

Chapter 17

U.S.

Telecommunications

Today

Nicholas Economides

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

DESIGNING AND OPERATING AN ENTERPRISE INFRASTRUCTURE

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-

DESIGNING AND OPERATING AN ENTERPRISE INFRASTRUCTURE

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

