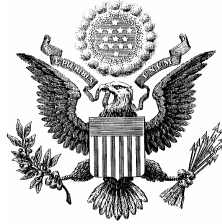


Convergence in the Communications Industry: Three Fronts and What They Mean for Congress

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Abstract

Convergence in the communications sector is occurring on three separate fronts. The first is the continued integration of the communications and computer sectors as communications increasingly become digitized. The second front involves convergence in the communications network as a variety of technologies compete to deliver voice, video, and data to consumers wherever they are. Last, the move to digital has made possible a variety of new products and services that combine voice, video and data to meet the needs of customers.

Convergence is undermining the current regulatory structure. Government policy should encourage competition, foster the growth of broadband connections, and ensure that spectrum is used to deliver as much value as possible to consumers. Convergence has also driven a number of important mergers in the communications and content industries as companies struggle to acquire the size and skills needed to compete in new markets. Few of these mergers will achieve their goals. But gradually, companies will discover business models that enable them to bring new value to consumers.

Convergence in the Communications Industry:

Three Fronts and What They Mean for Congress

Discussion of the implications of convergence in the communications industry is common place, yet often remains so undefined that it means little more than: “something big is happening here.” Convergence has also become used as a justification for rewriting the Telecommunications Act of 1996. Although no legislation is expected this year, the committees of jurisdiction are already preparing the groundwork for moving legislation later this Congress and at least two major bills have been introduced.

It is important to understand the exact ways in which convergence is occurring and what they mean for the communications industry. Any amendments to the Telecommunications Act must deal not only with what is currently happening in technology, but also accommodate for technological advancement over the next few decades. One of the criticisms of the 1996 Act is that, less than ten years after its passage, it is difficult to apply to current technology.

Regulation commonly suffers from two major problems. The first is the natural lag that occurs between changes in technology and business practices and the legislative and regulatory response to them. Recent amendments to the nation’s energy and bankruptcy laws took several Congresses to complete and it will take the relevant agencies several more years to write the implementing regulations. Second, government officials are at an inherent disadvantage in understanding the nature and implications of new technology. Government agencies have smaller staffs and must rely on the private sector for much of their knowledge about the details of an industry. Yet private sources of knowledge are almost always selective and biased in their reporting. Both of these problems are especially important in the communications industry because the technology is changing so rapidly and government policy has large implications for private firms and consumers. Without a good understanding of the trends at work, Congress cannot draft legislation that properly guides public policy now and in the future.

Convergence as a Sign of Technological Advancement

The convergence in communications is part of a larger trend. As society grows, it becomes more complex. With increased complexity the boundaries of previously separate industries or disciplines begin to overlap and the most interesting development increasingly occurs in these areas of overlap rather than in extending the reach of each separate field. In at least two other industries convergence has played a significant role in moving previously separate industries toward a single, integrated sector. In each case the process led to significant restructuring of both private business and the regulatory framework.

Convergence in the transportation industry was driven by a number of factors including the use of standardized containers, improved communications, and increased trade. The widespread movement toward moving goods in standardized containers that can be transported by ship, rail, truck, and even plane without reloading allowed companies to seek out the cheapest means of transportation from one point to another and to use different modes of transportation for different legs. Advances in communications helped carriers coordinate more shipments, both with each other and with their customers. The result was that the trucking and rail industries increasingly competed with each other for the same cargoes. Regulation that focused on just one mode of transportation, such as rail or shipping, increasingly prevented that mode from adapting to intermodal competition and neglected broader issues that involved the transportation sector as a whole.

Over the past decades the financial sector has also seen a great deal of convergence. Previously separate industries such as banking, securities, and insurance became more integrated as customers discovered the value in having a single business handle their multiple needs and as companies began offering overlapping products and services. The rise of complex financial products such as futures markets and derivatives helped match customer needs and diversify risk. Once again, this integration was aided by advances in communications and computing. Vast sums of money now cross international borders quickly and cheaply, seeking the highest rates of return. The transformation has forced Congress to deregulate many aspects of the nation's financial markets in order to respond to market forces.

Both of these cases share several traits with what is now occurring in communications. First, much of the change was driven by technological advances in communications and computing. The ability to exchange information quickly and cheaply allowed companies to compete on a global basis and to offer increased product differentiation. Second, changes in the market increasingly removed historic industry and institutional boundaries. Since federal regulation had been built on these boundaries, policymakers were forced to restructure much of their traditional approach. Regulators moved from protecting companies from each other toward ensuring that consumers enjoyed the benefits of competition and that companies with new products or services could enter the market. Finally, in each sector these developments produced significant additions to consumer welfare and economic growth. The government was forced to deregulate many aspects of the market and, even though each sector saw a wave of consolidation as companies sought to gain greater critical mass and bridge into other industries, in the end consumers ended up with greater choice, better service, and lower prices.

This paper will argue that the move toward digital signals is causing convergence on three separate levels; 1) the integration of communications and computers, 2) the network which brings information into separate homes and businesses, and 3) software and smart products that handle a mixture of voice, video, and data services. Each of these in turn is being reflected in a restructuring of business models as firms attempt to gain expertise in new technologies and markets that are now necessary to competitive success and to

achieve the critical mass needed to make multibillion dollar investments in new infrastructure and technology.

1. Convergence Between the Communications and Computing Industries

Both the communications and computing industries are coalescing around the collection, processing, and transmission of digital information. In this new information sector, voice, video and data become uniform once they are digitized and the origin and ultimate use of digital signals becomes irrelevant to how the network handles them. For the computing industry, this means that processed information can now be used over a wider network, increasing its ultimate worth. On the communications side, voice and video are increasingly digitized before transmission, making more spectrum available and opening up a wide range of new products that integrate information of various types.

At least two trends are apparent. The first is the increased importance of content as the transmission and handling of information becomes commoditized. In the first computers, memory was a scarce resource and most users had to do a great deal of their own programming. By the late 1980s personal computer manufacturers faced fierce competition and consumers came to expect annual improvements in both the price and capacity of hardware components, including memory and speed. Value had begun migrating to the software manufacturers. Computers stopped becoming a tool with which users could perform their own programming and instead became more of a generic platform on which to run a variety of prepackaged software programs.

A similar migration is happening today. When the Internet was first developed, processing and transmission speeds were significant bottlenecks that limited the value that users derived from being on-line. Increasingly this constraint is being overcome. As it is, computer connections will become more of a commodity and the value of the network will continue to move toward the content that it can deliver to consumers, now over communications channels rather than through prepackaged programs. Because there is vastly more information in the communications network than in a shelf of computer programs, the utility of computers and other electronic devices increases dramatically once they are connected to the network. The value of the computer is increasingly determined by its ability to access the network and its content.

The second major trend is the transition from analog to digital signals for a variety of content, from data, to music, to television. Computers can store, transmit, manipulate, and copy digital signals much better than analog ones. With the rise of the Internet, the digitization of television and radio, and voice over Internet protocol (VoIP), information will almost exclusively take the form of digital signals. Running the communications network increasingly involves the same processing of digital signals that lies at the heart of the computing industry. Moreover, as the size and complexity of the network grows, more of the operations will be automated with computers. Finally, as consumers use the network to interact with others, the distinction between a traditional computer and a communications device such as a phone or television will blur. Whatever device is used, it will have many of the components of a computer.

The primary implication for policy is that companies like Microsoft, Apple, Intel, and Cisco, which are used to working in an environment characterized by rapid change, fierce competition, and little regulation, will play a growing role in shaping the communications industry.

2. Convergence in the Network

If the analogy of the Internet as an information highway is valid, then most of the current focus is not on the main highways used to transmit masses of data between one central node and another. Much of this infrastructure has already been built using copper or fiber optic cable. The main constraint to providing broadband service is now linking individual homes to the highway. This “last mile” involves significant cost but is increasingly necessary in order to enable the type of high value products that technology makes available.

A. Competing Technologies

Over the last century four major networks have been built into the homes. They include power lines for delivering electricity, twisted wire for phone service, over-the-air broadcasting for licensed radio and television, and, finally, cable for wider television programming. Most recently, satellite dish service has offered a service similar to cable. Originally each of these transmission routes delivered only one type of service, almost exclusively in an analog format. Government policy reflected this service division by regulating each industry separately.

Increasingly, however, each of these networks is being redesigned to deliver the full range of voice, video, and data in digital form through a broadband channel that meets consumers’ needs for faster transmission speeds. At present two of these channels are dominant, two are likely to develop rapidly, and one is still in its infancy. Each technology has unique advantages and disadvantages. Ideally, consumers will soon face a choice of at least three main providers, each of which will offer a full range of information services.

Cable

Approximately 63 million households already subscribe to cable service, primarily to view broadcast and nonbroadcast television, including movies on demand.¹ Cable companies are rapidly upgrading their service to offer Internet connections as fast as 6 million bites per second. Since the local cable network is shared with neighbors, actual transmission speed slows when more people are using the network. The industry is already working on next generation technology to increase transmission speeds. In addition, most cable companies have already moved to offer IP-enabled services including telephone calls using VoIP.

¹ *Digital Broadcast Television Transition: Estimated Cost of Supporting Set-Top Boxes to Help Advance the DTV Transition*, Government Accountability Office, GAO-05-258T, February 17, 2005, p. 8.

Digital Subscriber Line (DSL)

The traditional method of home Internet access was dialup service over copper telephone lines. The main impediment to this service quickly became the slow transmission speeds, which made it difficult for users to take advantage of video and audio services like the World Wide Web, audio streaming, and video simulcasts. DSL technology allows faster transmission over the existing copper lines. Unlike cable, the local line is not shared with other users, but the technology only works within a limited distance of a central office facility. Telephone companies are also rapidly installing newer technology, including fiber optic cable, which will allow them to offer television and other video services over the Internet. These investments are spurred by the increased threat that VoIP and wireless phone service poses to their traditional telephone business.

Satellite Wireless

Over 22 million households get satellite television,² making it a strong competitor to cable service. Currently two satellite companies are also offering broadband service. Other companies are entering into partnerships to bundle services together. Like cable, satellite service is a shared medium, raising concerns about privacy and transmission speed when many users are on the line simultaneously. Because technology allows satellites to offer Internet service, VoIP service is also a possibility. By avoiding the need to put a physical line into each home, wireless promises to dramatically reduce the cost of providing full broadband service to rural and low-income areas.

Broadcast Wireless (Bluetooth, WiFi, WiMax)

Companies already use other spectrum frequency to provide national coverage for mobile phones. Increasingly wireless technology is also being used to offer the full range of voice, video, and data services. Bluetooth technology is already a recognized standard for connecting electronic equipment over very short distances. Wireless fidelity (WiFi) is currently being used to provide Internet access within small locations such as a business or home. A main advantage is that it eliminates the need for a physical connection between devices within these areas. The release of new spectrum in the 700 Mz band over the next few years should allow the introduction of other technologies such as WiMax for both fixed and mobile uses. Since this spectrum could allow companies to send a signal through buildings with coverage of as much as 30 miles, technologies like WiMax also promise to dramatically reduce the cost of providing broadband service to any geographical area.

Broadband over Power Lines (BPL)

The newest technology uses electrical signals over existing power lines to access the Internet. Signals from each home are transmitted to nearby equipment where they are separated from the power line and then conveyed by fiber. In theory BPL can offer the

² *Digital Television: An Overview*, Congressional Research Service, June 22, 2005, p. 8.

full range of voice, video and data services. Within a home, each electronic device, including appliances, would communicate through the existing electric cord. A version of this technology has recently been installed in Manassas, Virginia. An added benefit is that BPL may also allow for much better monitoring and utilization of the nation's power grid.

B. Major issues

Each of these technologies is affected by several common issues. The Federal Communications Commission (FCC) already has authority to deal with many of these under its existing powers. Congress will have to deal with each issue, however, if only to affirm the FCC's current approach.

Regulatory Neutrality

The nation's laws and regulations should not favor one technology into the home over another. If five or more separate solutions to the last mile problem exist, government policy should remain neutral as to which one consumers choose. There are, of course, some issues that pertain solely to one technology and not others, which may require regulation. For example, any use of BPL should not threaten the nation's power grid. Local telephone exchanges should not be allowed to use their monopoly over local service to compete unfairly in offering Internet service, at least until VoIP is firmly established as a competitive alternative. But attempts to deal with these issues should be limited to the minimal amount of intrusion necessary. To the maximum extent possible, technologies should have to compete with each other for customers.

Regulatory neutrality does not mean the government ensures that all providers do equally well in the market place; each has inherent advantages and disadvantages that companies will have to integrate into their strategic plans. It does mean that regulation should not tip the balance in any way, except to deal with very clear issues that have obvious social impacts. And when regulation is needed its main purpose should be to help the ultimate consumer, not any specific company or industry. The regulations should be crafted to minimize any competitive effects.

Universal Access

For several decades the federal government has pursued the goal of extending phone service and electricity to virtually all American households. Because private incentives may not be strong enough to extend full coverage, public subsidies and mandates have also been used. The cable industry has faced similar pressures to extend coverage by building out its franchises to cover all neighborhoods, not just the most affluent.

Current law recognizes that "universal service is an evolving level of telecommunications services that the [FCC] shall establish periodically under this section, taking into account advances in telecommunications and information technologies and services."³ Currently,

³ 47 U.S.C. § 254(c)(1).

the FCC defines universal service mainly in terms of telephone service and only interstate and international communications companies pay into the fund that subsidizes local connections. This practice is likely to change in two ways. First, as cable and satellite providers offer telephone service through VoIP, they also should be required to contribute into the fund in order to eliminate any competitive advantage against the incumbent telephone companies.⁴ Second, and perhaps over the longer term, the concept of universal service should be extended to broadband access and the full range of voice, video and data services that it provides. Once this is done, all technologies to extend broadband into the home, including cable and wireless, should qualify for support from the fund. It should be noted that the Administration's current goal of extending broadband to every home by 2007 may not be sufficient in this regard because its definition of "broadband" includes transmission speeds that are too slow to deliver many of the services made possible by current technology.

Local versus Long Distance

A central goal of the Telecommunications Act of 1996 was to create competition in the market for local telephone calls. The main problem was that the existing physical network of phone lines into homes was monopolized by the local telephone companies. In response, Congress ordered the local exchanges to lease their facilities to competitors and interconnect with competing equipment. The Act made compliance with this mandate a condition for offering long distance service in the local exchange's home market. The Baby Bells have never fully complied with these laws, instead challenging both them and the implementing regulations in a series of court cases. As a result, most homeowners still have only one home telephone service to choose from.

The continued lack of competition for local phone service would seem to demand further enforcement action by Congress and the FCC. However, new technology may be making the issue moot. With the spread of VoIP, individuals with broadband service can also make both local and long distance telephone calls over the Internet. In addition, more individuals are switching to mobile phones, where competition does exist. The combination of these two technologies may soon make the monopoly of traditional local phone service meaningless. In fact, many industry observers believe that in the near future individual voice transmissions will be free once individuals pay for a broadband connection. Until this day comes, regulators should prevent local telephone exchanges from using their remaining monopoly powers to compete unfairly against other broadband providers.

Ensuring Competition

A central goal of communications policy should be to ensure that consumers have a choice of providers from which to get broadband access and all of the services that go with it. Mergers and the historic monopolization of local cable, telephone, and electric service make it likely that consumers will have only one provider for each service. In

⁴ The Chairman of the FCC recently announced that the Commission would move to require Internet telephone providers and cable companies to pay into the fund.

other words, each home will have only one cable company and one local telephone company. It is extremely important therefore that Congress encourages the rise of new technologies and ensures that each of these separate industries competes against each other so that consumers can choose to hook to the network through a variety of routes.

Spectrum Usage

A final goal of government policy should be to ensure that spectrum continues to be used for its most valuable purposes. Spectrum is public property and its use should maximize public welfare. Much of the spectrum is still used for traditional broadcast purposes. Yet researchers continue to develop new technologies and products that increase the value society can derive from the spectrum. The challenge is to transfer usage rights from traditional users to new technologies so that consumers can take advantage of these opportunities. Over the last few decades Congress and the FCC have encouraged this process through the transition to digital transmissions and by transferring some government uses to other, less desirable frequency. This process needs to continue, however. Specifically, as broadband access becomes more universal, licensing spectrum to traditional over-the-air radio and television broadcasters for the sole purpose of transmitting one service rather than the full range of video, voice, and data, becomes questionable. This is especially true when the same frequencies could be used much more intensively to provide homes with wireless broadband service. In addition, the FCC needs to complete its current rulemaking process to permit unlicensed uses of unused broadcast spectrum in each market, provided they do not interfere with broadcasters' signals.

3. Convergence in Product Offerings

The third type of convergence will have the greatest impact on economic growth and consumer welfare. This will come from a combination of three interrelated trends: 1) a growing list of smart products that integrate voice, video, and data; 2) increased connections between traditional products and the Internet; and 3) the extension of broadband service into the physical world.

With respect to the first trend, we already have phones that can take pictures or serve as a personal digital assistant for recording events and messages. Digital television will allow users to also call up statistics about a player while watching a ball game. Email messages can include photographs and even video. Many more such products are already feasible. The technology is much more advanced than the available products. What is needed is the business model for developing applications that people will buy and a regulatory framework to encourage investment in these services.

The second trend involves hooking up previously unrelated products through the Internet, giving them new functions. This would allow users to turn on the oven during their commute home. Parents could pull up the Internet at work to watch their children playing at daycare. Power companies could monitor electricity usage remotely and take certain users off the grid in exchange for lower rates.

These two trends culminate in the third, which is the increased integration of the Internet into our physical world. At its base, the Internet extends the reach of whatever information is put into it. When combined with wireless technology, this reach can become pervasive. The information web has essentially six components; sensors to input data (such as a keyboard or video camera), a power source, transmission routes, processing software to manipulate data, storage, and an output device. Continued advances in the miniaturization, quality, and cost of each of these components will make it easier to collect more data, analyze it more carefully, transmit it more widely, and do more with it.

What will this mean? Perhaps clothing embedded with microscopic sensors that read our vital signs and transmit anomalous data to our doctors. Perhaps implanted chips that contain all of our children's health and educational records, that notify us of their location at all times, and that detect the use of any illegal drugs. Perhaps the ability to call up any person, anywhere, at any time and transmit to them not only our own voice but also any sounds and videos we wish to share. Perhaps a car that knows when it has been stolen and automatically transmits video of the driver and its current location to the nearest police station. One of the prerequisites for these technologies is the widespread availability of broadband connections with open access requirements.

Although the government's role in convergence among consumer devices is small compared to its role in ensuring competition among providers of communications and broadband service, development of the former depends heavily on the cost and availability of the latter. And it is the former that offers the manufacturing sector its best opportunity in several years to develop a wide range of new high-value products. Some products will resemble the refrigerators, sports equipment, and cars of today except for their ability to gather, analyze and use information. Others will be totally new, addressing previously unmet needs. Besides generating new markets, these products ultimately offer dramatic increases in important social measures such as personal lifestyle, health, energy conservation, and public safety.

Convergence as a Driver of Industry Consolidation

Each type of convergence has driven a wave of mergers between companies. These mergers have crossed industry and even sector boundaries. Each has been driven by at least one of three main goals.

The first goal is the desire to obtain the critical size needed to compete on a national and even international scale. Increasingly these technologies are characterized by large economies of scale, meaning that the average production cost per unit declines with the amount of units produced. Network effects have also been significant: the worth of any company's network increases more than proportionately to the number of people on it. In addition, companies are increasingly called upon to invest billions of dollars in new technology and infrastructure in order to offer consumers competitive services. There is

a widespread feeling that the necessary critical size is increasing and that smaller companies will be unable to offer the full array of services that consumers will want.

Second, the convergence of different industries and technologies has made it necessary for companies to offer an integrated set of products and services. The need to develop expertise or a presence in a number of different fields such as video transmission, message switching, and electronic circuitry has led companies to merge or enter into formal alliances, rather than to try to acquire the capabilities on their own. This is particularly prevalent in the information technology sector. Consolidation is also seen as a way to reduce business risk by establishing a presence in many technologies rather than relying on just one or two.

Mergers across industries allow companies to gain expertise in a number of technologies that impact the information network and to offer consumers a broader range of products. For example, providers of broadband service increasingly want to offer customers the full range of voice, video and data services in order to increase their profit margins and decrease customer churn. Doing so offers certain advantages for the customer as well since only one bill and one set of equipment is needed. Similarly, electronic companies are under pressure to find the right mix of functions to include in phones, personal digital assistants, cameras, content players, and computers.

The third driver of industry mergers stems from the economics of the new information age. In this age, the various communication routes into the home are likely to appear more and more as undifferentiated parts of the information infrastructure and be priced accordingly. Many aspects of these networks such as the large fixed costs, low marginal costs of connecting a subscriber once the capacity to do so has been built, and the fact that the network becomes more valuable as more individuals join it, make it unlikely that communications providers will command high margins just by offering basic connections. This is especially true if the FCC is vigilant in ensuring that companies provide open access to all lawful Internet content.

As happened in the computer and electronics industries, value is likely to migrate to content providers. Many of today's mergers and partnerships stem from a joint desire of content providers to ensure an outlet for their products and of communications providers to offer unique and valuable content to their viewers. At this point there is little reason to fear that private markets will not work well in ensuring that consumers receive a wide range of content and choices. It is interesting to note for example that the National Association of Broadcasters, which for years justified the franchises of its members partly on the claim that they provided the only local content available, is now fearful that satellite radio will provide similar programming. Apparently even national content providers are discovering the benefits of loyal consumers and local advertising.

Congress and the regulators need to acknowledge the economic and business realities driving these mergers. Otherwise, companies will be prevented from finding the most efficient business models. At the same time, they need to ensure that each consumer has several viable sources of connection and content and that within the new, more broadly

defined market competition remains strong. This competition will often not take the form of lower prices, instead focusing on better service, newer applications, and more interesting content. But that is an acceptable market choice. For those concerned about the effect on competition history offers one useful lesson: most of these mergers are unlikely to meet their financial goals. Most companies find that establishing a competitive presence in markets outside their core competencies and achieving synergies is more difficult than they thought. Many of the entertainment mergers that occurred in the past two decades turned out to be unwise and some were later unwound after large losses by the acquiring company. While consolidation and mergers may be necessary to discover the best business models, the fear of corporate dominance is often overstated.

Conclusion

Convergence in the communications sector is occurring in a variety of ways; between communications and computers, between industries that offer separate solutions to the last mile problem, and between consumer industries offering products that combine several functions. Each of these is driving companies to merge both within and across industries and even sectors. Whether these mergers prove wise is still an open question.

Congress is widely expected to address the underlying communications law this Congress. In doing so, it should be careful to ensure that statutes and regulations address only those issues where there is a clear public interest. Since the best industry structure and technology is likely to change significantly over the next 20 years, the new legal framework should be highly malleable. The main goal should be to increase consumer welfare and stimulate competition and innovation, rather than to protect incumbent companies. It should give the FCC clear guidance about what social goals, such as universal service and competition, to achieve and also ensure that the FCC accomplishes these goals in the least intrusive manner.

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