

Chapter 17

U.S.

Telecommunications

Today

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This chapter examines the current conditions in the U.S. telecommunications sector (i.e., October 2002). It examines the impact of technological and regulatory change on market structure and business strategy. Among others, it discusses the emergence and decline of the telecom bubble, the impact of digitization on pricing, and the emergence of Internet telephony. The chapter briefly examines the impact of the 1996 Telecommunications Act on market structure and strategy in conjunction with the history of regulation and antitrust intervention in the telecommunications sector. After discussing the impact of wireless and cable technologies, the chapter concludes by venturing into some short-term predictions. There is concern about the derailment of the implementation of the 1996 Act by the aggressive legal tactics of the entrenched monopolists (the local exchange carriers), and we point to the real danger that the intent of the U.S. Congress in passing the 1996 Act to promote competition in telecommunications will not be realized. The chapter also discusses the wave of mergers in the telecommunications and cable industries.

INTRODUCTION

Presently, the U.S. telecommunications sector is going through a revolutionary change. There are four reasons for this. The first reason is the rapid technological change in key inputs of telecommunications services and in complementary goods, which have reduced dramatically the costs of traditional services and have made many new services available at reasonable prices. Cost reductions have made feasible the World Wide Web (WWW) and the various multimedia applications that “live” on it.

The second reason for the revolutionary change has been the sweeping digitization of the telecommunications and the related sectors. The underlying

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ing telecommunications technology has become digital. Moreover, the consumer and business telecommunications interfaces have become more versatile and closer to multifunction computers than to traditional telephones. Digitization and integration of telecommunications services with computers create significant business opportunities and impose significant pressure on traditional pricing structures, especially in voice telephony.

The third reason for the current upheaval in the telecommunications sector was the passage of a major new law to govern telecommunications in the United States, the Telecommunications Act of 1996 (1996 Act). Telecommunications has been traditionally subject to a complicated federal and state regulatory structure. The 1996 Act attempted to adapt the regulatory structure to technological reality, but various legal challenges by the incumbents have thus far delayed, if not nullified, its impact.

The fourth reason is the “bubble” in investment in telecommunications and of the valuation of telecommunications companies of the years 1997 to 2000 and the deflation of the bubble since late 2000.

As one looks at the telecommunications sector in the Fall of 2002, one observes:

- The collapse of prices of the long-distance (LD) sector, precipitating in the bankruptcy of WorldCom, the collapse of the stock prices of long-distance companies, and the voluntary divestiture of AT&T. This comes naturally, given the tremendous excess capacity in long distance from new carriers' investment and from huge expansion of Internet backbones that are very close substitutes (in production) to traditional long distance.
- The fast, but not fast enough, growth of the Internet. In terms of bits transferred, the Internet has been growing at 100 percent a year rather than 400 percent a year as was earlier predicted. As a result, huge excess capacities in Internet backbone and in long-distance transmission were created. The rush to invest in backbones created a huge expansion and then, once the final demand did not get realized, the collapse of the telecom equipment sector.
- The bankruptcy of many entrants in local telecommunications, such as Covad. The reason for this was the failure of the implementation of the Telecommunications Act of 1996.
- A wave of mergers and acquisitions.

Before going into a detailed analysis, it is important to point out the major, long-run driving forces in U.S. telecommunications today. These include:

- Dramatic reductions in the costs of transmission and switching
- Digitization

- Restructuring of the regulatory environment through the implementation of the 1996 Telecommunications Act coming 12 years after the breakup of AT&T
- Move of value from underlying services (such as transmission and switching) to the interface and content
- Move toward multi-function programmable devices with programmable interfaces (such as computers) and away from single-function, nonprogrammable consumer devices (such as traditional telephone appliances)
- Reallocation of the electromagnetic spectrum, allowing for new types of wireless competition
- Interconnection and interoperability of interconnected networks; standardization of communications protocols
- Network externalities and critical mass

These forces have a number of consequences, including:

- Increasing pressure for cost-based pricing of telecommunications services
- Price arbitrage between services of the same time immediacy requirement
- Increasing competition in long-distance services
- The possibility of competition in local services
- The emergence of Internet telephony as a major new telecommunications technology

This short chapter touches on technological change and its implications in the next section. It first discusses the Telecommunications Act of 1996 and its implications, followed by a review of the impact of wireless and cable technologies. The chapter concludes with some predictions and short-term forecasts for the U.S. telecommunications sector.

TECHNOLOGICAL CHANGE

The past two decades have witnessed (1) dramatic reductions in costs of transmission through the use of technology; (2) reductions in costs of switching and information processing because of big reductions of costs of integrated circuits and computers; and (3) very significant improvements in software interfaces. Cost reductions and better interfaces have made feasible many data- and transmission-intensive services. These include many applications on the World Wide Web, which were dreamed of many years ago but only recently became economically feasible.

The general trend in cost reductions has allowed for entry of more competitors in many components of the telecommunications network and an intensification of competition. Mandatory interconnection of public telecommunications networks and the use of common standards for intercon-

nection and interoperability have created a "network of networks," that is, a web of interconnected networks. The open architecture of the network of networks allowed for entry of new competitors in markets for particular components, as well as in markets for integrated end-to-end services. Competition intensified in many, but not all markets.

Digital Convergence and "Bit Arbitrage"

Entry and competition were particularly helped by (1) the open architecture of the network and (2) its increasing digitization. Currently, all voice messages are digitized close to their origination and are carried in digital form over most of the network. Thus, the data and voice networks are one, with voice treated as data with specific time requirements. This has important implications for pricing and market structure.

Digital bits (zeros or ones) traveling on the information highway can be parts of voice, still pictures, video, or of a database or other computer application, and they appear identical: "a bit is a bit is a bit." However, because some demands are for real-time services while others are not, the saying that "a bit is a bit is a bit" is only correct among services that have the same index of time *immediacy*. Digitization implies arbitrage on the price of bit transmission among services that have the same time immediacy requirements.

For example, voice telephony and video conferencing require real-time transmission and interaction. Digitization implies that the cost of transmission of voice is hundreds of times smaller than the cost of transmitting video of the same duration. This implies that if regulation-imposed price discrimination is eliminated, arbitrage on the price of bits will occur, leading to extremely low prices for services, such as voice, that use relatively very few bits. Even if price discrimination remains imposed by regulation, arbitrage in the cost and pricing of bits will lead to pressures for a *de facto* elimination of discrimination. This creates significant profit opportunities for the firms that are able to identify the arbitrage opportunities and exploit them.

Internet Telephony

Digitization of telecommunication services imposes price arbitrage on the bits of information carried by the telecommunications network, thus leading to the elimination of price discrimination between voice and data services. This can lead to dramatic reductions in the price of voice calls, thereby precipitating significant changes in market structure. These changes were first evident in the emergence of the Internet, a ubiquitous network of applications based on the TCP/IP protocol suite. Started as a text-based network for scientific communication, the Internet grew dramatically in the late 1980s and 1990s once not-text-only applications

became available.¹ In 2001, the Internet reached 55 percent of U.S. households, while 60 percent of U.S. households had PCs. Of the U.S. households connected to the Internet, 90 percent used a dial-up connection and 10 percent reached the Internet through a broadband service, which provides at least eight times more bandwidth/speed than a dial-up connection. Of those connecting to the Internet with broadband, 63 percent used a cable modem connection, 36 percent used DSL, and 1 percent used a wireless connection.

Internet-based telecommunications are based on packet switching. There are two modes of operation: (1) a time-delay mode in which there is a guarantee that the system will do whatever it can to deliver all packets; and (2) a real-time mode, in which packets can in fact be lost without possibility of recovery.

Most telecommunications services do not have a real-time requirement, so applications that "live" on the Internet can easily accommodate them. For example, there are currently a number of companies that provide facsimile services on the Internet, where all or part of the transport of the fax takes place over the Internet. Although the Internet was not intended to be used in real-time telecommunications, despite the loss of packets, presently telecommunications companies use the Internet to complete ordinary voice telephone calls. Voice telecommunications service started on the Internet as a computer-to-computer call. As long as Internet telephony was confined to calls from a PC to a PC, it failed to take advantage of the huge network externalities of the public switched network (PSTN) and was just a hobby.

About seven years ago, Internet telecommunications companies started offering termination of calls on the public switched network, thus taking advantage of the immense externalities of reaching anyone on the PSTN. In 1996, firms started offering Internet calling that originated and terminated on the public switched network, that is, from and to the regular customers' phone appliances. These two transitions became possible with the introduction of PSTN-Internet interfaces and switches by Lucent and others. In 1998, Qwest and others started using Internet Protocol (IP) switching to carry telephone calls from and to the PSTN using their own network for long-distance transport as an intranet.²

Traditional telephony keeps a channel of fixed bandwidth open for the duration of a call. Internet calls are packet based. Because transmission is based on packet transport, IP telephony can more efficiently utilize bandwidth by varying in real-time the amount of it used by a call. But, because IP telephony utilizes the real-time mode of the Internet, there is no guarantee that all the packets of a voice transmission will arrive at the destination. Internet telephony providers use sophisticated voice sampling meth-

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ods to decompose and reconstitute voice so that packet losses do not make a significant audible difference. Because such methods are by their nature imperfect, the quality and fidelity of an Internet call depends crucially on the percentage of packets that are lost in transmission and transport. This, in turn, depends on, among other factors, (1) the allocation of Internet bandwidth (pipeline) to the phone call, and (2) the number of times the message is transmitted.³ Because of these considerations, one expects that two types of Internet telephony will survive: the low-end quality, carried over the Internet, with packets lost and low fidelity; and a service of comparable quality with traditional long distance, carried on a company's Intranet on the long-distance part.

Internet-based telecommunications services pose a serious threat to traditional national and international long-distance service providers. In the traditional U.S. regulatory structure, a call originating from a computer to an Internet service provider (ISP) (or terminating from an ISP to a computer) is not charged an "access charge" by the local exchange carrier. This can lead to substantial savings to the consumer.

The FCC, in its decision of February 25, 1999, muddles the waters by finding, on one hand, that "Internet traffic is intrinsically mixed and appears to be largely interstate in nature," while, on the other hand, it validates the reciprocal compensation of ISPs which were made under the assumption that customer calls to ISPs are treated as local calls. If Internet calls are not classified as local calls, the price that most consumers will have to pay to make Internet calls would become a significant per-minute charge. Because it is difficult to distinguish between phone calls through the Internet and other Internet traffic, such pricing will either be unfeasible or will have to apply to other Internet traffic, thereby creating a threat to the fast growth of the Internet. In fact, one of the key reasons for Europe's lag in Internet adoption is the fact that in most countries, unlike the United States, consumers are charged per minute for local calls. The increasing use of broadband connections is changing the model toward fixed monthly fees in Europe.

THE TELECOMMUNICATIONS ACT OF 1996 AND ITS IMPACT

Goals of the Act

The Telecommunications Act of 1996 (the 1996 Act) attempted a major restructuring of the U.S. telecommunications sector. The 1996 Act will be judged favorably to the extent that it allows and facilitates the acquisition by consumers of the benefits of technological advances. Such a function requires the promotion of competition in all markets. This does not mean immediate and complete deregulation. Consumers must be protected from monopolistic abuses in some markets as long as such abuses are feasible

under the current market structure. Moreover, the regulatory framework must safeguard against firms exporting their monopoly power in other markets.

In passing the Telecommunications Act of 1996, the U.S. Congress took radical steps to restructure U.S. telecommunications markets. These steps may result in very significant benefits to consumers of telecommunications services, telecommunications carriers, and telecommunications equipment manufacturers. But the degree of success of the 1996 Act depends crucially on its implementation through decisions of the Federal Communication Commission (FCC) and State Public Utility Commissions as well as the outcome of the various court challenges that these decisions face.

The 1996 Act envisions a network of interconnected networks composed of complementary components and generally provides both competing and complementary services. The 1996 Act uses both *structural* and *behavioral* instruments to accomplish its goals. The Act attempts to reduce regulatory barriers to entry and competition. It outlaws artificial barriers to entry in local exchange markets, in its attempt to accomplish the maximum possible competition. Moreover, it mandates interconnection of telecommunications networks, unbundling, nondiscrimination, and cost-based pricing of leased parts of the network, so that competitors can enter easily and compete component by component and service by service.

The 1996 Act imposes conditions to ensure that *de facto* monopoly power is not exported to vertically related markets. Thus, the 1996 Act *requires* that competition be established in local markets *before* the incumbent local exchange carriers are allowed in long distance.

The 1996 Act preserves subsidized local service to achieve "Universal Service," but imposes the requirement that subsidization is transparent and that subsidies are raised in a competitively neutral manner. Thus, the 1996 Act leads the way to the elimination of subsidization of Universal Service through the traditional method of high access charges.

The 1996 Act crystallized changes that had become necessary because of technological progress. Rapid technological change has always been the original cause of regulatory change. The radical transformation of the regulatory environment and market conditions that is presently taking place as a result of the 1996 Act is no exception.

History

Telecommunications has traditionally been a regulated sector of the U.S. economy. Regulation was imposed in the early part of this century and remains today in various parts of the sector.⁴ The main idea behind regulation was that it was necessary because the market for telecommunications

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services was a natural monopoly, and therefore a second competitor would not survive.

As early as 1900, it was clear that all telecommunications markets were *not* natural monopolies, as evidenced by the existence of more than one competing firm in many regional markets, prior to the absorption of most of them into the Bell System. Over time, it became clear that some markets that may have been natural monopolies in the past are *not* natural monopolies anymore, and that it is better to allow competition in those markets while keeping the rest regulated.

The market for telecommunication services and for telecommunication equipment went through various stages of competitiveness since the invention of the telephone by Alexander Graham Bell. After a period of expansion and consolidation, by the 1920s, AT&T had an overwhelming majority of telephony exchanges and submitted to state regulation. Federal regulation was instituted by the 1934 Telecommunication Act, which established the Federal Communications Commission.

Regulation of the U.S. telecommunications market was marked by two important antitrust lawsuits that the U.S. Department of Justice brought against AT&T. In the first one, *United States v. Western Electric*, filed in 1949, the U.S. Department of Justice (DoJ) claimed that the Bell Operating Companies practiced illegal exclusion by buying only from Western Electric, a part of the Bell System. The government sought a divestiture of Western Electric, but the case was settled in 1956 with AT&T agreeing not to enter the computer market but retaining ownership of Western Electric.

The second major antitrust suit, *United States v. AT&T*, started in 1974. The government alleged that (1) AT&T's relationship with Western Electric was illegal and (2) that AT&T monopolized the long-distance market. The DoJ sought divestiture of both manufacturing and long distance from local service. The case was settled by the Modified of Final Judgment (MFJ). This decree broke away from AT&T seven regional operating companies (RBOCs). Each RBOC was comprised of a collection of local telephone companies that were part of the original AT&T. The RBOCs remained regulated monopolies, each with an exclusive franchise in its region.

Microwave transmission was a major breakthrough in long-distance transmission that created the possibility of competition in long distance. Microwave transmission was followed by technological breakthroughs in transmission through satellite and through optical fiber.

The breakup of AT&T crystallized the recognition that competition was possible in long distance, while the local market remained a natural monopoly. The biggest benefits to consumers during the past 15 years have come from the long-distance market, which during this period was

transformed from a monopoly to an effectively competitive market. However, often consumers do not reap the full benefits of cost reductions and competition because of an antiquated regulatory framework that, ironically, was supposed to protect consumers from monopolistic abuses but instead protects the monopolistic market structure.

Competition in long distance has been a great success. The market share (in minutes of use) of AT&T fell from almost 100 percent to 53 percent by the end of 1996, and is presently significantly below 50 percent. Since the MFJ, the number of competitors in the long-distance market has increased dramatically. In the period up to 1996, there were four large facilities-based competitors: AT&T, MCI-WorldCom, Sprint, and Frontier.⁵ In the period after 1996, a number of new large facilities-based competitors entered, including Qwest, Level 3, and Williams. There are also a large number of "resellers" that buy wholesale service from the facilities-based long-distance carriers and sell to consumers. For example, currently, there are about 500 resellers competing in the California interexchange market, providing very strong evidence for the ease of entry into this market. At least 20 new firms have entered the California market each year since 1984. In California, the typical consumer can choose from at least 150 long-distance companies. Exhibit 1 shows the dramatic decrease in the market share of AT&T in long distance up until 1998, after which the declining trend has continued.

Prices of long-distance phone calls have decreased dramatically. The average revenue per minute of AT&T's switched services has been reduced by 62 percent between 1984 and 1996. AT&T was declared "non-dominant" in the long-distance market by the FCC in 1995.⁶ Most economists agree that presently the long-distance market is *effectively competitive*. Exhibit 2 shows the declining average revenue per minute for AT&T and the average revenue per minute net of access charges.

Local telephone companies that came out of the Bell System (i.e., RBOCs) actively petitioned the U.S. Congress to be allowed to enter the long-distance market, from which they were excluded by the MFJ. The MFJ prevented RBOCs from participation in long distance because of the anti-competitive consequences that this would have for competition in long distance. The anticompetitive effects would arise because of the control by RBOCs of essential "bottleneck" inputs for long-distance services, such as terminating access of phone calls to customers who live in the local companies' service areas. The RBOCs enjoyed monopoly franchises.

A long-distance phone call is carried by the local telephone companies of the place it originates and the place it terminates, and only in its long-distance part by a long-distance company. Thus, "originating access" and "terminating access" are provided by local exchange carriers to long-dis-

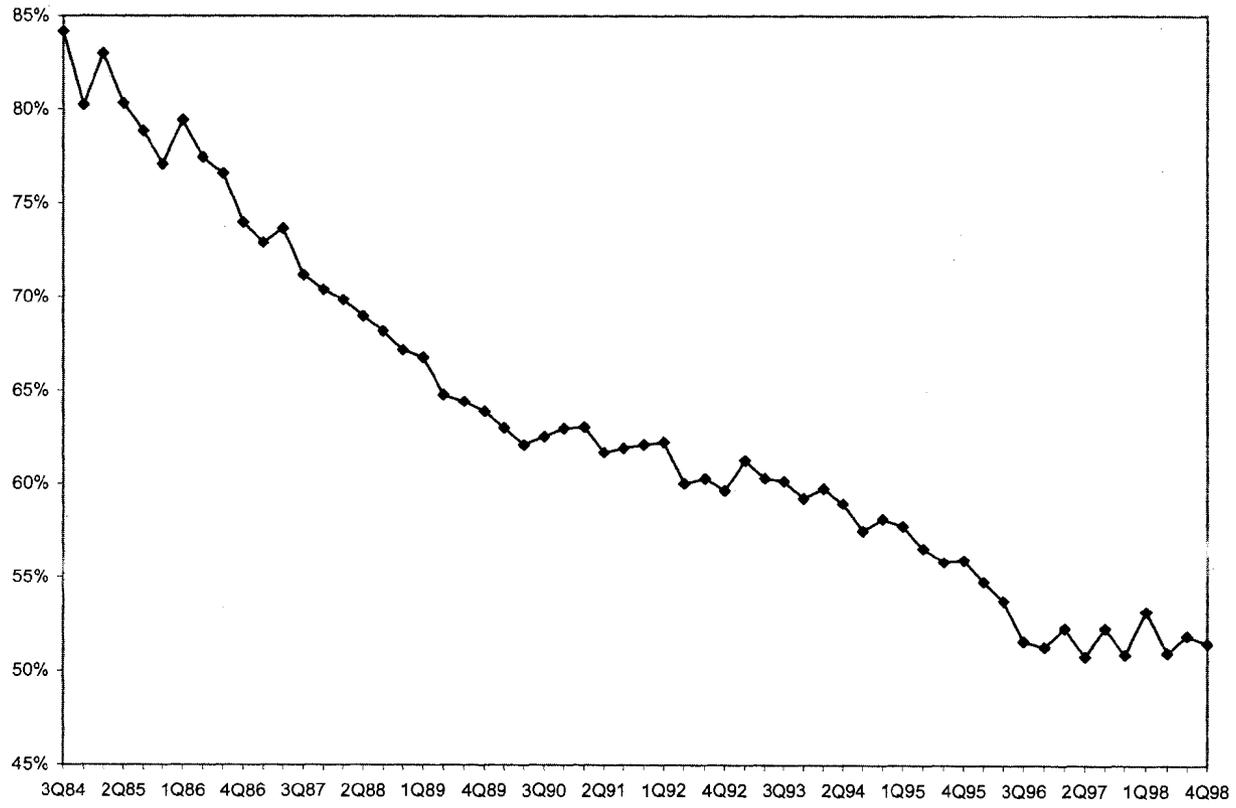


Exhibit 1. AT&T's Market Share of Interstate Minutes

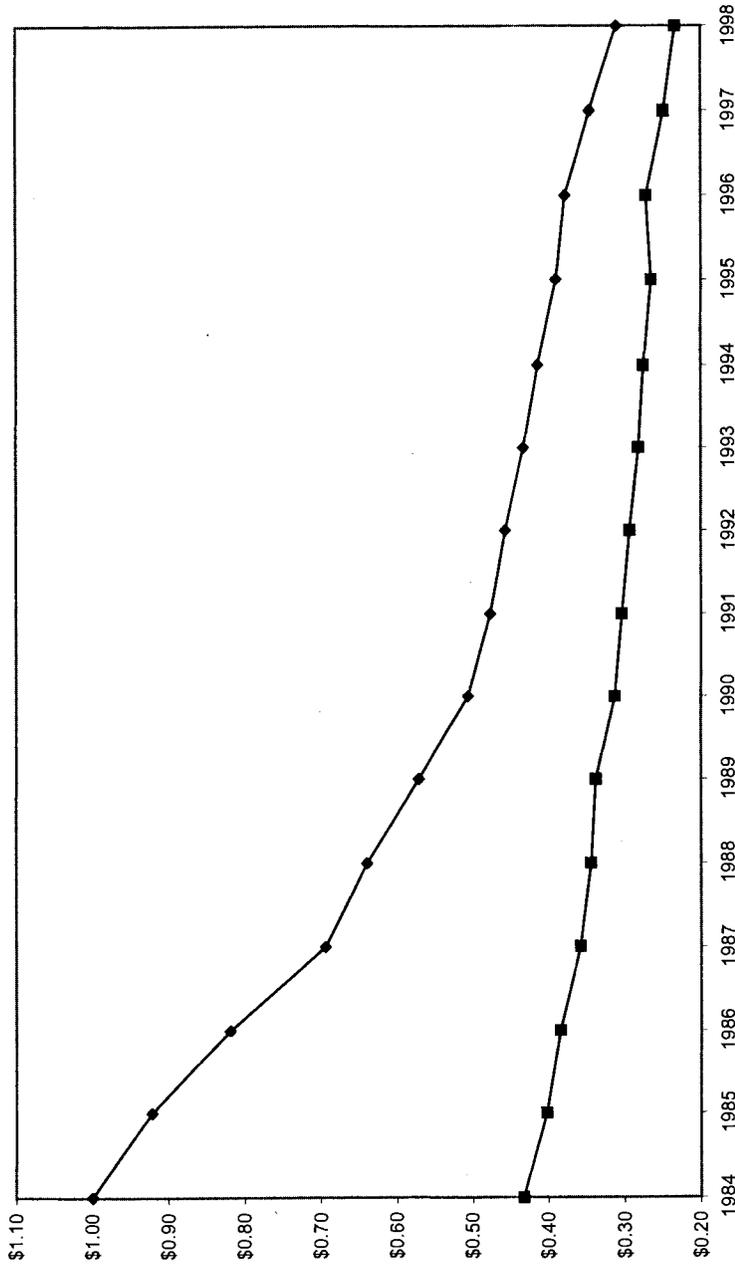


Exhibit 2. Average Revenue per Minute of AT&T Switched Services

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tance companies and are essential bottleneck inputs for long-distance service. Origination and termination of calls are extremely lucrative services.⁷ Access has an average cost (in most locations) of \$0.002 per minute. Its regulated prices vary. The national average in 2001 was \$0.0169 per minute. Such pricing implies a profit rate of 745 percent.⁸ Access charges reform is one of the key demands of the pro-competitive forces in the current deregulation process.

The great success of competition in long distance allowed the U.S. Congress to appear "balanced" in the Telecommunications Act of 1996 by establishing competition in local telephony, while allowing RBOCs into long distance after they meet certain conditions. However, the transition of local markets to effective competition will not be as easy or as quick as in the long-distance markets. This is because of the nature of the product and the associated economics.

Many telecommunications companies are presently trying to be in as many markets as possible so that they can bundle the various products. Companies believe that consumers are willing to pay more for bundled services for which the consumer receives a single bill. Bundling also discourages consumers from migrating to competitors, who may not offer the complete collection of services, so consumer "churn" is expected to be reduced.

Entry in Local Services as Envisioned by the 1996 Act

Currently, the "last mile" of the telecommunications network that is closest to the consumer (the "local loop") remains a bottleneck controlled by a local exchange carrier (LEC). In 1996, RBOCs (i.e., Ameritech, Bell Atlantic, BellSouth, SBC, and US West) had 89 percent of the telephone access lines nationwide. Most of the remaining lines belonged to GTE and independent franchise holders. Basic local service provided by LECs is not considered particularly profitable. However, in addition to providing access to long-distance companies, LECs also provide lucrative "custom local exchange services" (CLASS), such as call waiting, conference calling, and automatic number identification. The Telecommunications Act of 1996 boldly attempted to introduce competition in this last bottleneck, and, before competition takes hold, the Act attempts to imitate competition in the local exchange.

To facilitate entry into the local exchange, the 1996 Act introduces two novel ways of entry in addition to entry through the installation of its own facilities. The first way allows entry into the retailing part of the telecommunications business by requiring incumbent local exchange carriers (ILECs) to sell at wholesale prices to entrants any retail service that they offer. Such entry is essentially limited to the retailing part of the market.

The second and most significant novel way of entry introduced by the 1996 Act is through leasing of unbundled network elements from incumbents. In particular, the 1996 Act requires that ILECs (1) unbundle their networks and (2) offer for lease to entrants network components (unbundled network elements [UNEs]) "at cost plus reasonable profit."⁹ Thus, the 1996 Act envisions the telecommunications network as a decentralized network of interconnected networks.

Many firms, including the large interexchange carriers AT&T and MCI WorldCom, attempted to enter the market through "arbitration" agreements with ILECs under the supervision of State Regulatory Commissions, according to the procedure outlined by the 1996 Act. The arbitration process proved to be extremely long and difficult, with continuous legal obstacles and appeals raised by the ILECs. To this date (October 2002), over six years after the signing of the 1996 Act by President Clinton, entry in the local exchange has been small.

In the latest statistics, collected by the FCC,¹⁰ as of June 30, 2001, entrant competitive local exchange carriers (CLECs) provided 17.3 million (or about 9.0 percent) of the approximately 192 million nationwide local telephone lines. The majority (55 percent) of these lines were provided to business customers. Approximately one third of CLEC service provision is over their own facilities. For services provided over leased facilities, the percentage of CLEC service (which is total service resale of ILEC services) declined to 23 percent at the end of June 2001, while the percentage provisioned over acquired UNE loops grew to 44 percent.

Entry of RBOCs into Long-Distance Service

The 1996 Act allows for entry of RBOCs in long distance once a list of requirements has been met and the petitioner has proved that its proposal is in the public interest. These requirements can be met only when the market for local telecommunications services becomes sufficiently competitive. If the local market is not competitive when an incumbent LEC monopolist enters into long distance, the LEC can leverage its monopoly power to disadvantage its long distance rivals by increasing its costs in various ways, and by discriminating against them in its pricing. If the local market is not competitive when an incumbent LEC monopolist enters into long distance, an ILEC would control the price of a required input (switched access) to long-distance service, while it would also compete for long-distance customers. Under these circumstances, an ILEC can implement a *vertical price squeeze* on its long-distance competitors, whereby the price-to-cost ratio of long-distance competitors is squeezed so that they are driven out of business.¹¹

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In allowing entry of local exchange carriers into the long-distance market, the 1996 Act tries not to endanger competition that has developed in long distance by premature entry of RBOCs into the long-distance market. However, on this issue, the 1996 Act's provisions guarding *against premature entry* are insufficient. Hence, to guard against anti-competitive consequences of premature entry of RBOCs in long distance, there is need of a deeper analysis of the consequences of such entry on competition and on consumer and social welfare.

Currently, RBOCs have been approved in 15 states for in-region provision of long-distance services. As of October 2002, the approved, pending, rejected, and withdrawn applications are summarized in Exhibit 3.¹²

THE IMPACT OF WIRELESS AND OF CABLE TELEVISION

During the past 20 years there has been a tremendous (and generally unanticipated) expansion of the mobile phone market. The very significant growth has been limited by relatively high prices resulting from (1) the prevention of entry of more than two competitors in each metropolitan area, and (2) the standard billing arrangement that imposes a fee on the cellular customer for *receiving* (as well as initiating) calls.

However, during the past six years, the FCC has auctioned parts of the electromagnetic spectrum that will enable the transmission of personal communication services (PCS) signals.¹³ The auctioned spectrum will be able to support up to five additional carriers in the major metropolitan markets.¹⁴ Although the PCS spectrum band is different from traditional cellular bands, PCS is predicted to be a low-cost, high-quality mobile alternative to traditional phone service. Other wireless services may chip away at the ILEC markets, especially in high-capacity access services.¹⁵ The increase in the number of competitors has already created very significant decreases in prices of mobile phone services.

By its nature, PCS is positioned between fixed local service and traditional wireless (cellular) service. Presently, there is a very significant price difference between the two services. Priced between the two, PCS first drew consumers from traditional cellular service in large cities, and has a chance to become a serious threat to fixed local service. Some PCS providers already offer data transmission services that are not too far in pricing from fixed broadband pricing.

Industry analysts have been predicting the impending entry of cable television in telephony for many years. Despite numerous trials, such entry in traditional telecommunications services has fully not materialized. There are a number of reasons for this. First, to provide telephone service, cable television providers will need to upgrade their networks from analog to digital. Second, they will need to add switching. Third, most of the cable

Exhibit 3. Status of Long-Distance Applications by RBOCs in October 2002

State	Filed by	Status	Date Filed	Date Resolved
CO, ID, IA, MT, NE, ND, UT, WA, WY	Qwest	Pending	09/30/02	Due by 12/27/02
CA	SBC	Pending	09/20/02	Due by 12/19/02
FL, TN	BellSouth	Pending	09/20/02	Due by 12/19/02
VA	Verizon	Approved	08/01/02	10/30/02
MT, UT, WA, WY	Qwest	Withdrawn	07/12/02	09/10/02
NH, DE	Verizon	Approved	06/27/02	09/25/02
AL, KY, MS, NC, SC	BellSouth	Approved	06/20/02	09/18/02
CO, ID, IA, NE, ND	Qwest	Withdrawn	06/13/02	09/10/02
NJ	Verizon	Approved	03/26/02	06/24/02
ME	Verizon	Approved	3/21/02	6/19/02
GA, LA	BellSouth	Approved	2/14/02	5/15/02
VT	Verizon	Approved	1/17/02	4/17/02
NJ	Verizon	Withdrawn	12/20/01	3/20/02
RI	Verizon	Approved	11/26/01	2/24/02
GA, LA	Bellsouth	Withdrawn	10/02/01	12/20/01
AR, MO	SBC	Approved	08/20/01	11/16/01
PA	Verizon	Approved	6/21/01	9/19/01
CT	Verizon	Approved	4/23/01	7/20/01
MO	SBC	Withdrawn	4/4/01	6/7/01
MA	Verizon	Approved	1/16/01	4/16/01
KS, OK	SBC	Approved	10/26/00	1/22/01
MA	Verizon	Withdrawn	9/22/00	12/18/00
TX	SBC	Approved	4/5/00	6/30/00
TX	SBC	Withdrawn	1/10/00	4/05/00
NY	Verizon	Approved	9/29/99	12/22/99
LA	BellSouth	Denied	7/9/98	10/13/98
LA	BellSouth	Denied	11/6/97	2/4/98
SC	BellSouth	Denied	9/30/97	12/24/97
MI	Ameritech	Denied	5/21/97	8/19/97
OK	SBC	Denied	4/11/97	6/26/97
MI	Ameritech	Withdrawn	1/02/97	2/11/97

industry has taken a high debt load and has difficulty making the required investments in the short run.

When it is able to provide switching on a large scale, cable television will have a significant advantage over regular telephone lines. Cable TV lines that reach the home have a significantly higher bandwidth capacity than regular twisted-pair lines. Thus, it is possible to offer a number of "telephone lines" over the cable TV wire as well as broadband (high-bandwidth) access to the World Wide Web that require high-bandwidth capacity. A key reason for AT&T's acquisition of cable companies was the provision of telephone services through cable. Upgrades to provide telephony proved to be more expensive and much slower than expected, and it is uncertain if Comcast/AT&T will continue the upgrade of cable lines to telephony.

The announcement by AT&T of the provision of telephony through cable and the entry of independent DSL providers prompted incumbent LECs to aggressively market their DSL services, because it was generally accepted

that customers would not switch easily from DSL to broadband cable and vice versa. As the threat of AT&T and independent DSL providers diminished, ILECs reduced their DSL campaigns. At the end of 2001, broadband connections were 63 percent with cable, 36 percent with DSL, and 1 percent with wireless.

THE CURRENT WAVE OF MERGERS

Legal challenges have derailed the implementation process of the 1996 Act and have increased significantly the uncertainty in the telecommunications sector. Long-distance companies have been unable to enter the local exchange markets by leasing unbundled network elements (UNEs) because the arbitration process that started in April 1996 has resulted in long delays to the decision of final prices. Given the uncertainty of the various legal proceedings, and without final resolution on the issues of non-recurring costs and the electronic interface for switching local service customers across carriers, entry into the local exchange through leasing of unbundled network elements has been minimal. Moreover, entry into the retailing part of the business through total service resale has also been minimal because the wholesale discounts have been small.

In the absence of entry into the local exchange market as envisioned by the 1996 Act, the major long-distance companies are buying companies that give them some access to the local market.

MCI merged with WorldCom, which had just merged with Brooks Fiber and MFS, which in turn also own some infrastructure in local exchange markets. MCI-WorldCom focused on the Internet and the business long-distance market.¹⁶ WorldCom proposed a merger with Sprint. The merger was stopped by both the United States Department of Justice (DoJ) and by the Competition Committee of the European Union (EU). The DoJ had reservations about potential dominance of the merged company in the market for global telecommunications services. The EU had objections about potential dominance of the Internet backbone by the merged company.¹⁷ In June 2002, WorldCom filed for Chapter 11 bankruptcy protection after a series of revelations about accounting irregularities; as of October 2002, the full effects of these events on the future of WorldCom and the entire industry are still open.

AT&T acquired TCI, which owned a local exchange infrastructure that reaches business customers. AT&T unveiled an ambitious strategy for reaching consumers' homes using cable TV wires for the "last mile." With this purpose in mind, AT&T bought TCI. AT&T promised to convert the TCI cable access to an interactive broadband, voice, and data telephone link to residences. AT&T also entered into an agreement with TimeWarner to use

its cable connection in a way similar to that of TCI. In April 1999, AT&T outbid Comcast and acquired MediaOne, the cable spin-off of US West.

TCI cable reached 35 percent of U.S. households. Together with Time-Warner and MediaOne, AT&T could reach a bit more than 50 percent of U.S. households. Without access to UNEs to reach all residential customers, AT&T had to find another way to reach the remaining U.S. households. The provision of telephony, Internet access, broadband, data, and two-way video services exclusively over cable lines in the "last mile" requires significant technical advances, significant conversion of the present cable networks, and an investment of at least \$5 billion (and some say \$30 billion) just for the conversion of the cable network to two-way switched services. Moreover, there is some inherent uncertainty in such a conversion, which has not been successful in the past. Thus, it was an expensive and uncertain proposition for AT&T but, at the same time, it was one of the few remaining options of entry into the local exchange.

Facing tremendous pressure from financial markets, AT&T decided on a voluntary breakup into a wireless unit, a cable TV unit, and a long-distance and local service company that retained the name AT&T and the symbol "T" at NYSE. Financial markets tended to underestimate the value of AT&T by looking at it only as a long-distance company. The cable part of AT&T was merged with Comcast, and the full breakup should be almost finished by the end of 2002. In a complicated financial transaction, AOL/Time-Warner plans to divest the part of it that AT&T controls to AT&T/Comcast.

Meanwhile, Pacific Bell was acquired by SBC, and NYNEX by Bell Atlantic, despite antitrust objections, in an attempt by the RBOCs to maximize their foothold, looking forward to the time when they would be allowed to provide long-distance service. SBC bought Southern New England Telephone (SNET), one of the few companies that, as an independent (not part of AT&T at divestiture), was not bound by MFJ restrictions and has already entered into long distance.

Bell Atlantic merged with GTE to form Verizon, and SBC bought Ameritech. US West merged with Qwest, a new long-distance service provider. Thus, the eight large local exchange carriers of 1984 (seven RBOCs and GTE) have been reduced to only four: Verizon, BellSouth, SBC, and Qwest. The smallest one, BellSouth already feels the pressure, and it has been widely reported to be in merger/acquisition talks with a number of parties. Recently, BellSouth announced a pact with Qwest to sell Qwest's long-distance service once BellSouth is allowed to sell long-distance service.

A crucial cross-media merger occurred with the acquisition of Time-Warner by AOL at the height of AOL's stock price. The merger was achieved with the requirement that AOL/TimeWarner will allow independent ISPs to access its cable monopoly for broadband services. Synergies and new joint

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products failed to materialize at AOL/TimeWarner, and there is wide speculation that AOL will be divested.

The present crisis in telecommunications arose out of an incorrect prediction of the speed of expansion of the Internet. It was widely believed that the Internet would grow at 400 percent in terms of bits per year. In retrospect, it is clear that for the years 2000 and 2001, only 100 percent growth was realized. Of course, it was difficult to pin down the growth rate in the early stages of an exponential network expansion. The Internet was growing at 400 percent per year when the predictions were made. However, the rate of growth slowed with respect to the number of new hosts connected. And because no new "killer application" that required a lot of bandwidth was unveiled, the rate of growth in bits transferred also slowed. This is despite the very fast growth of transfers of bits in peer-to-peer (P2P) transfers of files, mainly songs in MP3 format, popularized by Napster and still going strong even after Napster has been practically closed down.

Based on the optimistic prediction of Internet growth, there was tremendous investment in Internet transport and routing capacity. Moreover, because capital markets were very liberal in providing funds, a number of companies invested and deployed telecommunications equipment more than would have been prudent given their then-current market share. This was done for strategic reasons, essentially in an attempt to gain market share in the process of the rapid expansion of the Internet.

Once the growth prediction was revised downward, the immediate effect was a significant reduction in orders and investment in optical fiber, switching, and router equipment. Service companies wait for higher utilization rates of their existing capacity as the Internet expands. There is presently a temporary overcapacity of the Internet in the United States. And, as mentioned, because it is easy to run the Internet backbone as a long-distance network, the huge overcapacity of the Internet backbone, combined with new investment and overcapacity of traditional long-distance networks, lead to very significant pressure and reductions of long-distance prices.

THE COMING WORLD

The intent of the 1996 Act was to promote competition and the public interest. It will be a significant failure of the U.S. political, legal, and regulatory systems if the interests of entrenched monopolists rather than the public interest as expressed by the U.S. Congress dictate the future of the U.S. telecommunications sector. The market structure in the telecommunications sector two years ahead will depend crucially on the resolution of the LEC's legal challenges to the 1996 Telecommunications Act and its final implementation.¹⁸ We have already seen a series of mergers leading to the re-

monopolization of local telecommunications. As the combinations of former RBOCs are approved state by state for long distance, we see a reconstitution of the old AT&T monopoly (without the present AT&T). We also see significant integration in the cable industry as AT&T found it extremely difficult to enter the local exchange market.

Whatever the outcomes of the legal battles, the existence of arbitrage and the intensification of competition necessitate cost-based pricing and will create tremendous pressure on traditional regulated prices that are not cost-based. Prices that are not based on cost will prove unsustainable. This includes access charges that LECs charge to IXCs (long-distance providers), which have to become cost based if the vision of a competitive network of interconnected networks is to be realized.

Computers are likely to play a larger role as telephone appliances and in running intermediate-sized networks that will compete with LECs and intensify the arbitrage among IXCs. Telephony based on the Internet Protocol (IP) will become the norm. Firms that have significant market share in computer interfaces, such as Microsoft, are likely to play a significant role in telephony.¹⁹ Hardware manufacturers — especially firms such as Cisco, Intel, and 3Com — that make switches and local networks will play a much more central role in telephony. Internet telephony (voice, data, and broadband) is expected to grow quickly.

Finally, the author expects expect that, slowly but steadily, telecommunications will drift away from the technical standards of Signaling System Seven (SS7) established by AT&T before its breakup. As different methods of transmission and switching take a foothold, and as new interfaces become available, wars over technical standards are very likely.²⁰ This will further transform telecommunications from the traditional quiet landscape of regulated utilities to the mad-dash world of software and computer manufacturing. This change will create significant business opportunities for entrants and impose significant challenges on traditional telecommunications carriers.

Notes

1. Critical points in this development were the emergence of GOPHER in the late 1980s and MOSAIC by 1990.
2. In November 1997, Deutsche Telecom (DT) introduced Internet long-distance service within Germany. To compensate for the lower quality of voice transmission, DT offers Internet long distance at one fifth its regular long-distance rates. Internet telephony is the most important challenge to the telecommunications sector.
3. A large enough bandwidth increases the probability that fewer packets will be lost. And, if each packet is sent a number of times, it is much more likely that each packet will arrive at the destination at least once, and the quality of the phone call will not deteriorate. Thus, the provider can adjust the quality level of an Internet call by guaranteeing a lot of bandwidth for the transmission, and by sending the packets more than once. This implies that the quality of an Internet call is *variable* and can be adjusted upward using the vari-

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ables mentioned. Thus, high-quality voice telephony is immediately feasible in intranets because intranets can guarantee a sustained, sufficient bandwidth. There is no impediment to the quality level of a phone call that is picked from the PSTN at the local switch, carried over long distance on leased lines, and redelivered to the PSTN at the destination local switch, using the recently introduced Lucent switches. For Internet calls that originate or terminate in computers, the method of resending packets can be used on the Internet to increase the quality of the phone call, as long as there is sufficient bandwidth between the computer and the local telephone company switch. The fidelity of calls can also be enhanced by manipulation of the sound frequencies. This can be done, for example, through the *elemedia* series of products by Lucent.

4. The telecommunications sector is regulated both by the federal government through the Federal Communications Commission (FCC) and by all states, typically through a Public Utilities Commission (PUC) or Public Service Commission. Usually, a PUC also regulates electricity companies.
5. Frontier was formerly Rochester Telephone.
6. See Federal Communications Commission (1995).
7. These fees are the single largest cost item in the ledgers of AT&T.
8. Termination pricing varies. In 2001, the FCC reported access charges ranging from \$0.011 to \$0.0369.
9. The FCC and State Regulatory Commissions have interpreted these words to mean Total Element Long Run Incremental Cost (TELRIC), which is the forward-looking, long-running (minimized) economic cost of an unbundled element and includes the competitive return on capital.
10. See "Trends in Telephone Service," Federal Communications Commission, May 2002, Tables 9.1-9.6.
11. Avoiding a vertical price squeeze of long-distance competitors, such as MCI, was a key rationale for the 1981 breakup of AT&T in the long-distance division that kept the AT&T name, and the seven RBOCs that remained local monopolists in local service. See Economides, (1998, 1999).
12. Source: FCC,
13. Despite this and other auctions of spectrum, the FCC does not have a coherent policy of efficient allocation of the electromagnetic spectrum. For example, the FCC recently gave (for free) huge chunks of electromagnetic spectrum to existing TV stations so that they can provide high-definition television (HDTV). Some of the recipients have publicly stated that they intend to use the spectrum to broadcast regular TV channels and information services rather than HDTV.
14. We do not expect to see five entrants in all markets because laxity in the financial requirements of bidders has resulted in default of some of the high bidders in the PCS, prompting a significant dispute regarding their financial and other obligations. A striking example is the collapse and bankruptcy of all three main bidders in the C-band auction. In this auction set aside for small companies, the government required that companies do not have high revenues and assets, and allowed them to pay only 10 percent of the winning bid price immediately and then pay in 5 percent installments over time. All large bidders winning were organized with the single purpose of winning the licenses and hardly had enough money to pay the required 10 percent. They all expected to receive the remaining money from IPOs. Given the fact that they were bidding with other peoples' money, spectrum bids skyrocketed in the C-band auction. Even worse, prices per megahertz were very much lower at the D-band auction that occurred before legal hurdles were cleared and before C-band winners could attempt their IPOs. As a result, no large C-band winner made a successful IPO and they all declared bankruptcy. The FCC took back the licenses but would not reimburse the 10 percent deposits. Thus, a long series of legal battles ensued, with the end result that most of the C-band spectrum is still unused, thus resulting in fewer competitors in most markets.
15. The so-called "wireless loop" proposes to bypass the ILEC's cabling with much less outlay for equipment. Trials are underway to test certain portions of the radio spectrum that were originally set aside for other applications: MMDS for "wireless cable" and LMDS as "cellular television."
16. The MCI-WorldCom merger was challenged by the European Union Competition Committee, the Department of Justice, and GTE on the grounds that the merged company would

have a large market share of the Internet "backbone" and could sequentially target, degrade interconnection, and kill its backbone rivals. Despite (1) a lack of an economically meaningful definition of the Internet "backbone," (2) the fact that MCI was unlikely to have such an incentive because any degradation would also hurt its customers, and (3) that it seemed unlikely that such degradation was feasible, the Competition Commission of the European Union ordered MCI to divest of all its Internet business, including its retail business where it was never alleged that the merging companies had any monopoly power. MCI's Internet business was sold to Cable & Wireless, the MCI-WorldCom merger was finalized, and WorldCom has used its UNET subsidiary to spearhead its way in the Internet.

17. The merged company proposed to divest Spring's backbone. Thus, objections of the EU were based on WorldCom's market share of about 35 percent in the Internet backbone market. The EU used a very peculiar theory that predicted that "tipping" and dominance to monopoly would occur starting from this market share because WorldCom would introduce incompatibilities into Internet transmission and drive all competitors out of the market. Time proved that none of these concerns were credible.
18. In one of the major challenges, GTE and a number of RBOCs appealed (among others) the FCC (1996) rules on pricing guidelines to the 8th Circuit. The plaintiffs won the appeal; the FCC appealed to the Supreme Court, which ruled on January 25, 1999. The plaintiffs claimed (among others) that (1) the FCC's rules on the definition of unbundled network elements were flawed; (2) the FCC "default prices" for leasing of UNEs were so low that they amounted to confiscation of ILEC property, and (3) the FCC's "pick-and-choose" rule allowing a carrier to demand access to any individual interconnection, service, or network element arrangement on the same terms and conditions the LEC has given anyone else in an approved local competition entry agreement without having to accept the agreement's other provisions would deter the "voluntarily negotiated agreements." The Supreme Court ruled in favor of the FCC in all these points, thereby eliminating a major challenge to the implementation of the Act.
19. Microsoft owns a share of WebTV and has made an investment in Qwest and AT&T, has broadband agreements with a number of domestic and foreign local exchange carriers, but does not seem to plan to control a telecommunications company.
20. A significant failure of the FCC has been its absence in defining technical standards and promoting compatibility. Even when the FCC had a unique opportunity to define such standards in PCS telephony (because it could define the terms while it auctioned spectrum), it allowed a number of incompatible standards to coexist for PCS service. This leads directly to a weakening of competition and higher prices wireless PCS consumers have to buy a new appliance to migrate across providers.

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