

Chapter 1 - The Telecommunications Industry

by

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Abstract: *The telecommunications industry is hard to define precisely because it is in the midst of convergence. Distinct industry segments are merging together and overlapping so that the line which separated them has become blurry. From a consumer perspective, there was once a separate voice, video and data market. However, today new wireline and wireless technologies are allowing new services to be provided by companies from a non-traditional segment. Within each industry segment, there has been increased market concentration so that control is held within a few large companies. High market concentration usually leads to higher prices and less choice and thus harms customers. However, as companies that traditionally only served the voice, video or data market come together to compete against one, consumers should benefit from the increased competition that convergence brings.*

1.1 Introduction

What exactly is the telecommunications industry? The telecommunications industry is hard to define because the march of technological advance causes the industry to continually redefine itself. Indeed, the only constant in the telecommunications industry is that it is always changing. So it is a somewhat dubious task to write a chapter on such a dynamic market as the telecommunications industry. Nevertheless, this chapter will attempt to provide an overview that segments the industry into different markets. It will be noted where these markets are converging or overlapping.

This chapter will look at the industry through the eyes of an economist and policymaker rather than through the eyes of a technologist. Many of the other chapters in this book will focus on various technologies used in the industry but this chapter will concentrate on the supply and demand of telecommunications services to the mass market - the consumer and small business marketplace. Although this may seem like a benefit because technologies change very rapidly, customer demands change rapidly too as the technological possibilities expand.

The telecommunications industry has been and will continue to be in the midst of convergence for some time. Convergence means that once separate and distinct industry segments are now overlapping and merging to provide similar competing services. Because of convergence it is hard to draw lines of separation within the industry that are clear and meaningful. For the purposes of this chapter, we will define the three industry segments as voice, video and data. From a pure technology standpoint, one could define voice and video as just different types of data, but from the consumer perspective, these products are different in use and access, at least at the present time. Within each of these industry segments, there are wireline and wireless technologies that deliver these products. To deliver voice communications, there is the choice of traditional landline phones or wireless phones. To deliver video, there is cable TV (wireline – coaxial cable) or broadcast and satellite (wireless). To deliver data, there is dialup or broadband technologies such as DSL and cable modem (wireline) or WiFi and satellite and data services provided by “cellphone” companies (wireless).

What is causing this convergence? There are several drivers of convergence. The first and primary driver is technology and specifically the Internet. Internet Protocol was once limited to data traffic such as e-mail and web pages, but now it is being used to provide voice services (Voice over IP (VoIP)) and video (IPTV). Voice and video (television), which were once analog, have become digitized and placed over an IP network. This transition has not always been smooth or easy. Two problems have plagued the transport of voice and video over IP networks – latency and prioritization. Voice and video communications require the information to arrive in the same order in which it was sent and without more than a split-second delay. Without this requirement, a packet of a conversation might arrive out of order and result in a jumbled and garbled mess. Likewise, delays of a second or more are very noticeable in voice and video communication but are a mere inconvenience to traditional data traffic such as e-mail. IP networks initially had problems transporting real-time voice and video but the problems of latency and prioritization have largely been overcome.

But how and why did this technological change take place? Much of the freedom to allow this technological change came in the United States from the Telecommunications Act of 1996 (TA96) and its associated rulings by the Federal Communications Commission (FCC). The FCC chose not to regulate nascent technologies out of existence and allowed them time to develop and mature. The intent of TA96 was "to provide for a pro-competitive, deregulatory national policy framework designed to accelerate rapidly private sector deployment of advanced telecommunications and information technologies and services to all Americans by opening all telecommunications markets to competition." (Duesterberg & Gordon, 1997, 2). Thus, the second cause of convergence is the legislative and regulatory restructuring that allowed the technologies to adapt and change.

Underlying both of these first two reasons is the basic economic incentives to reduce costs, increase revenues and ultimately, maximize profits. If VoIP can provide landline voice to customers at a much cheaper price than traditional landline networks, then there is a great economic incentive to develop it. If IPTV can enhance the revenue

stream and leverage the investment for Fiber to the Premises (FTTP)/Fiber to the Curb (FTTC) projects, then the economic incentives will drive development and allocate resources to overcome technological challenges. Ultimately, it is consumer demand and willingness to pay coupled with cost-effective technological innovation that is driving convergence.

There are four products that customers seem to be driven to purchase. Those four products are landline voice, high speed Internet access, TV/entertainment, and wireless voice/data. These four products have become known as the “quadruple play” by companies which are seeking to provide all these services to customers, sometimes in a bundle. Many telecommunications companies have merged in recent years either to increase their market share or market reach within one or more of these product areas or to provide a new product that they did not already offer to customers. For example, SBC merged with AT&T and Cingular (owned by SBC and BellSouth) bought out AT&T Wireless. Verizon then merged with MCI and the new AT&T (SBC-AT&T) plans to merge with BellSouth. These mergers and others have resulted in an industry that is dominated by large multi-market oligopolies.

After completing these mergers, the resulting companies have become the market leaders in each of the quadruple play markets except for TV/entertainment. The new AT&T is the second largest local landline company (it will be the largest after its proposed merger with BellSouth), the largest long distance company, the largest wireless provider (Cingular/AT&T Wireless) and the largest provider of DSL (and a nationwide IP network from the old AT&T). Verizon is the largest local landline company, the second largest long distance company, the second largest wireless provider (Verizon Wireless with 45% owned by Vodafone) and the second largest provider of DSL (and a nationwide IP network from MCI’s UUnet). Both companies have plans to aggressively build out their fiber network in order to provider TV/entertainment services.

The rest of this chapter is organized as follows: first, the landline voice market will be explored with its historical segments of local and long distance. Next, the wireless voice market will be examined along with its interactions with the landline market. The video and data markets will be explained along with wireline and wireless technologies to supply these markets. Finally, the U.S. telecommunications market will be compared to telecommunications markets in other developed countries.

1.2 Landline Voice

Landline voice is the oldest of the telecommunications markets discussed here and historically was the entire telecommunications industry. Before 1970, the landline voice market was mostly served by AT&T with its affiliated local Bell Operating Companies. During the 70’s and 80’s, the FCC allowed increased competition for long distance and customer premises equipment that culminated in the divestiture of AT&T in 1984. The divestiture of AT&T required that a precise definition for local calls and long distance calls be created. This somewhat arbitrary distinction between long distance telecommunications and local telecommunications had no real foundation in cost or

demand considerations. Because the distinction was a creation of regulation, market forces have caused the two markets to merge. Convergence and corporate mergers are blurring any remaining distinctions between this historical separation. SBC, the largest local company has recently merged with AT&T, the largest long distance company and Verizon, the second largest local company has merged with MCI, the second largest long distance company.

1.2.1 Long Distance Voice Market

Historically, long distance voice service was provided as a monopoly service by AT&T. During the 1960's and 1970's, the FCC allowed other companies (namely, Microwave Communications Inc. (MCI) and others) to provide long distance services in direct competition with AT&T. This policy eventually led to the divestiture of AT&T from its local telephone subsidiaries and full-fledged competition in the long distance industry. This movement from a regulated monopoly provision of services to competitive services from many companies will be repeated throughout different industry segments.

Long distance rates have declined significantly since the divestiture of AT&T in 1984. Graph 1.1 shows the decline in long distance rates from 1984 to 2003. In 1984, the average price of a long distance call was almost \$.60 per minute (in 2003 dollars) but the average price was less than \$.10 per minute by 2003. Much of the decline was due to lower costs to connect calls to the local telephone network (Taylor & Taylor, 1993). AT&T's market share declined from over 90% in 1984 to less than 40% in 2001 as shown in Graph 1.2. MCI and Sprint were the number 2 and 3 providers of long distance during this time and their market share grew as AT&T's declined. Table 1.1 shows the annual market share information for the long distance market between 1984 and 2001 (the latest year that the FCC produced these statistics). By 2001, MCI's market share had grown to 23.4% and Sprint had grown to 9.3%.

Graph 1.1 about here

Graph 1.2 about here

Table 1.1 about here

Overall, the traditional long distance landline voice market is in serious decline due to two causes. First, the death of distance (Cairncross, 2001) has been caused by a shift in long distance traffic away from the PSTN onto private data networks and the

public Internet. This shift was first led by international traffic that could avoid voice termination charges and high regulated prices by carrying the voice traffic over “data” lines. Even within the U.S., regulatory policies caused prices for domestic long distance calls to be high above their marginal cost. These high margins eroded as competitive alternatives became available. The second cause of the decline of the long distance landline voice was the high penetration of wireless phones with significantly different pricing. In 1998, AT&T Wireless’s Digital One Rate incorporated long distance into their wireless plan at no additional charge above the charge for airtime. This pricing plan was quickly adopted by other wireless firms. Under this plan, customers had monthly bundles of minutes on their wireless phone contract that they would lose if they didn’t use them. Thus, the effective marginal price of a long distance call on a wireless phone was zero as long as the user did not exceed their allotted minutes. It wasn’t long after this that wireless plans included free calls during nights and weekends (i.e. airtime during night and weekends did not count against their monthly allotment of minutes). Thus, customers shifted much of their usage away from landline long distance onto wireless phones.

Regulation of the long distance market also changed substantially during this time (Sappington & Weisman, 1996). Even after divestiture, AT&T was regulated under rate-of-return regulation by the FCC. Since MCI and Sprint had much lower market shares, they were not regulated but still filed their rates with the FCC. This asymmetric regulation allowed MCI and Sprint to know AT&T’s rates with certainty and respond in a competitive manner. The FCC changed the form of regulation from rate-of-return regulation to price-cap regulation in 1989 but it was not until 1995 that AT&T was declared non-dominant and effectively deregulated.

1.2.2 Local Voice Market

The path that the local voice market has taken is similar to the path of the long distance market. Each local market was historically served by a monopoly local telephone company that was rate-of-return regulated by the state regulatory board. Most of the cities and heavily populated areas were served by subsidiaries of AT&T until divestiture in 1984. At divestiture, AT&T’s local telephone subsidiaries were separated from its long distance and equipment pieces. The local telephone pieces of AT&T were broken into seven different companies called Regional Bell Operating Companies (RBOCs). The seven RBOCs were NYNEX, Bell Atlantic, Bell South, Ameritech, Southwestern Bell, US West and Pacific Telesis. These companies corresponded to different geographic regions of the country as shown in Graph 1.3. The companies did not serve every customer in that region but only its major population centers. Other local telephone companies, known as independents because they were independent of the Bell System, served customers in the other areas.

Graph 1.3 about here

Local telephone companies did not face competition until much later than their long distance counterpart. In fact, it is because of competition in the long distance that competition in the local market came about. Competition in local markets started in large urban areas where new start-up companies provided direct connections from the customer to the long distance network thereby bypassing the local telephone network. This competition arose because of artificially high regulated rates that the local telephone companies charged to long distance companies to connect their networks to customers. Much of this bypass was uneconomic in the sense that it was caused by regulatory rules rather than underlying differences in costs. The upstart companies became known as Competitive Access Providers (CAPs) or Alternative Local Transport Companies (ALTs). These companies continued to expand the local telecommunications services that they offered until full-fledged local competition was introduced by the Telecommunications Act of 1996. These upstart companies became known as Competitive Local Exchange Companies (CLECs) after this legislation. The traditional local telephone companies then became known as Incumbent Local Exchange Companies (ILECs). Several rules from TA96 sought to put CLECs on an equal footing with ILECs. One of these rules was local number portability. For many business and individuals, changing one's number when changing one's phone service presented a great barrier to switch carriers. Since the ILECs started with all the customers, this represented an unfair advantage to them in a fully competitive marketplace. To combat that advantage, local number portability required that all phone companies allow their customers to take their phone number with them when they change local companies (Black, 2002, 99).

Rates for local telephone service did not decline as they did in the long distance market. In fact, the recurring monthly charge for basic telephone service has increased from 1986 to 2004 as shown in Graph 1.4. The average monthly residential charge went from \$17.70 in 1986 to \$24.31 in 2004 (in nominal dollars). Part of the increase in local residential rates has been a shift in recovering costs away from per-minute charges, called access charges which are charged to long distance companies, towards per-line charges called subscriber line charges (SLC) charged to end users.

Graph 1.4 about here

The total number of switched access lines has decreased from a high of 192,432,431 lines in December 2000 to 175,350,377 in December 2005 (FCC 2006b, 5). Much of the decline has been caused by people disconnecting second lines that were used for connecting to the Internet or for teenagers to use. These individuals have switched to broadband connections for their Internet use and substituted wireless phones for teenagers. ILECs have suffered not only from the overall decline in the size of the market but also from competition with CLECs. CLEC market share has increased steadily from 4.3% market share in December 1999 to 17.8% in June 2004. This CLEC increase in market share is shown in Graph 1.5.

Graph 1.5 about here

In addition to suffering from the decline in second lines, the local wireline market is facing competitive threats from “intermodal” forms of competition for primary lines to a household. Loomis and Swann (2005) have shown a clear link between wireless, wireline and broadband telecommunications. In the future, more and more household will be going “wireless-only” and disconnecting their wireline service. Others will be shifting their voice usage towards voice over IP (VoIP) using their broadband connection and disconnecting their traditional landline phone.

The local landline market has changed considerably due to mergers since the time of divestiture. Graph 1.3 (the RBOCs at divestiture) has changed to Graph 1.6 (the RBOCs today). In 1997, Bell Atlantic merged with NYNEX to become the new Bell Atlantic. In 2000, the new Bell Atlantic merged with GTE, the largest independent telephone company, to become Verizon. Verizon merged with MCI in 2006. Southwestern Bell Corporation changed its name to SBC Communications in 1995 and acquired Pacific Telesis in 1997, SNET in 1998 and Ameritech in 1999. SBC merged with AT&T in late 2005 and took on the AT&T name for the company. On March 5, 2006, the new AT&T announced plans to purchase BellSouth. US West was acquired by Qwest, a long distance company in 2000. Thus, only AT&T, Verizon and Qwest will remain from the eight companies formed from 1984 divestiture of AT&T.

Graph 1.6 about here

1.2.3 Long Distance and Local Voice Market

Markets that are in decline often see industry consolidation through mergers as a means to decrease costs in order to survive in a shrinking market. The local and long distance markets have seen much industry consolidation with the top local provider (SBC) merging with the top long distance company (AT&T) and the second largest local company (Verizon) merging with the second largest long distance company (MCI). With these mergers, the distinction between local and long distance is difficult to discern except as a regulatory artifact.

In spite of blurring of lines between long distance and local services, two important regulatory and public policy decisions concern the interaction between these two industry segments. These decisions include universal service and intercarrier compensation.

Universal service refers to the public policy of having a telephone network that is available, integrated and affordable to all Americans (Mueller, 1997). Historically, long distance calls were priced above their marginal costs in order to price local telephone service below its marginal cost. This cross-subsidization was approved by both federal and state regulators in order to assure that local telephone service would be affordable to most people. With the divestiture of AT&T, the linkage between long distance rates and local rates was broken. As AT&T long distance faced more competition, policymakers feared that local rates would increase and that households would disconnect their local phone service. Local rates did increase following divestiture but households did not disconnect their phones. Instead, households responded to their total bill in which local rate increased but long distance rates decreased even more rapidly. As a result, the penetration rate went from 91.4 in 1984 to 93.3 in 1990 (Hausman et. al., 1993).

In addition to the cross-subsidy issue from long distance to local, TA96 added the e-rate program under the category of universal service. The e-rate program provides subsidies of 20-90 percent for Internet access to schools and libraries depending on their disadvantaged nature. The fund was capped at \$2.25 billion and the amount of requests for funding quickly exceeded the funds available. This program fundamentally changed the understanding of universal service. Previously, only landline voice service was treated as needing support under universal service but e-rate extends this same type of support to Internet access.

Another area of universal service is support for high-cost rural telephone companies. The RBOCs generally serve only densely populated areas of the states in which they provide service. These areas are generally cheaper to serve due to economies of scale and geographical considerations. The other areas of each state that are not served by an RBOC are served by an independent telephone company. The independents serve areas that are less densely populated, more rural, and therefore, higher cost. Because of the policy of geographic rate averaging, the high-cost rural telephone companies have needed subsidies to continue to maintain low rates. These funds have come from high access charges for long distance calls as well as surcharges on bills of all telecommunications service providers.

Access charges are a large part of the second public policy decision concerning local and long distance services – intercarrier compensation. Intercarrier compensation started with access charge plans around the time of divestiture. Because AT&T has being split between its long distance piece and its local piece, a mechanism of prices had to be developed to charge long distance companies for their use of the local telephone network in order to connect a long distance call. Economists had argued that these charges should only include the traffic-sensitive (variable) costs of completing the long distance calls and that the non-traffic-sensitive (fixed) costs should be paid for by end-users in the form of a per-line charge (later named the subscriber line charge (SLC)). Because of rate-shock and universal service concerns, the SLC was not set high enough to pay for all of the non-traffic-sensitive costs and the remainder was collected through raising the

access charges above the traffic-sensitive cost level. This decision ultimately led to bypass of the local network and the rise of CAPS and CLECs as discussed earlier.

TA96 recognized that the system of access charges was flawed and needed to be overhauled. The law charged the FCC with developing a solution and the FCC devoted the third of its trilogy of orders from TA96 to “Access Charge Reform.” The FCC reform plan however has a large failure. Instead of raising the SLC, the FCC created a brand new charge – a Presubscribed Interexchange Carrier Charge (PICC) that the local companies charged to the long distance companies based on the number of customers who had that company as their default long distance carrier. Revenue raised from this new charge was used to lower access charges. The FCC also distinguished between primary and other lines coming into a residence and allowed the SLC and PICC to be higher for non-primary lines. The FCC wanted the long distance companies to absorb the PICC charges as their per-minute access charges declined. Instead, they passed on the new PICC charges to consumers as a new fee and in some cases charged more than the PICC charge. The end result was then worse than if the FCC had simply raised the SLC directly. After two years, the FCC admitted their mistake and eliminated the PICC charge and began raising the SLC.

Intercarrier compensation includes more than just access charges for long distance service. Since TA96 formalized rules for full-blown local competition between ILECs and CLECs, intercarrier compensation has also included payments, called reciprocal compensation, between ILECs and CLECs for terminating local traffic between subscribers. Reciprocal compensation rates were set at a fraction of the price of access charges even though the physical act of terminating a phone call is the same whether it originates across the country or across the street. Charging different prices for the same service is referred to as price discrimination by economists and it invites arbitrage (buying in the low market and selling in the high market) unless there is an easy way to prevent it. In the case of reciprocal compensation, CLECs could accept long distance traffic from the long distance company and pass it on to the ILEC as local traffic. The CLEC would only pay the low per-minute reciprocal compensation rate and the long distance company would avoid the much higher access charge rate. This act would be even easier if the CLEC and the long distance company were part of the same holding company. Thus there was pressure to lower access charges and make reciprocal compensation rates higher than their marginal cost.

One of the byproducts of having reciprocal compensation rates higher than their marginal costs was that CLECs could make a profit from terminating local traffic. One type of customer with the highest amount of terminating traffic is Internet Service Providers (ISPs). ISPs with dial-up access have large modem banks that allow individuals to connect to the Internet by placing local calls. If the ISP is a customer of the CLEC and the individual connecting to the Internet is a customer of the ILEC, then the ILEC must pay the CLEC per-minute reciprocal compensation for the duration of the Internet connection. In this way, some CLECs received 40-70% of their total revenue from reciprocal compensation from the ILECs. The FCC eventually ruled that a call to

an ISP was not a local call and therefore should not be subject to reciprocal compensation rules. This ruling placed some CLECs into bankruptcy.

The rules for intercarrier compensation get even more difficult when VoIP providers and wireless carriers are added into the mix. Efforts to reform intercarrier compensation and the universal service fund in order to provide a consistent plan that addresses many of the concerns already raised have been lead by coalitions of industry players and regulators. One plan, known as the Missoula Plan, named for the town in which the group met at one point, was filed with the FCC in August, 2006 and will be the subject of comments and debate in the coming years. The Missoula Plan task force has worked under the auspices of the National Association of Regulatory Utility Commissioners (NARUC) and is sponsored by AT&T, BellSouth, and Cingular, as well as by about a quarter of the small rural companies. Qwest and Verizon and most wireless providers have reserved judgement on the plan.

1.3 Wireless Voice

The wireless voice segment of the telecommunications industry has been one of the fastest growing segments within the industry. The industry started in 1985 with two cellular providers awarded licenses in each geographic territory by the FCC. One of these licenses was given to the landline company and the other was awarded by a combination of merit hearings and lottery. This duopoly structure did not make for a very competitive environment but the industry grew at a rapid clip due to the high demand for mobility in communications. This robust demand led to calls for the FCC to allocate more radio spectrum to wireless telephony. The FCC did auction off an additional 120 MHz of radio spectrum in its broadband PCS auctions which were held from December 1994 to January 1997 (compared to 50 MHz for cellular at that time). In all, 2,074 licenses were awarded and over \$20 billion was bid.

To ensure that there was more competition than there was under the former duopoly structure, the FCC imposed a spectrum cap such that no single company could have a license for more than 45 MHz in any single market. In November, 2001, the FCC raised that limit to 55 MHz and in January 2003, they eliminated the spectrum cap altogether. This elimination of the spectrum cap has led to mergers and industry consolidation. Since the cap was eliminated, Cingular bought AT&T Wireless (at that time, a company independent of AT&T Long Distance) in 2004 and Alltel bought Western Wireless in 2005 and Sprint merged with Nextel also in 2005. These mergers helped solidify the emergence of four nationwide wireless carriers - Cingular, Verizon Wireless, Sprint-Nextel, and T-Mobile – with several smaller regional carriers. The firms' market shares are contained in Table 1.2.

Table 1.2 about here

In August, 2006, the FCC began an auction of an additional 90 MHz of wireless spectrum. The bidders with the largest upfront deposit include a consortium of satellite

TV providers including DirectTV and Echostar, and a group of Cable TV companies including Comcast, Time Warner Cable and Cox Communications. Wireless providers T-Mobile, Cingular, and Verizon Wireless have also registered at the auction to acquire additional spectrum. In 2008, the FCC will auction off additional spectrum that is now occupied by local television stations.

Before the creation of these nationwide carriers, the wireless industry was served by smaller regional carriers. Since customers wanted to use their wireless phones outside of their carrier's region, each company developed roaming agreements so their customers could utilize another company's network while their territory. The charges for using this roaming feature were passed along to the customer. Because roaming charges were much higher than the standard home rate for calls, customers complained frequently and loudly to their carrier. The development of nationwide carriers allowed consumers to utilize their own company's network and to choose pricing plans that would avoid all roaming charges.

Wireless subscribers and revenues have increased rapidly over time. Graph 1.7 shows the rapid increase in the number of wireless subscribers and Graph 1.8 shows the increase in minutes of use over wireless networks. As of December 2003, nationwide wireless penetration was 54%. The average minutes of use per month increased from 255 minutes in 2000 to 599 minutes in 2003. Graph 1.9 shows that the average total bill for wireless has declined greatly with the slight increase in recent years due to increased usage.

Graph 1.7 about here

Graph 1.8 about here

Graph 1.9 about here

The wireless industry has experienced several pricing innovations that has spurred its growth. The first innovation was AT&T's Digital One Rate which was introduced in May 1998. This plan combined wireless airtime and long distance charges into a single rate, effectively absorbing the long distance surcharge for long distance calls made on wireless phones. This pricing plan was quickly copied by the other wireless companies. As mentioned earlier, this type of pricing plan cut landline long distance usage significantly. On the flip side, it spurred wireless growth due to the "savings" in long distance that was introduced in this plan. In January, 2004, AT&T Wireless also introduced mobile-to-mobile calling whereby calls are free if made to another AT&T Wireless subscriber. These free calls did not count against the customer's monthly

allotment of minutes and also helped spur customers to get their friends and family to switch to the same carrier. Similar “in-network” plans were introduced later by many other wireless companies.

Wireless companies have also provided discounted or sometimes free phones with a one-year or two-year contract. Providing a discount for the cost of buying a phone in order to use the wireless service lessened the upfront financial burden of getting service even if the monthly charge was higher as a result. Wireless companies have also signed exclusive deals with phone manufacturers to capture consumer interest in the latest technology. One example is Cingular’s exclusive limited-time contract with Motorola to sell its RAZR line of phones.

As wireless phones became more and more of a substitute for landline usage, many customers started to see their wireless phone as a substitute for their landline phone itself. Surveys have shown that 10-15 percent of households have “cut the cord” and gone wireless only. This percentage has been highest among younger people and new households. One problem that the wireless industry faced in this substitution was that one landline phone could serve many individuals in the household. If the household consisted of a family of four, this would mean four separate wireless plans to substitute for one landline phone. In order to effectively lower the price of this substitution and to spur growth elsewhere, the wireless companies introduced family plans where family members could join another family members plan for as low as \$10/month and share their bundle of minutes. These family plans lowered the price for a household to substitute wireless phones for their landline phone.

As discussed earlier, local number portability required local landline companies to allow their customers to keep their local telephone number when they switched carriers. This rule applied only to landline companies and so wireless customers who changed carriers would have to change phone numbers and notify all their contacts of their new number. This hassle gave customers a great incentive to stay with their current provider and hindered free and equal competition in the market. In November, 2003, the FCC required companies in the top 100 markets to implement local number portability and roll it out nationwide by May 2004.

Unlike landline telecommunications, the FCC and state regulatory commissions do not regulate and never have regulated wireless firms’ prices or profits. However, the FCC does hold power over the wireless spectrum licenses that the wireless companies use and can impose rules on how the firms operate such as the ruling on local number portability.

In the beginning of the cellular industry, the FCC required all U.S. providers to use a single analog standard called Advanced Mobile Phone Service (AMPS). In the mid-1990s, the wireless providers began building second generation (2G) networks that used digital technology. 2G networks were better than the AMPS network because they had better signal quality and used the radio spectrum more efficiently. The FCC did not mandate a 2G standard and two different types of standards developed. The first set of

standards takes samples by time and is similar to time division multiplexing of landline networks. The time-slicing techniques include Time Division Multiple Access (TDMA) and Global System for Mobile (GSM) and Integrated Digital Enhanced Network (iDEN) GSM was the standard used in Europe and most U.S. companies that started using TDMA, like Cingular, have switched to GSM. iDEN is the standard used by Nextel. The second set of standards used complex algorithms to compress the digital signals. This standard is called Code Division Multiple Access (CDMA) and is used by Verizon Wireless and SprintPCS. TDMA was proven to work on a large scale sooner and enjoyed a “first-mover” advantage. CDMA is more sophisticated and expensive but ultimately was able to use radio spectrum more efficiently than TDMA. However, once a company chooses a standard, it is very expensive to switch technologies. Third generation wireless services (3G) have been developed in Europe and Asia. Two competing standards are available for 3G – Universal Mobile Telephone Service (UMTS) or WCDMA, which was mandated in Europe and CDMA2000 used in parts of Asia.

Of the five nationwide mobile telephone operators, Cingular, and T-Mobile use TDMA/GSM as their 2G digital technology, Sprint PCS and Verizon Wireless use CDMA, and Nextel uses iDEN. Verizon Wireless has deployed 1xRTT technology throughout its network. Discussion of the wireless carriers upgrade plans to 3G networks will be delayed until Section 1.5.

1.4 Video/Cable TV

Before the advent of cable TV, the delivery of video programming was accomplished by over-the-air broadcasts. The FCC licensed television channels to broadcast over Very High Frequency (VHF) – channels 2-13 and Ultra High Frequency (UHF) – channels above 13. In a typical local market, the FCC would license 3-4 channels in the VHF channels and several more UHF channels. A VHF station is often affiliated with one of the major commercial television networks – ABC, CBS, NBC, and later FOX. Some of these stations are owned by the network and some are independently owned but have the right to carry the network programming in that market. Although a small percentage of homes receive their video programming from over-the-air broadcasts, the local network affiliated stations are usually carried to homes over cable TV and satellite (Nuechterlein and Weiser, 2005, 360).

Cable TV started as non-commercial community antenna TV and was not originally seen as a competitive threat to broadcast TV over the airwaves. However, as more and more cable-only channels became available and more and more homes were passed by cable TV, cable TV became increasingly popular. As of June 2004, 98.8% of homes in the United States are passed by cable TV and 61% of homes passed subscribed to cable TV (FCC, 2005a, 14). Cable TV firms use coaxial cable to deliver cable content and their networks were traditionally one-way networks delivering video content from the cable head-end to end users. In order to provide cable modem service that is discussed in the next section, cable firms had to upgrade their networks to become two-way networks enabling users to send as well as received information.

Although local broadcast stations were being seen by fewer and fewer people over the airwaves, they were still seen by many people on their cable systems as cable TV companies retransmitted local over-the-air stations on their cable systems. At first, this seemed to “save” the local broadcast channels from a slow death as the over-the-air market shrunk but owners soon became jealous as other content channels received payment from the cable firms for their channels while the broadcast channels were essentially free. To change this situation, the Cable Act of 1992 gave broadcasters the right to forbid retransmission without their consent. This property right gave broadcasters the ability to negotiate a fee from the cable company for retransmission of its station. The broadcaster could waive this right and require the cable TV operator to carry its station under “must carry” rules. In most cases, broadcasters did not receive high monetary compensation but rather were able to negotiate additional channel “slots” on a cable firm’s line-up in exchange for the right to use its local network channel.

In addition to broadcast TV, cable operators faced competition from another “wireless” provider. By the mid-1990’s, Direct Broadcast Satellite (DBS) providers such as DirectTV and Dish Network, entered the video delivery market. The DBS market share of the video market has increased steadily reaching 25% by 2004, as shown in Table 1.3. Among cable TV firms, Comcast is the largest with over 21 million customers as shown in Table 1.4. Taking the video market as a whole, Comcast has the largest market share with 23% and DirectTV has a market share of 12%. The top 10 firms are shown in Table 1.5.

Table 1.3 about here

Table 1.4 about here

Table 1.5 about here

Within the cable TV industry, firms are organized as Multiple System Operators (MSOs). There has been significant consolidation in the cable TV industry and across the landline telecommunications industry and cable TV. In 1998, AT&T, the largest long distance company at the time, bought TCI, the largest cable TV operator at that time. AT&T then bought Media One in 1999, which was the fifth largest cable TV operator. TCI and Media One became AT&T Broadband which was sold in 2001 to Comcast, the second largest MSO. It seems that the convergence between cable TV and landline voice

communications took longer than AT&T anticipated and the cable TV properties were more valuable to another MSO than they were to a long distance landline voice company.

Prices for cable TV have risen steadily over the past several years. Graph 1.10 shows the average price for basic service while Graph 1.11 shows the average total cable bill for customers overall. Basic cable service has risen from \$11.57 in 1997 to \$13.80 in 2004 but the average total month bill has almost doubled from \$24.34 in 1995 to \$45.32 in 2004.

Graph 1.10 about here

Graph 1.11 about here

Cable TV has been regulated and deregulated several times. Before 1984, some municipalities regulated cable TV rates in addition to awarding local franchises. However in 1984, the Cable Act of 1984 removed cable systems from municipal rate regulation where it existed. Due to this deregulation and other causes, cable rates rose 43% from 1986 to 1989. This sudden rise in rates led to calls for federal rate regulation. So, in 1992, the Cable Act of 1992 required the FCC to regulate cable TV rates. This lasted about four years until the Telecommunications Act of 1996 was passed and removed rate regulation for all cable services except basic tier cable service.

In addition to the high prices and the regulation/deregulation of prices, the industry has also faced controversy surrounding so-called “a la carte” pricing. A la carte pricing refers to a pricing scheme whereby consumers would only pay for channels that they wanted and would not be required to buy packages or tiers of programming. Cable TV firms have consistently claimed that such a pricing scheme would raise the costs to all since programming and advertising is based on the number of subscribers and this number would be reduced under such a scheme. The FCC originally agreed with the industry’s analysis but has changed its mind recently. To head off a requirement to offer a la carte pricing, several firms have begun to offer “family-friendly” packages to placate the most vocal advocates of a la carte pricing.

Not only do cable TV providers face current competition from DBS, they now face future competition from the RBOCs who are rolling out fiber networks to provide Internet Protocol TV (IPTV) in addition to high speed Internet access. IPTV is projected to offer several enhancements over traditional cable TV including greater interactivity, easier guides and changing of channels, and even more channels. RBOCs have been hindered in their efforts to roll out video services because of local franchise agreements.

Cable TV companies usually have franchise agreements with local municipalities and the RBOCs argue that it would be too expensive and onerous to negotiate a city-by-city franchise agreement in order for them to provide service. They have asked Congress to issue a national franchise license for them to provide video programming nationwide and have already obtained statewide franchise authority in several states.

If one takes a larger definition of the relevant market, cable TV also faces competition from videotape and DVDs and Internet video downloads such as iTunes and video iPod. With convergence comes another emerging distribution channel for video programming - the Internet. Websites such as YouTube, Google Video, MSN Video and Yahoo Video are increasing the amount of free and paid content for viewers. In addition, TV networks are distributing their content over their own websites and partnering with others to sell on-line versions of their TV content.

The video programming and distribution industry is also somewhat vertically integrated. Several cable TV systems own parts of many of the programming channels that they and others carry on their systems. For example, Cablevision has a 60% ownership of American Movie Classics, Cox owns 24.6% of Discovery Channel and Time Warner owns 100% of HBO. TV networks are owned by larger corporations that also own video content and programming. CBS is owned by Viacom, NBC is owned by General Electric and Vivendi, ABC is owned by Disney and FOX is owned by News Corporation. Vertical integration could make it difficult for new firms to enter in competition with the cable TV firms. The Cable Act of 1992 required cable firms to make their own programming available on reasonable terms to rivals. This requirement was renewed by the FCC in 2002.

Some cable TV firms are offering voice communications (local and long distance) over their broadband cable modem systems in direct competition with the RBOCs and the long distance companies. Most of the firms are using VoIP to provide these services over their broadband, cable-modem network. Several cable companies have also partnered with Sprint-Nextel to offer wireless phones. Convergence is taking place as RBOCs enter the video market and cable TV firms offer voice services. Both types of firms are gearing up to provide the quadruple play of voice, video, data and wireless.

1.5 Data/Internet Access

Although there was talk of alternative “information superhighways” in the 1980’s, the Internet has taken over as the data network for the consumer market. The Internet is a network of networks that use the TCP/IP protocols. The Internet evolved from the ARPAnet which was developed in the 1960’s by the Department of Defense and NSFnet which linked universities and supercomputers in the 1980’s. Despite having these roots in government funding, the Internet was privatized on April 30, 1995. When privatized, there were five major backbone providers – UUNET, ANS, SprintLink, BBN, and MCI. By 2000, UUNET and ANS were brought by MCI Worldcom, BBN was part of Genuity, MCI’s old network was owned by Cable and Wireless and AT&T has created its own IP network using its own fiber and purchasing IBM’s Global Network. These backbone

providers had peering arrangements to exchange traffic and provide links to regional networks and Internet Service Providers (ISPs).

The exponential growth of the Internet would not have occurred without the development of easy-to-use end-user applications. The first application was e-mail systems that could exchange messages between systems. End-user email interfaces became easier to use with more and more features. Netscape and its world-wide-web browser popularized the use of the Internet beyond simply e-mail and customer demand grew rapidly. The explosive growth of websites and extensions of the basic browser functions drove consumers to demand access to the Internet and eventually, higher speed access.

Starting in the mid 90's, residential second lines soared, driven by demand for dial-up Internet access (Cassel, 1999). It was not long before the attraction of always-on connectivity, faster speeds and declining prices spurred a switch from second lines towards broadband technologies. Broadband is defined by the FCC as 200k or higher in one direction, which is low by some standards. The current technologies offering broadband speeds are cable modems, DSL, satellite and WiFi. The broadband market shows the greatest evidence of convergence, with Cable TV firms offering cable modem service and landline voice companies offering DSL. As shown in Graph 1.12, cable modems have the highest percentage market share of the broadband market with 59 percent followed by DSL with 37.2 percent. Cable modems were first to the marketplace but DSL has tried to close the gap in recent years with lower pricing leading to increased market share. Table 1.6 shows the number of lines served by various companies providing cable modems with Comcast being the largest provider. Table 1.7 shows the various companies providing DSL with SBC being the largest.

Graph 1.12 about here

Table 1.6 about here

Table 1.7 about here

Landline broadband faces increasing competition from wireless technologies. The wireless technology with the most users is WiFi, which is used in home wireless networks and coffeeshops. WiFi is also used by Wireless Internet Service Providers (WISPs) to provide Internet services in rural communities. WIMAX is an emerging wireless technology that promises wider ranges and faster speeds than WiFi and so it may

be a better competitor to wireline broadband. Sprint-Nextel recently announced its intention to build a “4G” wireless broadband network using WIMAX technology.

In addition to private companies building wireless broadband networks, cities and local governments have taken the initiative to build new networks. WiFi networks are being deployed across much larger geographies such as the cities of Philadelphia and San Francisco. In the cases of these cities, the city government is taking the initiative to have the technology deployed by partnering with private firms to build and manage the networks. These cities already have wireline broadband services available to most city residents. In other cases, smaller rural municipalities are looking to build broadband networks where private companies have not deployed any broadband technologies. Other cities have opted for a landline fiber solution similar to the Utah Telecommunication Open Infrastructure Agency (UTOPIA) project. Municipal broadband has been a politically controversial topic with private firms looking to bar municipalities from providing broadband services for fear of subsidies from taxpayers providing an un-level playing field and potentially delaying or stopping private investment.

Another politically sensitive issue concerning the Internet has been called “net neutrality.” Net neutrality does not have a precise definition but usually refers to a policy that broadband providers cannot charge content providers to send information over their broadband lines to end users. This policy debate began when broadband providers such as Verizon, AT&T and Comcast proposed charging content providers like Google and Yahoo for sending data over their lines. The providers would create “fast lanes” for high-bandwidth applications such as movie downloads or streaming video. The providers claim that this would ensure these applications have the bandwidth available when they need it and would support enhanced infrastructure. Critics claim that users will end up paying twice for access to content.

Aside from Sprint’s announcement concerning WIMAX, wireless companies are already upgrading their networks in order to provide wireless data that surpass minimum broadband speeds. Until the major carriers upgraded their networks, less than 2 percent of their mobile traffic was data. Their second generation networks, using GSM, CDMA and TDMA, yielded data speeds of 9.6 to 19.2 kbps. Recently, however, several networks are upgrading to third generation network technologies such as EVDO in major cities across the U.S.. These third generation networks allow broadband speeds from laptops, PDAs or cellphones from anywhere the signal reaches. Verizon Wireless launched its CDMA2000 1xEVDO network in late 2003 and now offers it in a number of major U.S. cities. Sprint began to deploy this same technology in July, 2005. Cingular Wireless is planning to deploy WCDMA with HSDPA (High Speed Data Packet Access) technology in a number of major U.S. markets. This technology will allow average download speeds of 400-700 kbps with burst rates of up to several Mbps whereas CDMA2000 1xEV-DO delivers average user speeds of 400-700 kbps and allows maximum data throughput speeds of 2.4 Mbps.

1.6 International Telecommunications

Although much of this chapter has focused on the U.S. telecommunications market, similar convergence of industry markets has occurred elsewhere in the world. In some cases the U.S. has been on the forefront of these changes while in other cases, notably wireless and broadband data, the U.S. has lagged behind. The movement of landline voice services from monopoly to competition in both local and long distance has followed the U.S. pattern with some delay. In many cases, countries first had to transition from a state-owned telecommunications monopoly to a private, regulated firm. In Canada, several telephone companies were owned by the provincial government. In the United Kingdom, British Telecom was privatized in 1985. In other parts of Europe, France Telecom and Deutsche Telecom moved from state-owned telephone and telegraph monopolies to private companies. In Japan, Nippon Telephone and Telegraph Corporation started the process in 1985 but in 1996, it restructured into a holding company with separate long distance division and two local telephone companies – NTT East and NTT West.

After privatization, all of these countries opened their landline markets to competition. In 1985, the United Kingdom opened entry into telecom services and Japan allowed long distance and international calling competition. Canada allowed competition in long distance in 1992 and local competition in 1997. The European Union opened all telecommunications markets to competition in 1998 (Crandall, 2005).

In the wireless telecommunications front, the move towards competition took a similar but delayed path in mimicking the U.S. experience. Most of the developed countries only had 1-2 wireless carriers as late as 1991. Even today, many countries only have 2-4 wireless carriers competing. In spite of being of the forefront in wireline and wireless competition, the United State has lagged behind in its auction of 3G radio spectrum and deployment of 3G services. In addition, the United States ranks 10th in broadband penetration at the end of 2003 (OECD, 2005, 129).

1.7 Conclusion

Having looked at each of the telecommunications industry segments separately, it is clear that each segment is facing competitive inroads by other industry segments. The landline voice market (both local and long distance) is facing competition from wireless voice and cable TV companies. Cable TV firms are facing increasing competition from DBS firms and local telephone companies using IPTV. Local voice companies, cable TV firms and wireless firms are competing for the broadband data market. Large multi-market firms will continue to increase their market share or market reach in each of the quadruple play markets of landline voice, high speed internet access, TV/entertainment, and wireless voice/data.

Glossary

2G: Second Generation – wireless network standards that use digital technology including TDMA and CDMA.

3G: Third Generation – wireless network standards that provide faster data transmission and include UMTS and WCDMA.

ALT: Alternative Local Transport Company – smaller local landline company that provided bypass of the ILEC network. Later become known as CLEC.

AMPS: Advanced Mobile Phone Service – wireless analog standard used in the United States.

CAP: Competitive Access Provider– smaller local landline company that provided bypass of the ILEC network. Later become known as CLEC.

CDMA: Code Division Multiple Access – a 2G wireless standard that uses complex algorithms to compress the digital signal.

CLEC: Competitive Local Exchange Carrier - smaller, upstart company that competes with ILECs for local landline voice customers.

DBS: Direct Broadcast Satellite – wireless video providers such as DirectTV and Dish Network that compete with cable TV companies.

DSL: Digital Subscriber Line – a broadband Internet access service provided by LECs.

EVDO: Evolution Data Optimized/Only – a third generation wireless standard that enables broadband data speeds on wireless networks.

FCC: Federal Communications Commission – the federal agency created by the Communication Act of 1934 that regulates interstate telecommunications.

FTTC: Fiber To The Curb – refers to using fiber optic cable to the pedestal or neighborhood and using cooper or coaxial cable from that point to the home.

FTTP: Fiber To The Premises - refers to using fiber optic cable directly to the home and replaces cooper or coaxial cable.

HSDPA: High Speed Data Packet Access – a 3G wireless data standard.

iDEN: Integrated Digital Enhanced Network – a 2G wireless network standard that uses time-slicing techniques.

ILEC: Incumbent Local Exchange Carrier – traditionally regulated monopoly providers of local voice landline services.

IPTV: Internet Protocol Television - delivers video (television) programming to homes using Internet protocols.

ISP: Internet Service Provider – company that provides Internet access to end-users.

GSM: Global System for Mobile – a 2G wireless network standard that uses time-slicing techniques.

MSO: Multiple System Operators – cable TV companies that provide video programming via many different local systems.

NARUC: National Association of Regulatory Utility Commissioners – umbrella organization representing state and federal regulatory commissions.

Presubscribed Interexchange Carrier Charge – new charge as a result of TA96 that the FCC instituted to lower switched access fees. Charged by local companies to long distance companies.

PSTN: Public Switched Telephone Network – the traditional voice network operated by ILECs and long distance voice companies.

RBOC: Regional Bell Operating Company – seven local telephone companies created from the divestiture of AT&T in 1984.

SLS: Subscriber Line Charge – per-line prices charged to end-users which started around the time of divestiture.

TA96: Telecommunications Act of 1996 – most recent, wide-ranging telecommunication law which was technically a rewrite of the Communications Act of 1934.

TDMA: Time Division Multiple Access – a 2G wireless network standard that uses time-slicing techniques.

UMTS: Universal Mobile Telephone Service – a 3G wireless standard also known as WCDMA.

VoIP: Voice Over Internet Protocol – using Internet protocols to transmit voice conversations over data networks.

WiFi: Wireless Fidelity – the popular name given to 802.11 standards for transmitting data wirelessly.

WIMAX – a newer wireless standard that allows higher speed and longer ranges than WiFi.

WISP: Wireless Internet Service Provider - company that provides Internet access to end-users using wireless technology usually over unlicensed spectrum.

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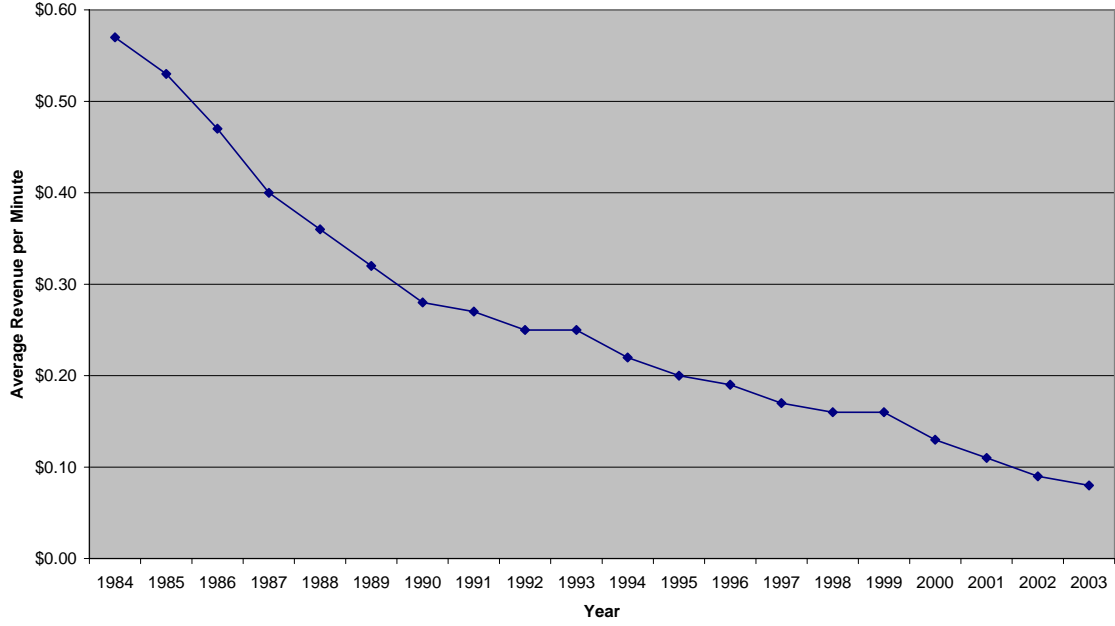
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Further Reading

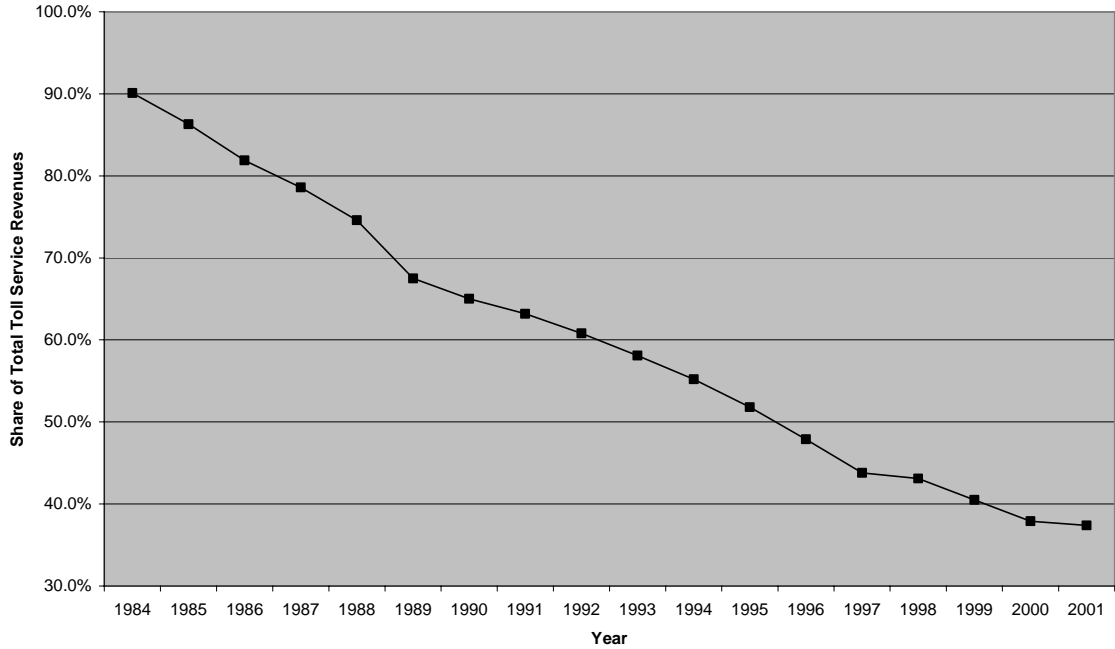
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Graphs

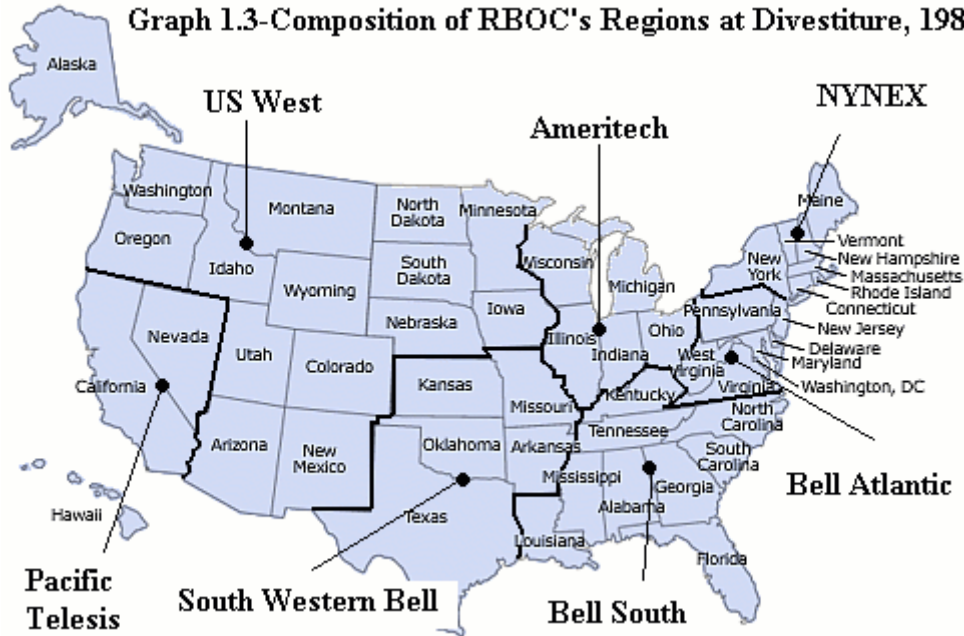
Graph 1.1
Average Revenue Per Minute for Interstate & International Calls (Restated in 2003 Dollars), 1984-2003



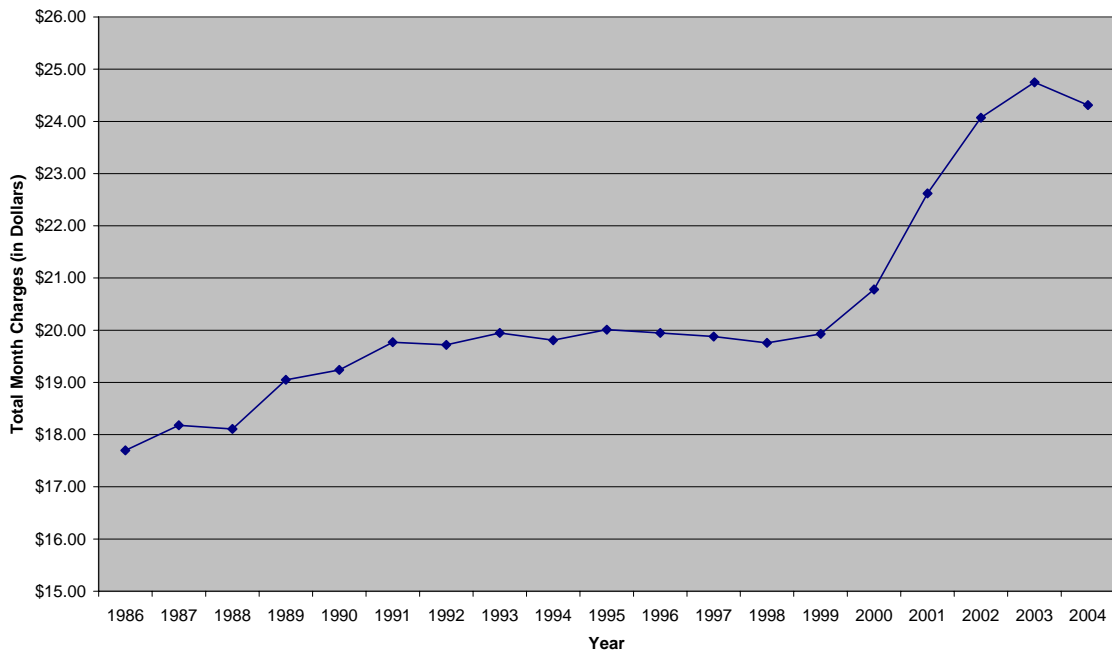
Graph 1.2
AT&T's Share of Total Toll Service Revenues, 1984-2001



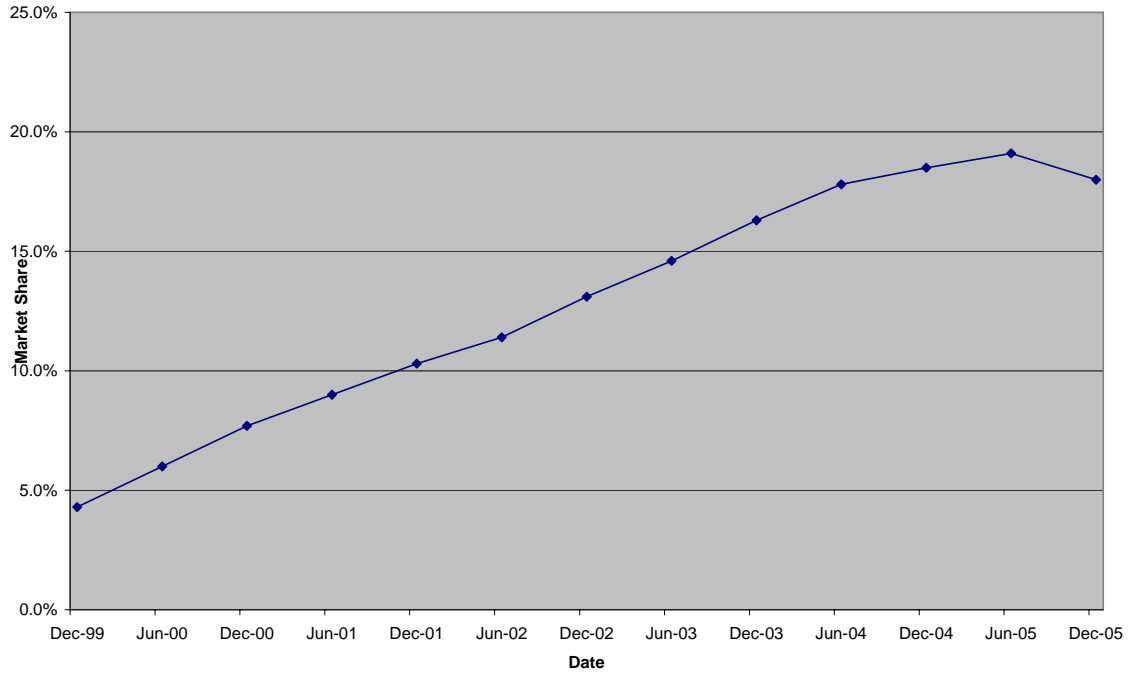
Graph 1.3-Composition of RBOC's Regions at Divestiture, 1984



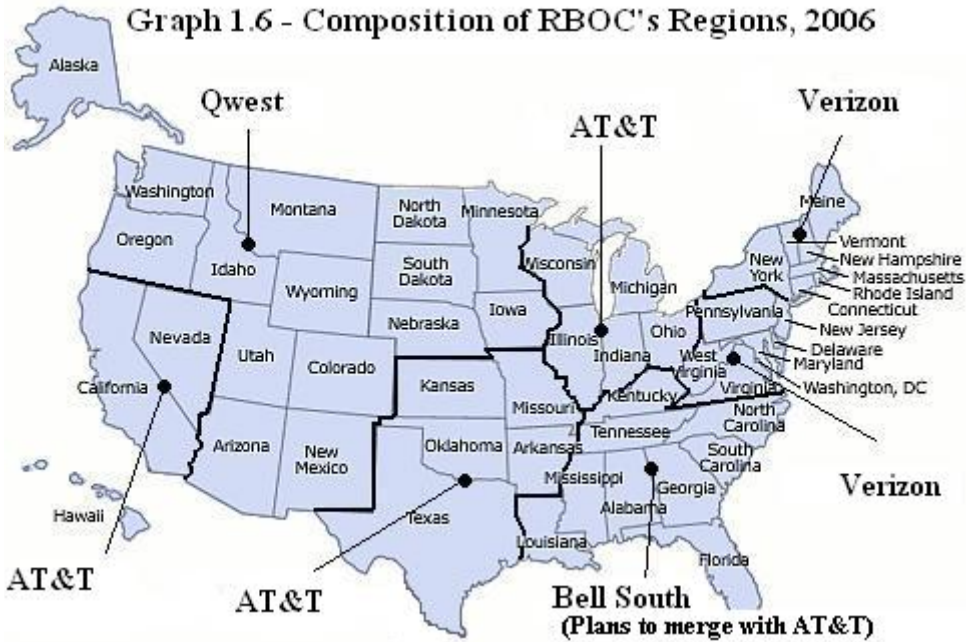
**Graph 1.4
Total Monthly Charges for Local Services in Urban Areas, 1986-2004**



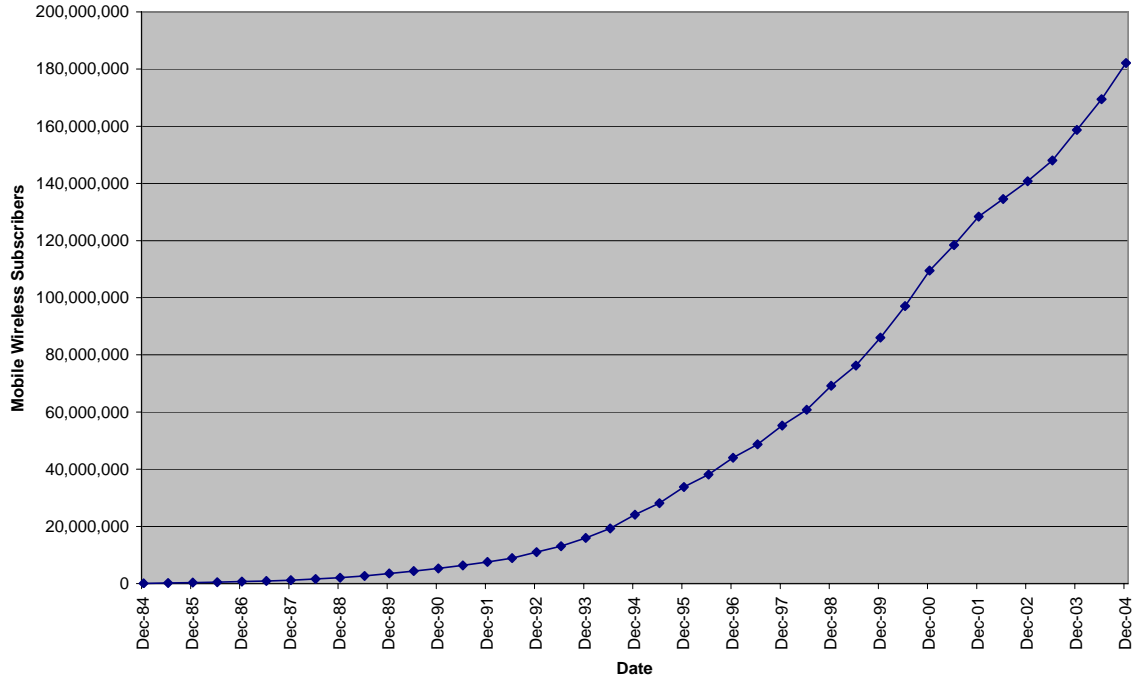
Graph 1.5 Competitive Local Exchange Companies' (CLEC) Market Share, 1999-2005



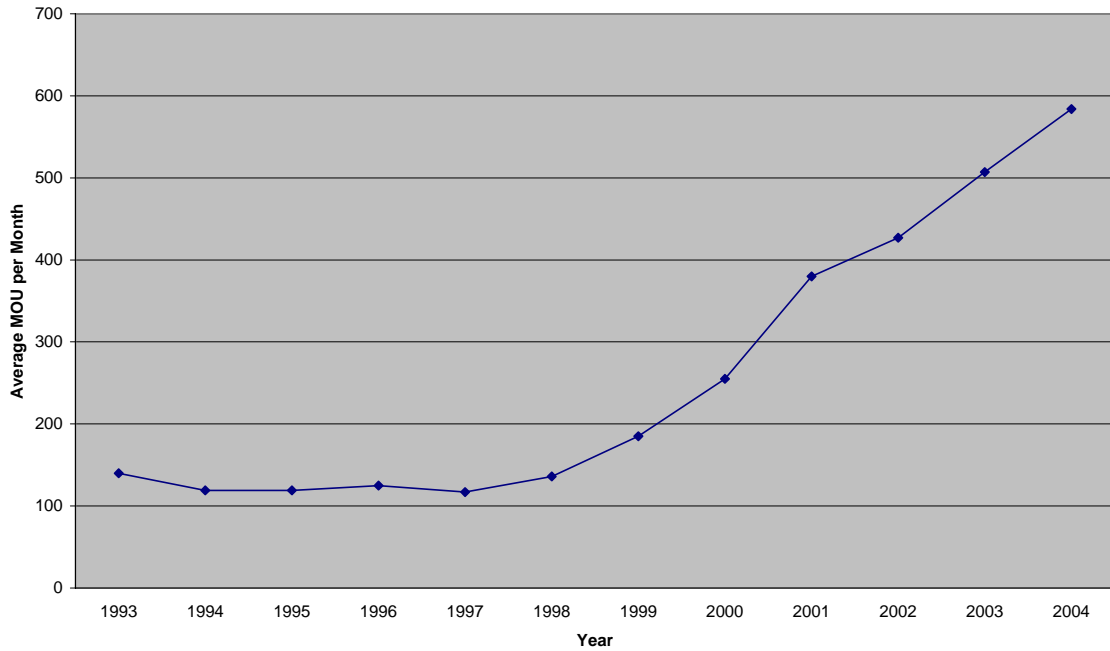
Graph 1.6 - Composition of RBOC's Regions, 2006



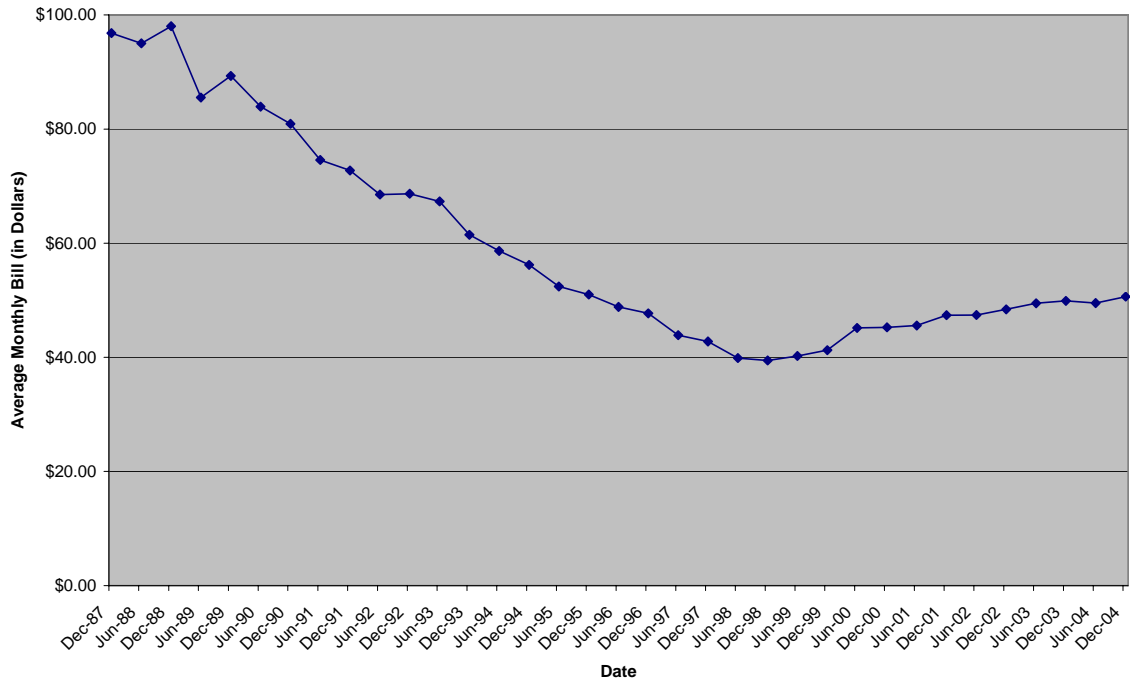
Graph 1.7
Number of Mobile Wireless Subscribers, 1984-2004



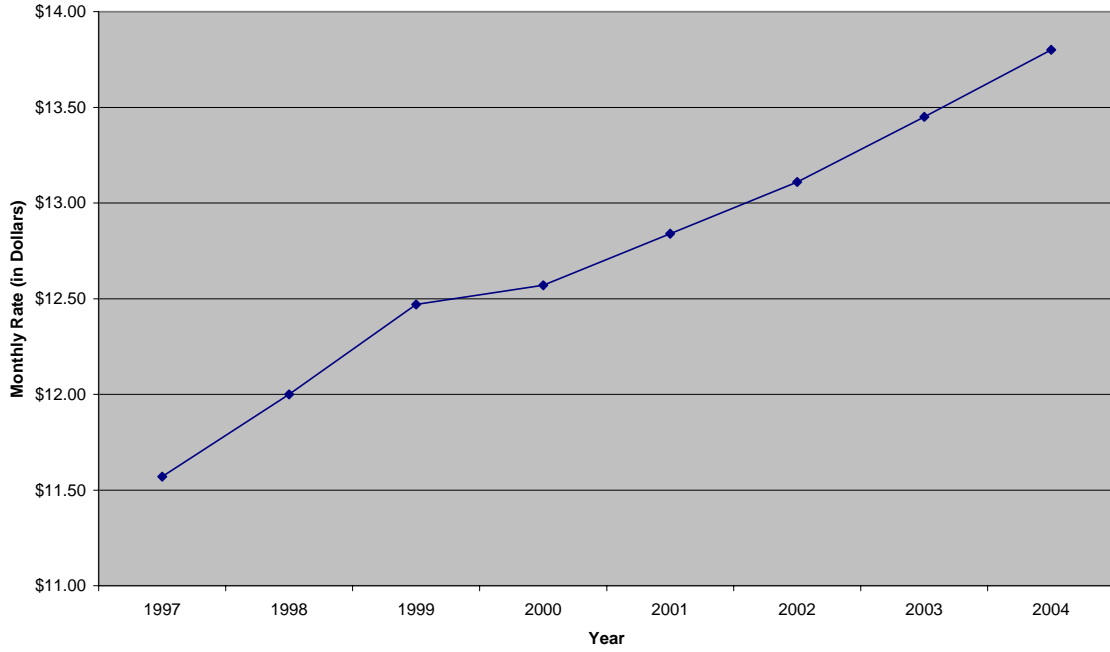
Graph 1.8
Mobile Wireless Telephone Service: Average Minutes of Use per Month, 1993-2003



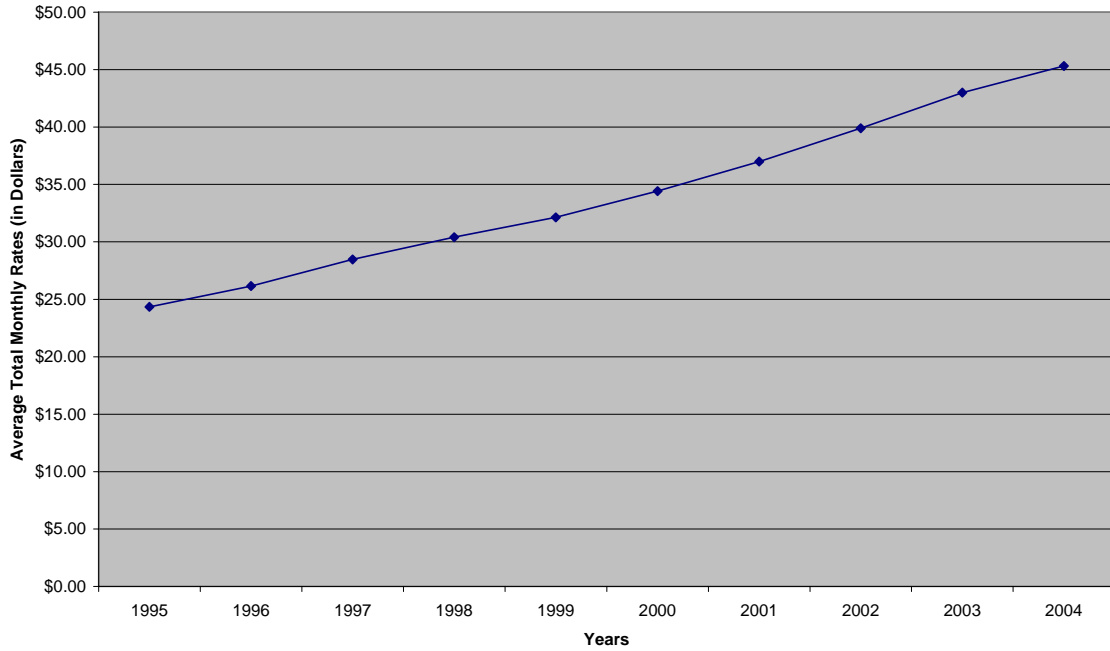
Graph 1.9
Mobile Wireless Telephone Service: Average Monthly Bill, 1987-2004



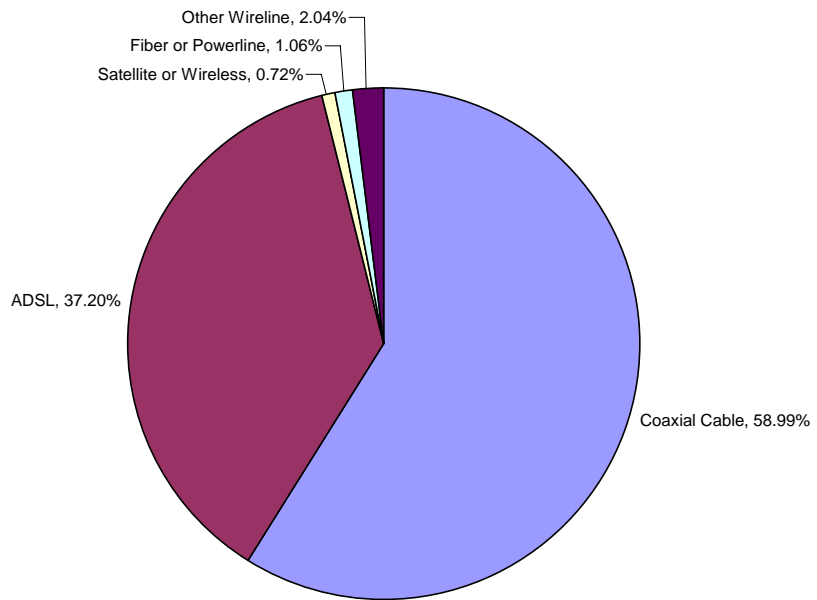
Graph 1.10
Average Monthly Rates for Basic Services, 1997-2004



Graph 1.11
Average Total Monthly Rates, 1995-2004



Graph 1.12 Broadband Technologies' Market Share



Tables

Table 1.1-Shares of Total Toll Service Revenues for Long Distance Carriers

Year	AT&T	MCI	Sprint	All Other Long Distance Carriers
1984	90.1%	4.5%	2.7%	2.6%
1985	86.3%	5.5%	2.6%	5.6%
1986	81.9%	7.6%	4.3%	6.3%
1987	78.6%	8.8%	5.8%	6.8%
1988	74.6%	10.3%	7.2%	8.0%
1989	67.5%	12.3%	8.4%	11.8%
1990	65.0%	14.5%	9.7%	10.8%
1991	63.2%	15.6%	9.9%	11.3%
1992	60.8%	18.1%	9.7%	11.5%
1993	58.1%	19.7%	10.0%	12.3%
1994	55.2%	20.7%	10.1%	14.0%
1995	51.8%	24.6%	9.8%	13.8%
1996	47.9%	25.6%	9.7%	26.8%
1997	43.8%	25.6%	9.5%	21.0%
1998	43.1%	23.5%	8.5%	24.9%
1999	40.5%	23.7%	9.8%	26.0%
2000	37.9%	22.4%	9.0%	30.7%
2001	37.4%	23.4%	9.3%	23.8%

Source: Federal Communications Commission (2003), Table 7

Table 1.2-Market Share by Subscriber for Top 5 Mobile Telephone Operators

Mobile Telephone Operator	Market Share
Cingular Wireless	27.1%
Verizon Wireless	24.2%
Sprint PCS	11.9%
T-Mobile	9.6%

Source: Federal Communications Commission (2005d), Tables 4 and 2

Table 1.3-Direct Broadcast Satellite's (DBS) Market Share

Date	Market Share (Percent of Total MVPD)
June 2000	15.65%
June 2001	18.67%
June 2002	20.83%
June 2003	22.68%
June 2004	25.09%
June 2005	27.72%

Source: Federal Communications Commission (2006a), Table B-1

Table 1.4-Number of Subscribers for Top Cable TV Firms in 2004

Company	Number of Subscribers
Comcast	21,569,521
Time Warner	10,955,507
Cox	6,386,867
Charter	6,211,505
Adelphia	5,426,991
Cablevision	2,944,235
Bright House	2,187,410
Mediacom	1,532,110

Source: Federal Communications Commission (2005a), Tables B-1 and B-3

Table 1.5-2005 Top Ten Firms By Market Share in the Video Market as a Whole

Rank	Company	Market Share (Percent of Subscribers)
1	Comcast	22.99
2	DirecTV	15.72
3	EchoStar	12.27
4	Time Warner	11.69
5	Cox	6.73
6	Charter	6.37
7	Adelphia	5.50
8	Cablevision	3.22
9	Bright House	2.34
10	Mediacom	1.55

Source: Federal Communications Commission (2006a), Table B-3

Table 1.6-Major Cable Modem Providers by Subscribership, Q1 2005

Company	Cable Modem Subscribers
Comcast	7,410,000
Time Warner	4,120,000
Cox	2,750,000
Charter	1,980,000
Adelphia	1,490,000
Cablevision	1,440,000
Total North America	21,150,000

Source: Leichtman Research Group cited in The Digital Fact Book (2005) 7th ed.

Table 1.7-Major DSL Providers by Subscribership, Q1 2005

Company	DSL Subscribers
SBC	5,610,000
Verizon	3,940,000
Bell South	2,350,000
Qwest	1,120,000
Sprint	550,000
Covad	550,000
Total North America	14,700,000

Source: Leichtman Research Group cited in The Digital Fact Book (2005) 7th ed.