.

while also offering necessary connectivity and services to other information service providers.[19] In effect, in the ONA framework, a LEC functions as both a wholesaler and a retailer, using its own facilities to provide service to its own subscribers and also providing the use of its facilities for a fee to those competing for those same subscribers.

The regulatory issues involved in the linchpin model are very much like those which were addressed in the ONA process:

- *Comparably efficient interconnection rules,*
- *Unbundled rate structure,*
- *Safeguards against cross-subsidization, and*
- *Access to and use of customer information.*

All of these issues are areas of concern in a linchpin network model. Regulators need to assure that the rules for interconnection are clear and applied in a nondiscriminatory manner. It would be all too easy for the dominant network provider to harm its competitors by denying them interconnection or by making interconnection arrangements prohibitive in price or inferior in quality. The linchpin network provider could also harm its potential competitors by withholding valuable information. Competitors, for their own planning purposes, need information about the dominant network provider's plans for network changes or upgrades. Potential interconnectors should know what service standards they can expect from the dominant network provider.

Of utmost importance are safeguards to assure that the linchpin network provider, for those services in which it is in direct competition with the interconnecting network, charges itself the same rates under the same conditions as it charges its competitors. By requiring, in

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[19] For a thorough explanation of the ONA proceedings, see Robert J. Graniere, *Implementation of Open Network Architecture: Development, Tensions, and Strategies* (Columbus, OH: The National Regulatory Research Institute, September 1989); and John D. Borrows and Robert Graniere, *An Open Network Architecture Primer for State Regulators* (Columbus, OH: The National Regulatory Research Institute, November 1991).

the ONA proceeding, that the LEC offer its competitors interconnection arrangements comparable to those it afforded itself (e.g., comparably efficient interconnection), the FCC sought to assure that the LEC did not give itself a competitive advantage. A major initiative of the ONA proceeding was the effort to unbundle the LEC's network services so that customers would be able to purchase only those elements of service which they needed. This same unbundling impetus would makes sense for all linchpin interconnection arrangements.

Cross-subsidization issues were a concern in the ONA Proceeding, because it was feared that the LEC could shift costs out of competitive services into noncompetitive services. The accounting safeguards of Computer Inquiry III were mandated for ONA services.[20] The same fear of cross-subsidization would pertain to the LEC in the linchpin model. Safeguards to protect against cost shifting would also be in order in this situation.

Another fear in the ONA proceeding was that the LEC would use customer information to its own benefit in competing with other information services; this could be a well-founded fear in the linchpin environment. If the LEC has, because of its position as linchpin network, competitively valuable customer information, restrictions on its use of that information would be in order to assure that the LEC could not use the information to position itself against its competition. LEC competitors, for example, have complained that because customers new to an area call the incumbent LEC for basic landline telephone

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[20] In its Computer Inquiries I and II, the FCC had relied on structural safeguards to protect against cross-subsidization. In other words, telephone companies seeking to provide enhanced services (in other words, non-basic services) would have to do so through a separate subsidiary. In its Computer Inquiry III, the FCC determined that structural safeguards were inefficient and unnecessary and that accounting safeguards would be sufficient to guard against cross-subsidization. Telephone companies would separate regulated and nonregulated costs and revenues through accounting procedures and would institute accounting measures, through Cost Accounting Manuals, to assure that cross-subsidization would not occur. The courts found that the FCC may not have had a sufficient basis upon which to move from structural to accounting safeguards and remanded the matter to the FCC for further consideration. The Commission reaffirmed its earlier decision to move toward accounting safeguards. See "In the Matter of Computer III Remand Proceedings: Bell Operating Company Safeguards and Tier I Local Exchange Company Safeguards," *Report and Order,* CC Docket No. 90-623, FCC 91-381, 6 FCC Rcd., No. 26 (1991).

services, the LEC is able to give new customer information to its cellular subsidiary, thus giving its subsidiary a competitive advantage. This, and other possible information sharing problems, would have to be addressed in a linchpin model.

Control market power in order to promote competition

None of these issues are new; they are the regulatory concerns involved in trying to control market power in order to promote competition and increase customer choices. In this configuration, the LEC obviously does have market power. It has the most subscribers, many of whom the other networks wish to reach and it has facilities which the other network providers might want to use. In a sense, it has all the problems and opportunities inherent in being there first. The creation of a true network of networks, if that is indeed what regulators wish to see, will require major changes in the way the LEC has done business. Services which were once exclusive to the LEC will become competitive; services which the LEC may wish to provide will already be available from other sources.

In effect, to facilitate a linchpin model, the focal point network provider must face some restrictions in order to make viable competition from the other networks a possibility. That is not always easy, as was made evident in the FCC's recent Expanded Interconnection Proceeding.[21] In that proceeding, the FCC sought to require that larger LECs offer interconnectors physical space in the LEC central offices for the collocation of the interconnector's transmission equipment. The proceeding, CC Docket 91-141, included a lengthy process of argument regarding the rate elements which could be charged the interconnector and the rules governing access to the network. The U.S. Court of Appeals in Washington recently struck down the physical collocation requirement, noting that the FCC

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[21] See, for example, "In the Matter of Expanded Interconnection with Local Telephone Company Facilities, Amendment of the Part 69 Allocation of General Support Facility Costs," *Report and Order and Notice of Proposed Rulemaking,* CC Docket No. 91-141; CC Docket No. 92-222, FCC 92-440, 7 FCC Rcd., No. 23 (1993); and "In the Matter of Expanded Interconnection with Local Telephone Company Facilities and Amendment of Part 36 of the Commission's Rules and Establishment of a Joint Board," *Second Notice of Proposed Rulemaking,* CC Docket No. 91-141, Transport Phases I & II, and CC Docket No. 80-286, 7 FCC Rcd., No. 24 (1992).

had exceeded its authority. The FCC is now requiring "virtual collocation," interconnection outside of the LEC central office.[22] In their efforts to "level the playing field," regulators face a fine line between mandating conditions which will facilitate competition and requiring actions which do not adequately protect the rights of the linchpin network provider.

While the ONA experience provides some insights about the need to address issues of interconnection, customer records, and rate structure, it does not provide all of the insights needed to address a network of networks model. The ONA proceeding assumed that information providers would use LEC facilities to reach subscribers; there was no equivalent consideration of the possibility that the LEC might want reciprocal treatment. *In an interconnected network environment, reciprocity will become an issue.* The experience of cellular discussed earlier illustrates such a need. Not only did the cellular provider seek interconnection to the LEC in order to route subscriber's calls to their desired destination, the cellular provider and the LEC also negotiated arrangements dealing with how the LEC would be able to terminate traffic originating on its own network to customers on the cellular network.

Reciprocity between the LEC and the other network components could be a major issue from the subscriber's perspective. Cellular subscribers would not be as eager to sign up for service if they could only reach other cellular subscribers. Cellular service is more attractive because it includes access to LEC customers.[23] The same may prove true for the LEC subscriber. The ability to access a multitude of networks may become a necessary part of LEC service. Just as cellular networks have emerged, offering a service which the LEC cannot offer, mobility, other new networks may develop, offering other unique services. Just

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[22] See "FCC Requires Telcos to Offer Interconnection to CAPs, Other Third Parties Through "Virtual Collocation Arrangements; Tariffs Due Sept. 1," *Telecommunications Reports* 60, no. 29 (July 18, 1994): 3-6.

[23] Cellular customers also want access to E-911 services, which are offered over the PSN. Because cellular is a mobile service, it is difficult to accommodate E-911, which is based on the ability to locate the subscriber calling for emergency services. Until it is possible for cellular, and other wireless services, to provide true E-911 service, it is difficult to say that cellular is not in this regard an inferior network to the PSN.

as customers expect the ability to access the LEC network through the cellular network, and vice versa, so will customers expect the ability to access these new networks and new services. Reciprocity among networks is necessary to facilitate such customer choice and should, therefore, emerge as an issue of concern for regulators considering the linchpin model.

The ability to access a multitude of networks may become more than a desirable feature for consumers, it could become a universal service requirement if universal service is redefined in the future as "universal access."

An inescapable fact of telecommunications regulation is the mandate in the Communication Act of 1934:

> . . . . to make available, so far as possible, to all the people of the United States a rapid, efficient, Nation-wide, and world-wide wire and radio communication service with adequate facilities at reasonable charges . . . .[24]

Efforts to rewrite the Communication Act continue to include provisions for universal service, as the recent debate over Senator Holling's Senate Bill 1822 so clearly illustrates. A major component of that bill is the definition and provision of universal service. Until now, the LEC industry has carried the burden of providing universal service. Recent developments suggest that this burden may need to shift and change.

At a basic level, the definition of universal service is not clear. For decades, during the days of the parallel networks model discussed above, the assumption was that universal service meant the provision of reasonably priced dial tone. The National Telecommunications Information Administration (NTIA), in its examination of the status of the U.S. infrastructure, suggested that a "current, reasonable" definition of universal service includes, "one-party-, voice-grade service with rotary dialing, the ability to receive and place calls, and access to and direct dialing of local and toll calls."[25] The authors of the NTIA study, however, urged

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[24] Title I of the Communication Act of 1934.

[25] National Telecommunications and Information Administration, *The NTIA Infrastructure Report: Telecommunications in the Age of Information* (Washington, DC: U.S. Govt Dept of Commerce, October 1991): 304.

policymakers to go beyond a list of basic services to a more expansive concept, which they call universal service access (Advanced USA). Advanced USA is access to a host of services offered by providers other than the traditional PSN providers. As the NTIA study's authors note, "an important component of Advanced USA is the recognition that services or capabilities need not be available only through a traditional common carrier, such as a LEC or IXC."[26] If access becomes a component of universal service, then reciprocity of interconnection will become an important element in the network of networks configuration.

Beyond the issue of definition, two major concerns arise during any discussion of universal service: who must provide it? and how will it be paid for? In a network of network configuration it is desirable to assume that every component of the network should play some role in the provision of universal service, either as a provider of the service or as a contributor toward it. At this point, only the LEC serves as a carrier of last resort and only the LEC has a history of pricing subsidies designed to keep residential rates and rural rates relatively low. Also at this point, only the LEC receives monies from a Universal Service Fund provided by the IXC industry. It would, of course, be the easiest approach to allow things to continue as they have; however, the telecommunications landscape has changed, and universal service provisions will also need to change.

In a network of networks, if only the LEC is responsible for universal service, the LEC may become the provider of the least-common-denominator network. As other networks grow in technological sophistication, and in high-end subscribers, the LEC may under some scenarios be left with basic services and low-end rates. This is not a healthy situation for the nation's basic infrastructure. Requiring that all networks take on their share of low-end subscribers would help maintain some parity in network sophistication and in over-all service pricing. If other networks are also required to provide universal service, it is still not clear what that universal service should include. It could be merely the least sophisticated services available from each provider. An alternative would be to require that each subscriber, regardless of network, only be assured the ability to fulfill his or her basic voice telephony

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[26] Ibid., 305-6.

needs. Another question to be considered is the amount of access to include in this type of universal service. Each subscriber could be assured the ability to access one network of his or her choice. Or, each subscriber could be assured the ability to reach only the subscribers residing on his or her network of choice.

If each network provider is not required to provide universal service/access, should each network provider help subsidize the network which does? When the cellular industry was formed, it was not set up as a carrier of last resort nor was it required to contribute toward any universal service fund. Should the requirement to at least contribute to a fund be put in place for all networks other than the PSN? Should the requirement be extended to the PSN as well? Suggestions have been made that universal service assistance should be provided directly to needy subscribers. These subscribers could then choose their network provider.[27] Another aspect of the universal service discussion involves the issue of the availability of services. CAPs are not required to serve sparsely populated areas. According to a recent study, CAPs have sought certification in twenty-three states, and these states represent three quarters of the nation's population and economic activities.[28] For their part, LECs have been required to serve rural areas and inner-city areas. Regulators must decide whether other network providers, beside the LECs, should also be required to serve less profitable locations.

There are, as yet, no answers to the regulatory questions of what should be included in universal service, who should provide it, who should pay for it, and how it should be paid for. There are many questions because the logistics of what is involved in a network of networks are not yet clear. Nor is the range of services totally defined as of yet. There are some basic

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[27] For an extensive discussion of universal service in its various aspects, see John D. Borrows, Phyllis Bernt, Raymond Lawton, *Universal Service in the United States: Dimensions of the Debate* (Columbus, OH: National Regulatory Research Institute, June 1994).

[28] "CAPs Follow the People and the Dollars to Affluent Regions," *State Telephone Regulation Report,* July 14, 1994, 1.

Mandating interconnection requirements requires coordination.

considerations which should guide the debate regarding universal service in the new network environment. In a network of networks, universal service arrangements should not favor one network over another. Universal service arrangements should not relegate one network to the role of inferior service provider. If universal service arrangements are to keep up with technological advances, they should be built on a definition of universal service which is robust enough to encompass new developments.

Issues of reciprocity and universal service represent regulatory challenges because it is not clear which regulators should decide these issues. Each of the components of the linchpin network model are regulated in a different fashion, often by different bodies, usually under different requirements. As Table 1 shows, there is little uniformity across networks.

While the regulatory model for addressing a changing network configuration is in the process of evolving from the traditional parallel services network model, the underlying checkerboard of regulation continues. Mandating interconnection requirements, universal service arrangements, and reciprocity agreements across all of these services will require, at a minimum, coordination and agreement between the FCC and state commissions, and cooperation with a wide range of actual and potential communications providers.

In the complexity of the new environment, the linchpin network model provides a bit of stability because it maintains the idea of a PSN, as represented by the LEC, as the focal point. The emphasis of regulation for new services, such as cellular and PCS has been to get the new technology introduced. Considerations which pertain to LEC regulation, like universal service, have not played much of a role for non-LEC providers. This is not surprising, since the new services have not typically been seen as replacements for the LEC. They have been seen as different services whose introduction would have no real impact on the LEC, at least in the foreseeable future. This may no longer be a valid assumption. Alternatives to the LEC are developing. If they significantly displace the LEC, considerations which have usually been reserved for the LEC may also have to be applied to these new players. For example, CAPs may have to agree to be a universal service provider.

TABLE 1

THE REGULATORY TREATMENT AND STATUS OF CURRENT SERVICE PROVIDERS

PROVIDER	REGULATORS	SERVICE AREA	Common Carrier	Market Type
LEC	FCC & PUC	LATA	YES	Local Monopoly Total Competition
Cable	FCC & Muni	Local Franchise	NO	Monopoly
Cellular	FCC (mainly PUC	MSAs/RSAs	YES	Duopoly
PCS	FCC (mainly)	MTAs/BTAs	YES	Oligopoly
CAP	Sometimes Certified by PUC	N/A	NO	Competitive

Source: Author's construct.

The Intermeshed Network Model

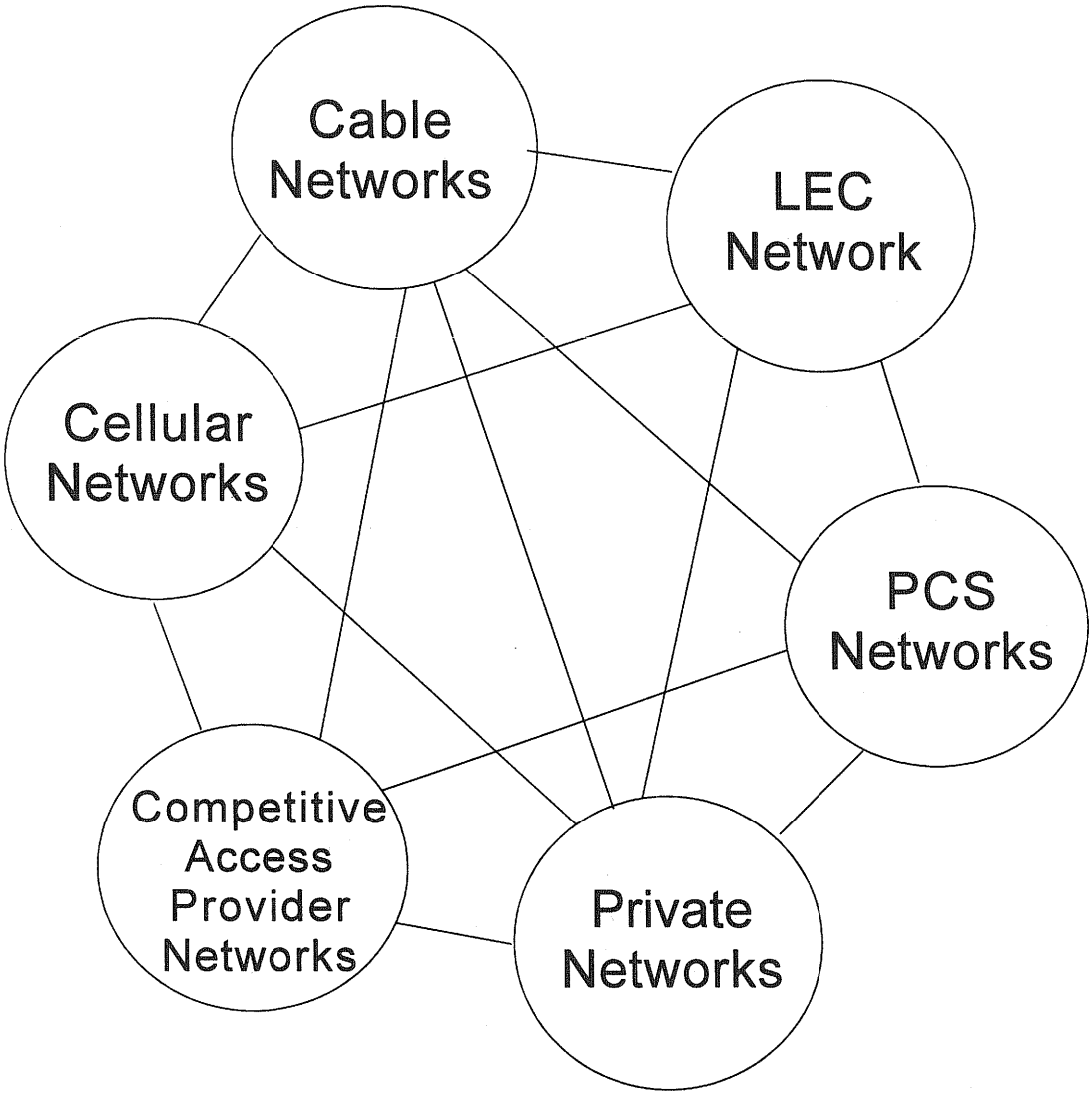
The central regulatory question is "How can LEC and nonLEC interactions best be conducted?"

The linchpin network presupposes a dominant focal point to the network of networks, but the linchpin model may only be transitional. The other networks may grow in their ability to compete with the LEC portion of the PSN by providing services which are good substitutes for LEC services and which may offer advanced features not available from the LEC. If that proves to be the case, the LEC may no longer be a linchpin. This may occur, not because of any degradation of the LEC in its role as a ubiquitous telecommunications provider, but because others have grown and expanded their services. There may emerge a configuration which is similar to the configuration in Figure 4. This is called the "intermeshed network" model.

In this configuration, many of the same issues raised by the linchpin model still pertain. Interconnection, reciprocity, service standards all are a concern. While the LEC in the linchpin model offered some easy means of coordination among networks, the intermeshed model offers no such coordination point.

Because the linchpin approach is a centralized model, the central regulatory question is, "How can LEC and non-LEC interactions best be conducted?" The LEC remains the center of all regulatory efforts and allows "one-stop" shopping as rules promulgated for the LEC automatically affect all of its interactions with its customers and competitors. In the intermeshed environment a major function of regulation may be to provide that coordination. Because so many different regulatory approaches have been taken to the various service providers involved, as is shown in Table 1, the need for agreement among federal, state, and local regulators will be even greater.

The LEC in the linchpin model maintained some semblance of a public utility, an entity providing an essential service and so subject to regulatory constraint in return for some guarantees of market territories and cost recovery. In the intermeshed model, none of the players necessarily function as the public utility. In a sense the whole construct provides a



Source: Author's construct.

Fig. 4. The Intermeshed Network Paradigm.

public utility service. It may be necessary for each of the networks in the intermeshed model to face some level of regulatory oversight. At a minimum, regulators may need to assert their right to require certain interconnection rules, to require reciprocity agreements and common carriage-type obligations, to set certain service quality standards to assure that interconnection proceeds in a fair and orderly manner, and in the best interests of all involved. Some participants in the intermeshed model may face greater oversight than they have before; others may experience less. If this model is successful, the net amount of regulation of all network components should be less than that required for the linchpin or the parallel services approaches. Conceptually, greater opportunities for competition among network components should obviate the need for close regulatory scrutiny of all pricing and service delivery. Whatever the amount of oversight, it should be as symmetrical as possible, so that no one network is arbitrarily advantaged because of its technology, content, size, or geographical scope.

For those policymakers who believe that competition is superior to monopoly and that competitive market forces are superior to regulation, this paradigm may be especially attractive. In the intermeshed model it would appear that competition can, and indeed must, be prevalent and that market forces should result in fair and reasonable prices and interconnection arrangements. There are any number of networks possible, all providing a range of services, many of which are substitutes for one another. The various network providers are free to compete on quality and on features. Customers should be able to pick and choose based on desired features, price, and quality of service. The secret, it would appear, is to assure that customers have maximum choice and control in making their decisions.

Implementing this model may not be that simple, however. In this model, the ability to connect subscribers to a variety of networks may be a key competitive advantage. Network providers could deny interconnection and reciprocity to other network providers to enhance their own position, or the position of their subsidiaries or sister companies. An element of this network model that is not clear is the ownership of the various network modules. With the proliferation of mergers and joint ventures, the same entity may own, or control, or have a

vested interest in, a PCS network, a cable network, and a CAP network. It is conceivable that, over the course of time, one entity, or a very small group of entities, could emerge which controlled, directly or indirectly, virtually all components of the network of networks. The potential for market power and for noncompetitive behavior still pertains, regardless of the network configuration. In fact, the historical domination of American telephony by the Bell System was not achieved immediately but came about through various mergers and acquisitions that occurred because of Bell financial resources, control of key patents, and discriminatory interconnection practices. The result was concentrated ownership and control of international calling, long distance, local services, manufacturing, and research and development by one firm.

Regulation of joint ventures is uncharted territory.

State and federal regulators, therefore, face an interesting challenge. It has often proven difficult enough to regulate a part of a Regional Bell Operating Company. Indeed, regulators in the state commissions comprising the Ameritech region have formed the Ameritech Regional Regulatory Committee to help get a picture of the total corporation and of the subsidiaries which comprise it.[29] Regulators will face even greater difficulties in ensuring that anticompetitive practices do not arise from the vast conglomerates that will emerge from continuing mergers. Traditionally regulators exercised "cautious restraint" in carrying out their oversight of utility holding companies. Joint ventures offer just as much opportunity for anticompetitive practices, but the rationale for regulatory intervention is much less clear. Regulation of joint ventures is uncharted territory.

If regulators in this environment assure that fair interconnection provision are followed, that reciprocity agreements are available to all, that service quality standards are maintained, and that customer choice is protected and encouraged, they may be performing

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[29] Douglas N. Jones discusses regional regulatory approaches, especially for the electric and telecommunications areas in "Revisiting Regional Regulation of Public Utilities," in *Journal of Economic Issues* XXVII, no. 4 (December 1993): 1219-1239.

the most important regulatory functions necessary for this new environment. Enough options and competitive choices may result to keep prices reasonable and service quality high.

The key to assuring open competition, and to lessening the likelihood of noncompetitive behavior, will rest with assuring freedom of customer choice. If a subscriber on a CAP network wishes to access a specific cellular network, but the CAP has a relationship with another cellular provider, the subscriber should be guaranteed equal access to his or her choice. Once again there are lessons from the recent past which provide some insight into what is involved in such a situation. Those lessons come from equal access and presubscription. In the long distance arena, LECs are required to provide ***equal*** access to all IXCs, this includes assuring that subscribers are able to reach the IXC of their choice through specific, easily understood dialling patterns, and through a presubscription process. This has been achieved through a lengthy and often confusing process, especially for subscribers. LECs updated switches, customer records and customer service procedures. LECs also began to route traffic to specific IXCs.

Access needs to be based on subscriber wishes.

There are many lessons from this experience. One lesson deals with the provision of access based on ***subscriber*** wishes. In this scenario, subscribers use the facilities of one network provider to reach another network provider. The presubscription rules required that customers' wishes be honored, and precluded LECs from favoring one IXC over another, either in routing the traffic itself or during contacts with customers. The same type of arms-length treatment may be required of all network providers in this model to assure choice and to control anticompetitive behavior.

In the intermeshed model, the issue of universal service remains a concern. With no one dominant network, who serves as the carrier of last resort? In this model, extending universal service requirements to all network providers would preserve some level of equality among subscribers. The expansion of universal service to universal access would also make sense. It is not enough in this arrangement to provide a subscriber with access to customers on one network; access to other networks is essential, since the whole amalgam of networks represents what was once the unified PSN.

Another issue which the parallel services network and the linchpin network models did not address, largely because the PSN, or parts of the PSN, features so prominently in them, is the issue of exit and entry. LECs have had to demonstrate an ability to provide services and then have had to get permission to withdraw from those services. If subscribers can move easily from one network provider to another, exit and entry limitations may not be an issue. If, on the other hand, it appears that such movement is not simple, and alternative network options are not available, some exit restrictions may need to be developed. The issue of exit and entry figures prominently in the consideration of service availability. If only one network is available in a specific location, its ability to withdraw services may need to be curtailed. Equally, exit and entry constraints may limit potential service providers to those firms with significant financial resources.

The intermeshed networks model presents an interesting landscape for subscribers and for regulators. It is more complex than the linchpin model; however, regulatory concerns regarding this model may not be that different from those in the linchpin model. In the linchpin model, a major concern was to control the ability of the dominant network to abuse its power. In the intermeshed model, a major concern is to keep any network, or cartels of networks, from becoming dominant. The linchpin model was concerned with issues of interconnection and reciprocity. The same issues pertain for the intermeshed network. However, coordinating these issues without a focal network may be more difficult. The jurisdiction of the regulators seeking to oversee each of the network providers will have to be clearly defined.

Regulators seeking a greater sense of control and security in maintaining some semblance of a PSN in order to achieve universal service goals may wish to stop at the linchpin model. However, that model may be just a transition to the intermeshed approach. The continuing forces of technology, offering new features and services and new service providers, may push in the direction of competition even where the regulators do not.

The Significance of the Cable/Telco Debate

The relationship between the cable companies and the telephone industry has been a major theme of regulation in the U.S. for over two decades. Telephone companies have been precluded from offering cable service within their telephone serving areas in order to shield the cable industry from competition from the telephone company, which already owns rights of way, telephone poles, and facilities that extend into virtually every home in the nation. Cable companies, on the other hand, have not faced such restrictions regarding their ability to provide voice and data services. Until now, cable companies have not moved quickly to take advantage of their freedom to offer other services.

The development of fiber optic facilities and the growing indication that data services, video, and voice all seem to be merging have changed the picture for both the telephone companies and the cable companies. If telecommunications is moving toward multimedia services, in which voice, data, and video may all terminate in one instrument, or travel over one line, then neither the cable company, which has been the video provider, nor the telephone company, which is the voice and data provider want to be left out. If fiber optic facilities offer enough bandwidth to deliver voice, data, and video over one pipe, both the telephone company and the cable company want to provide fiber facilities. However, fiber is expensive, and the cable companies already have coaxial facilities in place, while the telephone companies serve their customers through copper wires. For both industries, fiber optic facilities mean replacement of existing facilities. That is expensive.[30] To justify such expense, and to be positioned for multimedia delivery, both the telephone and cable companies want to provide, and be paid for, a full range of services.

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[30] An analysis of the cost of upgrading PSN facilities to provide ubiquitous fiber to the home (FTTH) cited a range of $100 billion to $1,900 billion in total costs. The cost of providing fiber to the curb (FTTC) was estimated as being one third to one half that amount. See Julia A. Miezejeski, Michael Miller, and Bruce L. Egan, *An Analysis of a Portion of the Cost of Converting a Local Telephone Utility Network into a Network Capable of Delivering Broadband and Cable Television Services to all Subscribers*, (Columbus, OH: National Regulatory Research Institute, October 1990), 41-58.

Will cable companies be common carriers?

The question is one of economics. Whoever has the resources to get fiber deployed more quickly, will get fiber and the whole range of services, to the customer first, supplanting its rival in the process. The broader regulatory question is often framed, however, in the context of whether subscribers will function in a two-wire or a one-wire world. In other words, will either the telephone company or the cable company be able to replace the other, and thus offer all services over one wire, or will there be two or more wires owned by others that provide the same range of services as the incumbent LEC?

What clouds this issue further is the drive to build an "Information Super Highway" of broadband facilities across the country. The super highway is envisioned as being fiber-based. The question is, who will build it. The telephone companies assert that they cannot afford to build this super highway unless they can offer lucrative video services, mainly video programming. The cable companies declare an inability to build this super highway if they lose their hold over video services. The validity of the telephone and cable companies' arguments may be obscured because of the public policymakers' enthusiasm for a broadband highway which they regard as a crucial strategic tool for the U.S. economy.

How does this issue fit into the network of networks discussion? In a network of networks, fiber-based facilities are only one piece of the picture, not the whole picture. Wireless plays a role, and may play an ever increasing role, in the future network configuration. Questions about the relationship between the PSN and the cable networks are similar to the ones about the relationship between the PSN and other networks: do they provide substitutable services? what are the rules governing their interconnection? do they have reciprocal agreements?

A wrinkle in the cable network, that does not exist in the other networks, is that cable is not a common carrier. Cable provides content; the other network providers do not. If the telephone companies are able to provide content as well, that component of their business will

not quite fit the old regulatory model, just as that aspect of the cable networks does not quite fit now. A cable company providing voice services but not having common carrier obligations or reciprocal interconnection obligations could easily (and almost unknowingly) engage in competitive practices forbidden to the LECs. The important questions from a regulator's perspective regarding the relationship between cable and telephony deal with issues of diversity of information sources and questions of common carrier responsibilities.

If video programming is easily available to subscribers from both the telephone company and the cable company, diversity of information has been enhanced. A two-wire duopoly, of course, provides more diversity than does a one-wire monopoly. From the standpoint of information diversity, a multitude of providers is optimal. Despite the number of providers, information diversity has not been appreciably increased if it is difficult for a subscriber to move from one provider to another. The ability to move from one network provider to another with a degree of ease is important in the whole network of networks configuration. Again, this is the issue of customer choice and control which has been discussed elsewhere in this report.

In regard to common carrier responsibilities, it is not clear whether the cable company will have to provide basic voice and data service as a common carrier, or whether the company will be able to pick and choose whom it wants to serve. As a common carrier, will the cable company have to provide voice and data at just and reasonable prices? If so, policymakers will have to decide how those prices will be determined and by whom. Cable is regulated by local franchisers and by the FCC for its video services. Will the FCC and state commissions regulate the voice and data service provision? If so, there will be three different entities regulating services flowing over one pipe. The same would hold true if the telephone company had to apply for a local franchise to offer cable service over the same pipe it offered voice and data services. It is difficult enough to allocate the cost of that pipe between state and interstate and local voice and data services; adding yet another category will make things all the more complicated.

In many ways the network of networks paradigm offers some insight into the cable/telco debate. Certainly in the intermeshed model, for the model to work there must be some equality in regulation across the networks. This speaks for some effort to arrive at symmetrical regulation of cable and telephony. The FCC is encouraging the telephone companies, through the video dialtone process, to provide video common carriage. Telephone companies will have to lease facilities to all comers as long as capacity exists. That is not the case for cable. There is, therefore, still a large degree of asymmetrical regulation. Bringing other services, which have traditionally been treated as common carriage, into the picture makes the situation even more difficult. The Clinton Administration has tried to arrive at some symmetrical arrangement by calling for a new Title VII to the Communication Act, which would regulate "broadband services" providers (in other words those who provide voice, video and data over one pipe). This approach brings one more category into the mix. It also exhibits the shortcomings of regulating according to technology rather than service provider. If wireless is able to provide voice, video, and data to one customer, does it then also become a Title VII carrier? A better option might be to work toward establishing parallel requirements.

If the telephone companies will have to offer video services, notably programming, through a separate subsidiary, shouldn't the cable company have to offer voice and data services through a separate subsidiary as well? All of these are questions which must be addressed for one piece of the future telecommunications picture. For purposes of the network of networks model, the important issues center on the point-to-point services offered by these two service providers; the focus is on the conduit and common carriage aspects of their service provision. In that context, the cable network offers its subscribers point-to-point services on its own network and access to other network providers. Any regulatory action which assures that the cable network has no unfair advantage in the delivery of these services enhances the efficacy of the network of networks.

Regulatory Goals

Precise regulatory boundaries are no longer possible.

Changes in technology are forcing regulators to examine issues from a different perspective. Services which were once neatly separated by technology and service provider, are no longer separate. Precise regulatory boundaries are no longer possible. The traditional parallel services network model no longer reflects the growing interrelationships between services and service providers. A new model needs to be developed. This study has suggested two possible models, both based on a network of networks concept. The linchpin model assumes the LEC is the focal network to which other networks seek interconnection. The intermeshed model assumes a network of equals, with no one network serving as the focal point or linchpin.

Both paradigms present different regulatory challenges and options. The linchpin network is closer to what regulators are accustomed to seeing. There is still a remnant of a PSN. There is still a focal point for coordination. There is still a dominant provider who has been the traditional provider of universal service. Some regulators may see the linchpin model as the network topology they would wish to attain, and then go no further. If the monopoly position of the LEC in that model is not eroded, if matters of interconnection and reciprocity are not dealt with vigorously, the linchpin model may emerge as the ultimate structure for regulation.

Technology may not give regulators that option. If other networks continue to expand in market share and in span of features and services, the relative position of the LEC may inevitably decline until it is just one of many networks. If that is the case, regulators may be able to keep the LEC viable, and focal, by encouraging LEC investment and the provision of new services.

The underlying question in looking for a new regulatory paradigm must be the ultimate goals to be achieved. It may be that the linchpin model makes the attainment of universal service easier to achieve; the intermeshed model makes that process more

problematic. The intermeshed model, on the other hand, provides great promise for advanced technology and a host of new services offered in a more competitive environment.

It is improbable that all goals are reachable.

It is important to remember that there is no one goal to be achieved by regulation, rather there are many potential goals. Regulation may be undertaken to support a social agenda. The universal service requirement of the Communication Act of 1934 advanced such an agenda. Telephone companies have averaged rates and have built in pricing subsidies in order to make universal service an affordable reality. Other social goals are equitable access to services; all citizens have a right to an equal chance to benefit from services which are perceived to have some "public utility" aspect. Other goals include economic development, the idea that a specific service can help the development of rural areas or of other sectors of society. And there is a significant social goal of education. Another more recently articulated set of goals has to do with improving the delivery of governmental and safety services through an advanced telecommunication infrastructure.

Regulation can also be used to push new technologies, as was the case with cellular and will be the case with PCS. Regulation can be used to shield emerging technologies from unfair competition or undue harm, as was the case with the FCC's decision to shield the early cable industry from the deep pockets of the telephone companies.

Another goal of regulation has been to further a competitive market model, making sure that market dominance does not result in monopoly and that competition exists to enhance consumer choice. In the cable world, regulatory goals include assuring a variety and diversity of information sources for citizens.

It is improbable that all goals are reachable. Some goals may be mutually exclusive or at least may make the attainment of other goals more difficult. If a goal is the encouragement of infrastructure investment, then a regulatory environment which places no restrictions on investment seems an appropriate approach. However, if there are social goals, such as universal access, such an unlimited approach may be counterproductive. This seems to be the case in the recent debate over whether to amend the Communication Act to include a

requirement that advanced technologies be introduced in all areas, including the less affluent inner cities, at the same pace.

Regulators may find the intermeshed networks model attractive because it encourages a competitive playing field and may make regulation unnecessary where market forces will come to bear. It is important for regulators to remember that competition may not always thrive without some regulatory involvement. As Kaysen and Turner have noted, regulation may be needed in instances in which competition cannot survive or market imperfections exist.[31] If the intermeshed network becomes a reality, regulators will have to very carefully monitor how viable competition will be.

In formulating regulatory goals, it may be useful for regulators to realize that there is a push to have both unfettered growth and development and the achievement of a social agenda. The Clinton Administration, in outlining its vision for a National Information Infrastructure, articulates this dual purpose very clearly:

> An advanced information infrastructure will enable U.S. firms to complete and win in the global economy, generating good jobs for the American people and economic growth for the nation. As importantly, the NII can transform the lives of the American people—ameliorating the constraints of geography, disability, and economic status—giving all Americans a fair opportunity to go as far as their talents and ambitions will take them.[32]

This vision of an infrastructure mixes both social goals and economic ones. This is a difficult balance to achieve. Achieving that balance makes the formulation of flexible, effective regulatory paradigms all the more necessary.

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[31] Carl Kaysen and Donald F. Turner, *Antitrust Policy: An Economic and Legal Analysis* (Cambridge: Harvard University Press, 1959), 189-90, as quoted by Charles F. Phillips, Jr., in *The Regulation of Public Utilities: Theory and Practice* (Arlington, Va.: Public Utility Reports, 1993), 50.

[32] National Telecommunications and Information Administration, Docket No. 930940-3240, The National Information Infrastructure: Agenda for Action, *Federal Register* 58, no. 181 (Tuesday, September 21, 1993): 140.

Conclusions and Directions

The traditional regulatory paradigm of jurisdictional boundaries and distinctions between services and service providers worked well for decades. The integrity of the PSN was preserved; affordable rates were encouraged; universal service was fostered; and new services, such as cellular telephony, were introduced through regulatory action.

Technological advances, such as wireless technologies and broadband fiber and new industry players, such as PCS providers and CAPs, are breaking down boundaries between jurisdictions and between service providers. Competition has come into all parts of what was once an unbroken public switched network. Customers have their choice of customer premise equipment and long distance providers. They also have their choice of cellular companies and soon will have options for PCS services and for local service providers.

Old regulatory paradigms are no longer adequate.

In this era of change, the old regulatory paradigms are no longer adequate. As customers' needs change, as new services and new networks proliferate, and as mergers and joint ventures create new types of service providers, a new regulatory paradigm is needed to guide policy decisions. A possible new paradigm is the network of networks. The network of networks approach accommodates such important elements as customer choice, multiple service options, and multiple providers offering a range of substitutable services. The network of networks paradigm is also technology neutral and flexible enough to accommodate growth in number of services and changes in service providers. All of these attributes reflect current and developing conditions in the telecommunications environment.

In a network of networks configuration, the regulatory focus can no longer be on boundaries and distinctions; rather state and federal regulators and policymakers will need to formulate rules which will assure that a network of networks includes necessary protections for all subscribers and for all service providers. An efficient network of networks will provide customers with access to a wide range of services and will give service providers the opportunity to compete fairly and to be treated equitably.

Interconnection must be available in a nondiscriminatory manner.

In a perfect world, market forces would make all of this a reality. In the world of telecommunications, regulatory action is needed to at least approximate these desired outcomes. It is unlikely that telecommunications can move from a model dominated by the PSN to a model of equal competitors without some regulatory intervention. It is also doubtful that enough services and enough competitors will emerge in the foreseeable future to assure the benefits of full-blown competition, even in a network of networks. Clouding the picture even further is the existence of the universal service mandate. So long as universal service remains a goal, some regulatory action will be necessary to assure that no one falls through the cracks, regardless of the regulatory paradigm followed.

In addition to formulating universal service strategies for a network of networks environment, regulators and policymakers will need to be concerned that:

(1) equitable and open interconnection requirements exist;

(2) reciprocity requirements are in place;

(3) safeguards against the abuse of market dominance and against cross-subsidization are effective;

(4) service standards are preserved across networks;

(5) regulation is symmetrical across networks, so no single network provider is inadvertently advantaged or disadvantaged.

Regulators, at both the state and federal levels, should assure that all those seeking interconnection are treated in a fair and nondiscriminatory manner. Policymakers should also be concerned that all subscribers in the network of networks configuration reap the benefits of reciprocity. In other words, network providers should be required to offer one another reciprocal interconnection and access to their networks. Efforts should be made to assure that no one network provider, or cartel of providers, is able to achieve, or to abuse, a position of dominance in order to drive out competitors, either through predatory pricing or interference

with customer choice. Until robust competition makes the regulation of service standards unnecessary, state and federal regulators should take steps to assure that those seeking interconnection can expect specific standards of service and performance.

Perhaps most importantly, policymakers should be concerned that they do not inadvertently "pick a winner" because of asymmetrical regulation. Simply stated, regulators in addressing the network of networks model should not hold the various network providers to vastly different regulatory standards and requirements and thereby give one provider a distinct advantage over its competitors.

By addressing all of these issues, regulators and policymakers will help assure that the successes of the traditional regulatory paradigm will remain in place. In the traditional paradigm of one unified PSN, customers came to expect seamless service, known and exact service standards, and ubiquitous service. Customers have been able to establish point-to-point communication with virtually any location quickly and easily. They will expect no less in a network of networks environment. Without some level of service standards, without efficient interconnection arrangements, and without reciprocity among networks, customers will not be as well served as they have been in the past.

If the network of networks configuration is one of a linchpin network, regulatory attention will have to focus on issues of market dominance and safeguards against abuse of market power. If the configuration is one of equal networks, the intermeshed model, issues of coordination, service standards and reciprocity will take on greater importance.

No matter what the specifics of the configuration, issues of interconnectivity remain paramount, and so do issues of customer choice. *Indeed, customer choice may hold the key to the appropriate regulatory approach.*

Regulatory options should support customer choice.

The issue of customer choice has been central to the development of competition in telecommunications. The FCC's Computer Inquiry II, which deregulated inside wire and telephone equipment, made it possible for customers to use their choice of customer premise equipment. Facilitating choice in the information services area was at the heart of the ONA

proceeding. Equal access in the provision of long distance services centered on maximizing customer choice through presubscription procedures.

Regulators and policymakers can turn to the lessons offered by these earlier proceedings in formulating their approach to the network of networks configuration. All three proceedings dealt with equitable interconnection and the preservation of service standards. Even more importantly, all three proceedings enhanced customers' options. A successful regulatory approach to a network of networks configuration will take as its central mandate the goal of protecting customer choice and maximizing customer control. That approach will assure that there will be a range of services which are fairly and equitably provided; that reciprocity among providers will be available; that service standards will be maintained; and that all customers desiring services will receive them.