

Cybernetworks and  
Telecommunications  
Carriers

by J. Gregory Sweeney

Do not quote without the permission of the author.  
©1996 Columbia Institute for Tele-Information

Columbia Institute for Tele-Information  
Graduate School of Business  
Columbia University  
809 Uris Hall  
New York, NY 10027  
(212)854-4222

**CYBERNETWORKS AND  
TELECOMMUNICATIONS  
CARRIERS**

**By: J. Gregory Sweeney**

**AT&T**

## Introduction

When assessing the potential impacts of the emerging Internet on the businesses of the traditional telecommunications industry, it is important to put this discussion in the overall context of the evolving National Information Infrastructure/Global Information Infrastructure or NII/GII. The general press commonly refers to the NII as the "Information Superhighway" and many people believe that the "Information Superhighway" is only the Internet. The Internet is a fast growing component of communication networks that are part of the NII/GII, to understand its future one needs to understand the future of the NII/GII.

The future of the NII is closely aligned with AT&T's Mission and Strategic Direction; The future NII envisions an information environment that allows people, information resources, and information appliances, e.g., PCs and telecommunications devices, to connect and communicate with each other anytime and anywhere via a myriad of communications networks. These components of the NII encompass the entire information industry value chain. This emerging NII vision is identical to AT&T's vision of the information revolution, and AT&T's associated business mission and strategy. This is not coincidental since our mission and strategy span all sectors of the information industry value chain, and since AT&T has led and significantly influenced the NII vision and policy.

The NII exists today, but continues to evolve rapidly, led by industry and fueled by competition and technology. Industry is advancing and rapidly evolving the NII, driven by competition in almost all sectors of the industry value chain, combined with breakthrough innovation and ongoing advances in the underlying technologies. This is particularly significant in communications and computing technologies because of digitization, which is enabling voice, data, text, image, video, and multimedia to be generated, processed, transmitted, stored, and received in a common format or language.

Information-related markets are converging at a rapid rate. Common product and service platforms are now supporting multiple functions. This is being driven by technology and the digital revolution. The ability to represent all types of information (voice, data, video, etc.) as a stream of 0s and 1s is driving convergence in each of the three industry sectors: information appliances, communications networks and information resources. For example, a single information appliance in the home could be a television, telephone and computer terminal; a single communications network could transport voice, data, and video (ATM); a single information resource could create, distribute and store information content. Convergence is driving corporate relationships both within (AT&T/McCaw/DIRECTV, Sprint/TCI, US West/Time Warner) and across (Viacom/NYNEX, Disney/ABC, Microsoft/NBC) the industry sectors. Technological evolution and convergence represent a significant national opportunity in that they support the advancement and development of the NII, particularly multimedia

capabilities. These in turn can enable applications that provide new and innovative solutions to some traditional needs and problem areas e.g., education and healthcare.

Technological evolution and convergence represent a significant national opportunity, and this is recognized by governments and they are interested in assisting industry in whatever way possible to ensure they are capitalized on. However, this opportunity may be lost. Since government laws, regulations, and practices may not be able to keep pace with technology evolution, this may have the potential to slow or distort normal market development. Governments at all levels, both in the U.S. and throughout the world, are concerned and are addressing the policy issues associated with this technology-driven infrastructure evolution. The umbrella concepts being used to facilitate discussion and resolution of these laws, regulations, and practices impacting market development are the NII and GII. Each country has its own NII; the GII is the interconnection of the many NII's of the world.

The NII represents a high-priority policy initiative for the current U.S. Government. The NII has been and continues to be championed by Vice President Gore. The Vice President, supported by the Administration, has put the NII on the "radar screen": of many political and industry leaders. Speaker of the House Gingrich is very engaged in the NII debate and believes its evolution is key to optimizing the benefit of the Third Wave Information Revolution. Congress, through its Telecommunications Act

of 1996, has removed the traditional barriers between industries to unleash the potential of broadened competition.

Understanding this background is critical in trying to define a future landscape for the Internet and its place in the NII. Currently, many of the rules, regulations and practices surrounding the Internet and traditional communications networks will significantly change; potentially altering the evolution of the Internet and traditional communications networks. It is clear that the current regulatory framework will soon become obsolete with its basic and enhanced dichotomies not applicable for the multimedia networks soon to be deployed extensively. These issues will be more fully explored later in this paper.

### CYBERNETWORKS AND COMPETITIVE DIMENSIONS

The Internet will increase competitive pressures on the entire industry, providing competition to all traditional communications network services including traditional carriers, wholesales and resellers. The most obvious and strongest current competitive threat deals with electronic messaging/electronic mail. Internet mail is one of the largest uses of the Internet and competes directly with services offered by other commercial providers. Electronic mail indirectly competes as a substitute product with facsimile and voice communications. This indirect competition will occur whether the Internet or other communications networks are utilized for transmitting this information. Data

transmission, particularly at lower bandwidth requirements could use the Internet as a substitute for the traditional data transmission networks offered commercially. Longer term as the infrastructure supporting the Internet evolves the potential for more real time communication uses for the Internet becomes possible. Voice over the Internet or packet telephony could offer a competitive alternative for some applications to the traditional public switched voice networks at some point in the future. Additionally the Internet will be able to support video teleconferencing which again could be a competitive alternative for some applications to other commercial network services offering similar functionality. As previously stated in this paper convergence and multimedia networks will happen across the industry allowing the Internet to compete with any current communications service.

The distinct, specific impacts between wholesalers, resellers, and traditional carriers may be more difficult to determine. However, competition will continue to be a driving force with market pressures increasing. This will reduce the opportunity for arbitrage a role often played by resellers. Although cybernetworks are adding to the competitive pressures they are hardly the only or even largest competitive pressure.

Lastly, are more esoteric behavioral impacts a virtual world may have on society at large. Many studies have been done in this area. Recently, there has been some

interesting research<sup>①</sup> done on current Internet users. Among the findings of the study is that Internet use most displaces TV viewing and telephone usage in the home.

### POTENTIAL IMPACTS OF CYBERNETWORKS

Today, competition and global opportunities dictate that businesses harness information to provide better products and services to their customers. The ability to support sales people, customers and internal departments is more dependent than ever on distributing information; and the vehicle for sharing that information has become 'the network'.

Local area, wide area and enterprise networks are becoming a strategic resource for corporations. As they rely more on enterprise networks, the reliability of those networks and the flexibility to dynamically modify networks is critical. At the same time, applications such as telemedicine and distance learning will require higher levels of bandwidth and greater network capacity.

Before industry can rely on the Internet for many traditionally provided by the switched telecommunications networks, significant changes will need to take place. The commercialization of the Internet will increase investment in the network leading to upgrades in network capacity and network functionality. The pressure from the business community for performance and reliability will be much greater than the traditional users from the academic community. Most corporate users today would find the occasional,

<sup>①</sup> "American Internet User Survey" by FIND/SVP



extremely poor performance from the Internet unacceptable. Although the Internet may be ready to carry non-critical, delay insensitive communications, such as electronic mail, one-way data transfers and occasional low-bandwidth LAN-generated traffic, it's not yet robust enough for high-bandwidth, two way real-time communications such as videoconferencing. Nor is it accepted as secure enough for transmitting sensitive data. Currently if the various communications networks applications for the Internet were compared to the existing solution many potential problems would be highlighted. For example, database access using dial-up connections or dedicated data links provided by traditional telecommunications carriers is secure and reliable, with the capability of handling high-bandwidth traffic. Using the Internet for database access may lead to security concerns and unpredictable performance. Future improvements to the Internet infrastructure by traditional telecommunications carriers could potentially offer performance guarantees and improved security mechanisms. File transfer over dial-up, dedicated or virtual data links provided by the telecommunications industry are timely and a secure method for delivery of internal corporate data. Using the Internet for the same application may present issues of limited security and unpredictable transmission times. Over time, improvements will be made to allow faster transmission rates and additional security schemes and data encryption techniques will be developed to protect sensitive data. Perhaps, many feel the biggest long term potential impact to the traditional telecommunications carriers will be in their core voice telephony business. This impact could be felt across business, government and residential market segments for today's standard local and long distances service. The public switched telephone

network is highly reliable, secure and ubiquitous. The dialing schemes permit instant access to any other telephone. By contrast voice telephony over the Internet has mostly poor quality and security. The number of end points is severely limited to those who have multimedia PCs and the calls must be arranged in advance. Many of these limitations could be addressed; for example, enhanced data compression schemes would increase voice quality, and protocol schemes that utilize prioritization techniques could identify and deliver real-time packets. Furthermore, gateways in the network could convert packetized voice to pulse code modulated voice as a call traverses the Internet to the public switched network. This would greatly expand the number of endpoints, essentially allowing anyone with a multimedia PC to place a voice call to any telephone. However, a very large portion of the cost advantage Internet Telephony has over long distance and international long distance comes from artificially high access charges and international settlement rates interexchange carriers now pay to complete their calls. This issue will be further explored in the next section dealing with the effects of the Internet on traditional telecommunications.

Today the Internet may serve as an alternative or substitute for intermittent or slow speed connections. From a corporate network perspective, the Internet provides an effective way to link a few geographically remote locations with low bandwidth requirements. The commercialization of the Internet will lead to improved quality and maintenance as well as new billing systems. The traditional telecommunications carriers in many cases will lead the charge in the deployment of cybernetworks, improving quality and security,

and bringing their customers to this new medium. Ultimately this will lead to greater price competition and margin pressures.

### EFFECTS OF CYBERNETWORKS

In order to understand the effects of cybernetworks on private networks in particular and communications in general it is important to understand the trends in the marketplace which is ultimately driving the deployment of technology.

In order to survive in the competitive and global marketplace, businesses, large and small, with a local, state or national presence are pursuing a strategy of focusing on and growing their core businesses. Business growth is leading to increased decentralization within the firm. In this growth mode, in order to improve customer service, reduce expenses, and shorten customer-supplier processes, e.g., order, delivery etc., businesses are decentralizing by establishing or expanding the number of branch locations, by placing sales or service reps closer to the customer, in many cases even placing them on the customers' premises. These trends will drive an increased need for electronic communications and information exchange.

As they grow, businesses recognize the strategic advantage of electronically bonding with their suppliers and customers. Businesses understand the strategic advantage of being closer to their suppliers and customers in both a physical and virtual sense.

Achieving this strategic advantage in the virtual sense involves electronically bonding to both suppliers and customers. Also, global markets drive geographically broader and more flexible sourcing, sales, and distribution processes which can best be supported in an electronic environment. These new customer-supplier relationships lead to the business need of workgroup collaboration when business functions are decentralized; this includes virtual meetings to save travel time and expenses. Businesses also want to automate sales and keep customers and suppliers current on each others' needs. Order entry, billing, and invoicing between suppliers and customers via networked computers and databases form a customer-supplier information technology relationship which creates a barrier to terminating business relationships. Finally, businesses want to enable rapid information distribution and distributed data processing for their employees and partners.

When projecting the effect of cybernetworks on private networks, again the needs of business are the real driver. As security and performance concerns are solved, companies will move gradually from private networks to virtual private networks.

There is an obvious tie between the business and work-at-home markets. This work-at-home environment will be a major "top-down" force which drives at-home NII needs and resultant at-home product or service capabilities which will then also be used for consumer applications. Firms are actively encouraging their employees to telecommute one or two days a week. These trends require a similar environment in the home as in

the office to conduct business, i.e., similar information appliances and information access. In many cases, it is desirable to create a virtual presence at home on the Local Area Network (LAN) used in the office. In addition to telecommuting, a new generation of entrepreneurs is starting businesses in which the home is the main and only office. The downsizing in Corporate America is also creating a sector of independent contractors and consultants who work out of their home. Lastly, many retired people are "plugging-in" to the information superhighway from their homes, as a way to conduct part-time business. This trend of occasionally working out of the home or establishing a business headquartered in the home replicates the business needs previously discussed, namely, the need to tie people together with their customers and suppliers and with the information needed to conduct business.

This top-down phenomenon of business needs driving "consumer" needs can be seen historically: PCs and fax machines found their way into the home because of people needing to stay in touch with their customers and suppliers or do business internationally taking into account time zone differences. Once in the home, they were put to use for a wide variety of consumer applications.

But business needs are not the sole factor driving what consumers want in their homes. A variety of "bottoms-up" forces are also at play. In their complex world, people want to simplify their lives as much as possible. Products and services that support home banking, home shopping, continuing education, interaction with government, etc., that

are simple and easy to use (user-friendly), and most importantly are cost effective, will find their way into the home environment.

In the final analysis, however, the key "bottoms-up" factor driving consumers' willingness-to-pay for new home products and services will probably be entertainment. People want to relax and entertain themselves in their home. Video-on-demand or near video-on-demand, PC applications that entertain their children, High Definition TV (HDTV), etc., could provide the bottoms-up push to drive new infrastructures and "pay-the-way" for the other applications previously discussed.

Understanding the market needs shows the tremendous pressures on countries with monopolies providing service. The Internet will provide another force to pressure liberalization and to drive international settlement rates down. Technology coupled with the needs of the marketplace will break down the walls of monopoly markets.

Governments will not be able to prevent this outcome, however, they could distort or slow the process putting their citizens and industry at a disadvantage in the global marketplace.

There also is pressure on the existing regulatory frameworks. As discussed earlier the phenomena of convergence is creating multimedia networks and voice over the Internet is illustrative of this phenomena. Existing laws, regulations and practices may not be able to keep pace and could hinder the deployment of these new capabilities.

Voice services with virtually no access costs are emerging due to technological innovation coupled with imperfect traditional regulation. Currently, Internet access providers are categorized as information/enhanced service providers (ESPs) and therefore are exempt from paying access charges. This situation was mandated by the FCC to encourage the growth of the information industry. Recently, the Internet Phone, a product which allows voice telephony over the data communications facilities usually associated with ESPs, was developed and introduced to Internet users. With the Internet Phone, the ESP acts effectively as an interexchange carrier and enables voice communication. This innovation in the use of packet telephony and the FCC's policy allowing ESPs to avoid access charges (which will give the ESP a competitive advantage over interexchange carriers) raises questions about the ability or desirability of sustaining the current access cost rules in the long term.

Additionally, it may not be practically possible to extend access charges only to the telephony portion of an ESP's service. For example, if a customer uses an ESP for both data information and voice telephony in one session, it would be very difficult (if not impossible) to distinguish the telephony portion of the session, which would incur access charges, from the non-telephony portion, which is exempt from access charges.

Clearly, all communications providers that require access should be charged the equivalent, underlying cost in a neutral and unbiased manner. This will eliminate the

need to measure voice traffic over a data network. However, today's access prices (4 cents per minute) are much higher than cost (.2 - .5 cents per minute) primarily because of their monopoly supply and subsidization support for universal service. AT&T believes that this traditional way of funding universal service is incompatible with the development of competition in the local exchange. Access charges should be viewed and priced as the true unbundled economic cost of local connectivity. The only cost a local access provider should charge would be the economic cost of interconnection to their network which should be independent of regulatory boundaries (local or toll call) and content (e.g., voice vs. data). This will foster local exchange competition, which itself will further ensure access charges are driven to their economic cost. ESPs should incur the economic cost of access at that point in time when access charge reform results in access prices being driven to cost.

The Internet therefore will be a catalyst for change that in many cases would have been inevitable. However, the Internet model of openness, ubiquitous connectivity and highly interactive nature where all information consumers can also become information producers, will have a multitude of impacts on telecommunications. It will force traditional telecommunications carriers to offer more value added services in order to provide incremental value. There may be significant advantages as well, to some traditional telecommunications carriers who may benefit from changes in the regulatory environment domestically and internationally. In this case, the Internet might indeed be



a stimulus for access charge reform and international liberalization of telecommunications markets.

Many newcomers to the Internet may feel speed (current maximum of 28.8 kilobits per second) is the biggest drawback. Downloading video and graphic files at today's modem speeds can be a frustrating experience. The facilities-based local exchange company owning the so called "last mile" of the NII has been and will be the bottleneck to higher speed access, until real competition develops in the local exchange. Currently, every Internet Access Provider is dependent on the local exchange company for bandwidth.

The local exchange company, historically a franchised monopoly is characterized by slow adoption of new technologies and limited innovation. The only solution to this problem is real competition in the local exchange. For this to occur proper conditions must exist in the local exchange to ensure competition, legal and practical barriers must be removed, and the incumbent facilities-based local exchange company must not exploit its monopoly stranglehold on its market. Many of the provisions of the Telecommunications Act of 1996 are structured to prevent such an outcome. However, this will require close monitoring by the FCC and other governmental agencies to ensure the emergence of true competition in the local exchange. By contrast, the facilities-based interexchange carriers are highly competitive and in most cases their facilities will meet the demands of cybernetworks. Additionally, due to the nature of their very competitive markets, these companies are very innovative and search for growth opportunities has led the facilities-based interexchange carriers to significantly upgrade their networks to

higher speed digital platforms and to use their infrastructure to provide backbone networks for the Internet. This experience should position them well for the emerging world of cybernetworks.

### AN ONLINE STRATEGY

Many traditional telecommunications carriers will embrace the Internet, and look to combine their Internet offers with their traditional service offers, creating one stop shopping for the consumer. The remainder of this section will broadly outline AT&T's strategy in the era of cybernetworks.

In AT&T's vision of electronic networking, people will be able to choose from a wide variety of multimedia applications offered through diverse networking environments. Communications and applications will move easily across a spectrum of networks, both wired and wireless, ranging from the most closed private networks through public networks to the fully open Internet.

AT&T will make the Internet as universally accessible and as easy to use as telephone service is today. AT&T will make the Internet as useful for commerce as 800-services are today. Just as universal telephone service was a promise at the beginning of this century, the promise today is universal connectivity to people, information and services in the Internet model. AT&T's online strategy is to introduce the Internet to a wider

audience, one that over time will approximate the size of the telephony market. AT&T online networking will bring together a more diversified group of information seekers and content providers, of buyers and sellers and create a safe environment to exchange information and transactions.

The online industry is beginning to run on a model which parallels the publishing industry in which owning or running paper mills, printing presses or delivery trucks are not required to produce a magazine.

AT&T believes that by the year 2000, components which go into producing an online service will exist as three separate businesses; an access industry, a hosting and transaction services industry similar to an expanded service bureau industry, and a content aggregation industry.

The access business is the first to separate clearly from the hosting and content applications services as witnessed by the latest efforts of key players such as America Online, Prodigy, CompuServe, IBM and even Microsoft.

Web hosting businesses are making it unnecessary for content providers and applications owners to own or operate servers. Nor do they need to provide an access network to allow people to receive their content when it can be easily reached via the Internet.

Content providers, in turn, will take advantage of the services offered by the access and hosting businesses to avoid the complexity of setting up and managing their own networks.

AT&T is creating three separate businesses - access, hosting and content services, each designed to give customers the best possible and most comprehensive set of option. Each service will be offered separately but can also be bundled with one or two of the other services. The technical interfaces between the three businesses will be Internet compatible, allowing for total flexibility.

AT&T expects that a very close relationship will develop between traditional telephony services and access to online services. We expect families and businesses will select a single access provider the way they chose a single telephone carrier. AT&T will offer access to the Internet as yet another communications option to its existing and new customers. Based on delivering the easiest and broadest possible access, we will become the provider of choice for Internet access.

In the business market, almost 80% of MIS managers surveyed are looking to their long distance company as the provider for Internet access.

AT&T's value added Internet access services will be designed for both consumer and business customers, for dial-up and dedicated connections.

The AT&T Internet services will take an open approach. Users will be able to access content services provided by other access companies as well as AT&T-hosted or AT&T-provided content services, content services running on the content owner's premises or content residing on merchants' online premises.

What's more, AT&T will provide access to the Internet that will look the same whether users are sitting at work and connecting through the business LAN, at home connecting with a dial-up line or on the road using a wireless connection.

AT&T's applications and transactions business is a hosting service which will help organizations extend their marketing reach to more customers and build new commercial relationships in an electronic environment. AT&T will create a safe environment for electronic commerce by providing end-to-end applications and handling capabilities that will be accessible to any Internet user. The service will offer hosting platform choices ranging from proprietary service to World Wide Web Servers and special tools for dealing with the platforms.

AT&T will change the success metric for electronic commerce on the Internet from the number of hits to a merchant's home page to the number of sales the merchant attributes directly to its presence on the Internet.

AT&T's enhanced hosting services will offer a secure, scalable turnkey solution. The services will provide billing and settlement mechanisms, collect customer information, make order tracking possible and offer high quality customer care. We will offer authoring tools to provide author once and publish many capabilities as well as special tools to create and manage enhanced Web Sites. The hosting services will be packaged with AT&T's existing electronic commerce services such as 800-services and call centers. Collectively, AT&T's electronic commerce offerings will enable lower costs of marketing, sales, customer service and fulfillment for our business customers. Merchants will expand the communications they have with their customers in new ways and will be able to continually update and tailor their catalogues quickly and easily.

As AT&T makes the Internet easier to access and easier to use, we will attract new users which in turn will attract new content providers. The AT&T customer base of consumers and businesses represents the kind of critical mass required to motivate general interest content providers to go online.

AT&T's content services will create information services tailored to the needs of communities in both business and consumer markets. In partnership with independent content providers wishing to reach these markets, AT&T will match compelling content sets to the needs of its key customer segments in ways that foster active user communities and vibrant commercial marketplaces.

AT&T will focus on aggregating content rather than creating it. We will define key areas of interest built on our broad customer base and work with content providers to create markets that match individuals' lifestyles, professional interests and business needs. We believe that a diversified approach to content will encourage new and expanded Internet demographics. We will develop communities of interest around diversified content. And, generally we will make it easier for new content providers and users to find each other.

In conclusion AT&T will market its various services under the following names; AT&T WorldNet<sup>sm</sup> service for Internet Access, AT&T EasyCommerce for Hosting and Transactions and AT&T New Media Services for business content aggregation and AT&T Personal Online services for consumer content aggregation. This will allow AT&T to meet the needs of the various market segments in the era of cybernetworks.