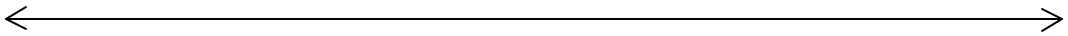


BROADBAND

TODAY

A STAFF REPORT TO

WILLIAM E. KENNARD, CHAIRMAN
FEDERAL COMMUNICATIONS COMMISSION

ON INDUSTRY MONITORING SESSIONS
CONVENED BY CABLE SERVICES BUREAU

DEBORAH A. LATHEN
BUREAU CHIEF
CABLE SERVICES BUREAU

OCTOBER 1999

TABLE OF CONTENTS

The Blind Man and the Elephant

It was six wise men of Indostan
To learning much inclined,
Who went to see the Elephant – (though all of them were blind),
That each by observation—might satisfy his mind.

The First approached the Elephant,
And happening to fall
Against his broad and sturdy side—At once began to bawl:
"God bless me! But the Elephant—Is very like a wall!

The Second, feeling of the tusk,
Cried, "Ho! What have we here?
So very round and smooth and sharp – To me 'tis mighty clear
This wonder of an Elephant – Is very like a spear.

The Third approached the animal,
And happening to take
The squirming trunk within his hands, -- Thus boldly up and spake:
"I see," quote he, "the Elephant—Is very like a snake!"

The Fifth who chanced to touch the ear,
Said: "Even the blindest man
Can tell what this resembles most; -- Deny the fact who can,
This marvel of an Elephant – Is very like a fan!"

The Sixth no sooner had begun
About the beast to grope,
Than seizing on the swinging tail –That fell within his scope,
"I see", said he, "the Elephant – Is very like a rope!

And so these men of Indostan
Disputed loud and long,
Each in his own opinion –Exceeding stiff and strong
Though each was partly in the right –And all were in the wrong!

--John Godfrey Saxe

FOREWORD

In May and July 1999, at the request of Chairman Kennard, the Cable Services Bureau, with the participation of the Common Carrier Bureau, the Office of Plans and Policy, and the Office of Engineering and Technology, convened a series of Monitoring Sessions on the state of the broadband industry. The goal of these Sessions was threefold: (1) to establish an ongoing dialogue with the major stakeholders involved in the provision and delivery of broadband services to American consumers; (2) to obtain a comprehensive perspective on the status of the residential broadband industry; and (3) to receive perspectives on the Commission's regulatory policy options.

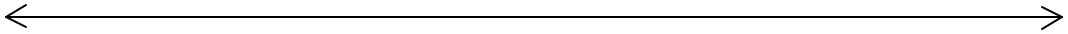
We invited a distinguished and diverse group of experts, including representatives from Internet service providers (ISPs), online service providers (OSPs), local exchange carriers (LECs), long distance telephone companies (IXCs), community organizations, financial analysts, academics and local franchising authorities (LFAs). We asked these participants to engage in candid, not-for-attribution discussion of the major issues and challenges facing consumers, the industry, regulators and policymakers with respect to the deployment of broadband services.

The following Report contains our summary and analyses of those Monitoring Sessions, in addition to a current survey of the issues, technological developments and market trends that have become integral to the broadband debate.

We have learned a great deal about the state of the broadband industry as a result of those sessions. We have discovered that broadband is an awesome, yet largely inchoate, technology that will bring the Internet and advanced services to millions of Americans. We have learned that the Commission's longstanding de-regulatory policy toward enhanced services, generally, and broadband services, particularly, has contributed to the Internet's phenomenal growth. And we have learned that there is yet much to learn.

We have learned that not even the experts are any more "sighted" at this early stage of the rapidly evolving broadband industry than the wise men of Indostan referred to at the beginning of this Report. While it is clear that broadband will play an important role in the lives of most Americans, it is not clear whether current systems will maintain their same positions in the broadband industry, or whether new, and as yet undiscovered systems will dominate the market in the long term. The splintered and divergent views expressed by the experts in our Monitoring Sessions demonstrate the difficulty in arriving at these conclusions.

Although this Report endeavors to capture the sense of where things are now, we recognize that the rapid pace of technological development and a dynamic and competitive market will require our monitoring efforts to continue. Thus, we anticipate holding future Monitoring Sessions with other sectors of the broadband industry,



including e-commerce and Internet companies, to ascertain their views on the relevant issues.

We acknowledge and appreciate the cooperation and expert assistance of the Directors and staff of the Office of Plans and Policy, the Office of Engineering and Technology, and the Chief and staff of the Common Carrier Bureau, without which we would not have been able to prepare this Report.*

Deborah A. Lathen
Bureau Chief
Cable Services Bureau

Executive Summary

This Report summarizes the results of two sets of Monitoring Sessions conducted by the Cable Services Bureau on recent developments, major issues, and the current state of the broadband industry.

At the outset, the Monitoring Sessions had two principal objectives:

(1) To ascertain a better understanding of the broadband industry since the filing of the Section 706 Report; and
(2) To answer the question: Should the government require cable companies to provide access to their plant by unaffiliated Internet and online service providers?

Part I examines the principal issues, parties and arguments in the open access debate. This part traces the roots of the open access issue as discussed in the FCC's first Section 706 Report to Congress, the Commission's Memorandum and Order on the AT&T/TCI License Transfer, and the Commission's "friend of the court" brief in *AT&T v. City of Portland*. This part also discusses recent developments in legal, legislative and regulatory proceedings, particularly actions by municipalities.

Part II outlines the definition of broadband as defined in Section 706 of the Telecommunications Act of 1996 and provides an in-depth technical discussion of broadband service and technology.

Part III discusses the broadband industry at large and provides a snapshot of the state of cable modem, digital subscriber line (DSL), fixed wireless, and satellite technologies for the provision of Internet services. It also details the schedules and projections for deployment of these technologies.

Part IV details the preliminary findings reached in the Monitoring Sessions convened by the Bureau. This part also lists the participants (by category) and summarizes the questions posed to the participants and their responses.

Part V contains the conclusions reached as a result of the Report, particularly whether the government, at this time, should mandate that cable operators provide access by unaffiliated Internet service and on-line service providers to the cable platform.

I. Broadband: The Debate Over Access

A. The Debate Defined

Broadband refers to technology that will allow users to access the Internet and Internet-related services at speeds significantly higher than traditional narrowband modems allow. Currently, many Americans who use the Internet do so at speeds of less than 56kbps. Broadband technology allows users to access the Internet at speeds that range from fifty to several hundred times faster. This increased speed will provide consumers with a range of enhanced services, including streaming video and telephony services. Analysts predict that broadband technologies will produce applications that will change the way consumers communicate, shop, educate and entertain. By year's end, analysts predict that approximately two million Americans will have access to broadband technology. By 2008, that number is predicted to reach 78 million.[1]

Cable operators have begun to offer broadband services to consumers in various localities through cable modems. When a consumer signs up for cable modem service, the cable operator will usually provide Internet access through a wholly or partially owned or affiliated ISP. For instance, a consumer who signs up for broadband cable services from AT&T will receive Internet service from Excite@Home. A consumer who signs up for broadband cable services from Time Warner will receive Internet service from RoadRunner. When these cable modem subscriber accesses the Internet through the cable line, the first Web page they will see displayed is Excite@Home or RoadRunner, unless the subscriber reconfigures his or her Internet access device to go through a different ISP.

ISPs that are not affiliated with cable operators are attempting to obtain direct access to cable broadband platforms that would enable consumers to access the Internet directly through their service, thereby bypassing the services of Excite@Home and RoadRunner. Currently, there is no national regulation that would force cable operators to allow this access. Local franchising authorities, who have the power to grant cable franchises and approve the transfers of cable franchises in their localities, have begun to require cable companies to "open up" or provide "open access" to their broadband platforms for competing ISPs as a condition for the approval of franchise transfers. Thus, as cable company consolidation increases and as cable franchises come up for renewal, this issue will become more pronounced.

At the same time, cable broadband rollout has spurred the deployment of digital subscriber lines (DSL), the telephone platform for broadband services. Currently, the number of DSL subscribers is significantly behind the number of cable broadband subscribers. The rollout of DSL and other broadband technologies, such as wireless, satellite, however, is accelerating to close the gap.

Broadband access is among the most compelling issues in the communications industry today. Important regulatory and legal decisions affecting how Americans receive high speed Internet access, voice, video and data services —whether through cable modem, DSL, wireless, or satellite—can affect the fates of many companies involved in the development and deployment of broadband services. In addition, billions of dollars in revenue and investment are at stake. As a growing number of franchising authorities consider franchise license transfers and legislative proposals to mandate access to the cable broadband platform for competing ISPs, cable companies, telephone carriers and Internet service providers will continue to lobby local governments to regulate or refrain from regulating access to the systems providing broadband services.

The Issue

It is in this environment that the debate over broadband access is occurring. With enormous potential revenue streams and unique opportunities at stake, the debate over broadband access has been characterized by strong lobbying efforts and media strategies designed to define the debate in terms of "open access" or, for those opposed to regulation, "forced access." At the heart of the debate is how competing Internet service and content companies will utilize the infrastructure of broadband systems. The debate gives rise to a host of policy issues for federal, state and local policymakers that revolves around one central question: Would government intervention and regulation help or hinder the deployment of broadband services for consumers?

The Parties

Proponents of mandated "open access" include:

- Many, but not all, independent ISPs
- Local telephone companies
- Consumer advocacy groups, including the Media Access Project and the Consumer Federation of America
- Some local governments, including the City of Portland and Broward County, Florida

Opponents of mandated "open access" include:

- Some ISPs
- Cable operators and their affiliated ISPs
- Consumer advocacy groups, including NetAction

Arguments For Mandated Open Access

Supporters of "open access" argue that a closed broadband network threatens consumer choice and the open nature of the Internet. Specifically, they posit that a broadband system without a policy of nondiscriminatory access to any ISP that is willing to invest in the network threatens the open nature of the Internet. They believe that without access requirements, consumers will be faced with a choice between broadband services and the freedom of movement and content that characterizes the Internet. Open access supporters claim that this will lead to less competition, higher prices, and less innovation.

Among the supporters of "open access" are coalitions of ISPs, led by America Online (AOL), MindSpring Enterprises (MindSpring) and other ISP companies. ISP advocates are concerned that the owners of a closed networks will be able to exercise control over the content and navigational services that the Internet offers. They also claim that cable broadband is the only feasible option for the delivery of broadband services at this point in time. Local telephone companies also support an open access policy. Their arguments are based on regulatory parity, which argues that since the phone companies are mandated to provide open systems, the cable companies should be required to as well.

Arguments Against Mandated Open Access

Opponents of mandated open access, led in part by cable interests, argue that any regulation of the Internet will stifle deployment and competition. Mergers and acquisitions have resulted in a consolidated cable industry. With the acquisition of Telecommunications Inc. (TCI), AT&T became the largest U.S. cable operator, followed by Time-Warner Cable (Time-Warner), MediaOne, Cox Communications Inc. (Cox), and Cablevision Systems Corporation (Cablevision). As technologies converge, many of these operators are engaged in efforts to provide services not traditionally offered by cable. Specifically, these operators are attempting to enter the local telephone market in order to provide telephony services over their cable systems. Additionally, many of these operators are upgrading their networks in order to provide broadband technologies to allow Internet access over cable systems.

These interests are largely opposed to a mandated access requirement. They argue that the market in which they compete should guide their corporate policy, not government regulation. One tangent of these arguments relates to the costs that cable operators have incurred in upgrading their systems. They argue that they should be allowed to reap the benefits of these investments, and that supporters of an "open access" policy should not be allowed to share market rewards they have not earned. AT&T has also claimed that their system is not technologically capable of supporting a large number of competing Internet service providers.

B. Roots of the Debate

The First 706 Report

On January 28, 1999 the Commission adopted the first report to Congress on the deployment of advanced telecommunications capability (Section 706 Report).[2] The Commission based its findings on comments submitted by interested parties, as well as research conducted by Commission staff.

In the report, the Commission concluded that, at present, the deployment of advanced services capability in comparison to other technologies appears to be proceeding in a timely and reasonable manner. The report states that "deployment of broadband, both backbone and last mile, is occurring on a major scale, for both business and consumer markets."[3] The Commission's research demonstrated that "although the consumer market is in the early stages of development, we see the potential for this market to accommodate different technologies such as DSL, cable modems, utility fiber to the home, satellite and terrestrial radio." [4]

Additionally, the report found that while the consumer broadband industry is still in the development stage, multiple sources of broadband technology are now, or soon will be available to Americans. Thus, the report finds that there is "no reason to take action on this issue at this time. [The FCC] will, however, continue to monitor broadband deployment closely to see whether there are developments that could affect our goal of encouraging deployment of broadband capabilities pursuant to the requirements of Section 706." [5]

The AT&T/TCI Merger

In June 1998, AT&T and TCI announced their plan to merge in 1999, whereby TCI would become a wholly owned subsidiary of AT&T. AT&T/TCI provided @Home, a service that gives residential cable subscribers high-speed access to the Internet. A number of parties in the merger proceeding argued that, if approved, "AT&T-TCI (through @Home) will have a substantial head start in the provision of high-speed Internet access and could develop an insurmountable position as a monopoly provider (or duopoly provider together with LECs) of broadband Internet access services to residential customers."[6]

The Commission was not persuaded by this argument. While stating that the issue of broadband access was not merger specific, the Commission found that, although AT&T and TCI may be able to deploy these services more quickly than competitors at the present time, other firms such as telephone, satellite, electric utilities, and wireless providers were working towards the same goal using different technologies. The Commission found that the merger might expedite the goal of deployment of high-

speed Internet access services by allowing a quicker rollout of these technologies. The Commission reiterated the position taken in the Section 706 Report that there was no need for an "open access" requirement at this time, but the Commission "will monitor broadband deployment closely."[7] After carefully weighing the arguments offered by participants in the merger review process, the Commission concluded that the proposed merger would not deny broadband subscribers the ability to access the Internet content and portal of their choice.

AT&T/TCI v. City of Portland

Pursuant to TCI's cable franchise agreements with the City of Portland and the County of Multnomah, any changes of TCI's corporate control would have to be approved by the City and County. Thus, Portland and Multnomah County began proceedings to review the franchise transfer applications of AT&T and TCI. As required by law, TCI had to obtain approval from the FCC in order to transfer its licenses to AT&T. Thus, the FCC instituted a separate proceeding to determine whether the transfer of the licenses from TCI to AT&T served the public interest, convenience and necessity.

The Mt. Hood Regulatory Commission (Regulatory Commission), which advised the City and County on the request for franchise transfer, conducted a series of public hearings. In the course of those hearings, ISPs not affiliated with @Home claimed they could not compete with @Home's higher speed, low cost and widespread availability. The Regulatory Commission concluded, and recommended to the City and County, that @Home had no viable competitors in the local market for residential Internet access services and that AT&T's cable modem platform was an "essential facility" that could not exclude competitors without a legitimate business reason.

In December 1998, the City and County adopted the country's first mandatory access provision in the wake of the AT&T/TCI merger. AT&T rejected the mandatory access provision set forth by the City and County ordinance, and in January 1999, the City and County stated that AT&T's rejection resulted in a denial of its request for a change in control in the TCI franchises. AT&T sued the City and County alleging that the denial of the franchise transfer was unlawful. The principal issue was whether the City of Portland had the power to require access to the cable modem platform as a condition of approving TCI's franchise transfer to AT&T.

On June 3, 1999, the District Court ruled in favor of the City of Oregon and Multnomah County. AT&T appealed the decision to the Ninth Circuit Court of Appeals under an expedited appeal schedule. Oral arguments are scheduled for November 1999.

C. Recent Developments

In the wake of the Portland decision, local franchising authorities (LFAs) from Florida to California were confronted with intensive lobbying campaigns from proponents and opponents of mandated access provisions. To date, four LFAs have voted on mandated access proposals, with differing results: Portland, Oregon, Broward County, Florida, San Francisco, California, and Fairfax City, Virginia.

Broward County

On July 13, 1999, the Broward County Board of County Commissioners voted 4 to 3 to adopt a general ordinance requiring cable operators under Broward County's jurisdiction to provide unaffiliated ISPs nondiscriminatory access to the cable companies' broadband facilities. AT&T has appealed the decision. Cable operator Comcast Corporation (Comcast) filed suit against Broward County on July 20 in federal court challenging the authority of the county to impose new regulations.

San Francisco

The San Francisco Board of Supervisors reached a different result. On July 26, the Board approved the transfer of control of TCI to AT&T without mandating nondiscriminatory access. The Board did, however, establish a city policy of supporting nondiscriminatory access to broadband services, and directed the San Francisco City Attorney, the Department and Telecommunications and Information Services, and the Telecommunications Commission to take steps to implement that policy. Among those steps are directives to monitor developments at state and federal levels, and monitor market developments. The Board requested that the San Francisco City Attorney, the Department of Telecommunications and Information Services and the Telecommunications Commission file a report on developments by December 15, 1999. The City also filed a "friend of the court" brief in support of the Portland ordinance with the United States Court of Appeals for the Ninth Circuit.

City of Fairfax

On September 28, 1999, the Fairfax City Council of Fairfax, Virginia voted 4 to 2 to require Cox to provide access to its high speed Internet platform to non-affiliated ISPs. The requirement was a condition of approval of the transfer of the Media General Inc. franchise to Cox. Cox is discussing the situation with city officials.

Other Localities

While only four localities have conducted votes on the issue, other localities have seen an increase in broadband access activity. Numerous localities are conducting studies and hearings on the issue. On January 26, 1999, the City Council of Los Angeles adopted a resolution instructing its Information Technology Agency to develop a policy and implementation plan for open, nondiscriminatory access to cable architecture by Internet access providers. The Agency recommended that the City of Los Angeles should not order cable companies to unbundle content from access in the provision of cable modem services and that the city should not order cable companies to open their cable modem platforms to unaffiliated ISPs. Additionally, the Agency recommended that the City continue to monitor the market for broadband access services in the City over the next three years as the Agency enters into renewal negotiations with cable operators in order to gauge the necessity of imposing an open access provision in transfers or cable television franchises.

A public workshop on the issue also was held in September in Dade County, Florida. Additionally, proponents of mandated access have started petition drives to place mandated broadband access initiatives on the ballot in Colorado and Massachusetts.

Congressional Action

Thus far, Congress has not acted on the broadband issue. There are, however, several bills pending in the U.S. House of Representatives and in the U.S. Senate which address the cable access question. To date, no action has been taken in the relevant committees on these legislative proposals.

Federal Policy

Pursuant to the requirements of Section 706 of the Telecommunications Act of 1996[8] (1996 Act), the FCC has studied the deployment of broadband services and methods to promote the expeditious rollout of advanced services. Based on these studies, the Commission has adopted a policy of vigilant restraint, refraining from mandating "open access" at this time, while closely monitoring for anticompetitive developments that may require intervention. Additionally, the Commission is also actively promoting the development of many broadband competitors - - including wireless, satellite, cable, and telephone providers - - by limiting regulatory burdens, by making more spectrum available, and by making spectrum use more flexible. Competition from multiple broadband providers is seen as the best way to prevent a monopoly by one provider.

II. TECHNICAL BACKGROUND

Over the last two years, the term “broadband” has leapt from the pages of obscure technical journals into popular American lexicon. The rapid pace of technological achievement and the convergence of discrete industries have moved broadband to the top of consumer and regulatory agendas.

As more Americans access the Internet, they all want the same thing -- more information at faster speeds. The access providers need broader bandwidth capacity to meet this seemingly simple and basic demand and to provide multimedia applications involving two-way data, voice and video.

The increasing demand for broadband services has been fostered by the explosive growth of the Internet,[9] which has risen from 10 million users in 1995, to an estimated 150 million worldwide users in 1999. Indeed, this growing medium offers unlimited possibilities and multimedia applications to a worldwide network of online users.[10]

As such, the Internet is much more than a network of networks; it links people, communities, and nations together in ways previously unimagined. The potential to provide education, health care, employment, and training information, in addition to entertainment and data transmission, establishes the Internet as one of the principal media for societal transformation. Perhaps most significantly, the Internet has produced the booming economic model we have come to call e-commerce, which last year alone generated more than $300 billion in revenue.

Transmitting data, voice and video services at high speeds has become both a business and regulatory mandate, spurring an immense level of investment.
As will be described more fully below, cable operators, telephone companies, fixed wireless operators, and satellite providers, among others, have deployed, or are planning to deploy, a wide array of advanced services in response to, and in anticipation of, increasing consumer demand.

A. What is “Broadband?”

The 1996 Act itself does not define the term “broadband.” Instead, the 1996 Act refers to “broadband” as one of the characteristics of “advanced telecommunications capability.” “Advance telecommunications capability” is defined as "high-speed, switched, **broadband** telecommunications capability that enables users to originate and receive high-quality voice, data, graphics, and video telecommunications using any technology."[11] The term "advanced telecommunications capability" is defined without regard to any specific transmission media or technology.[12]

Section 706 of the 1996 Act instructs the Commission to:

> *regularly … initiate a notice of inquiry …[to] determine whether advanced telecommunications capability is being deployed to all Americans in a reasonable and timely fashion. If the Commission's determination is negative, it shall take immediate action to accelerate deployment of such capability by removing barriers to infrastructure investment and by promoting competition in the telecommunications market*.[13]

As Defined in the Section 706 Report

In response to the congressional mandate, the Commission initiated its first inquiry on the state of deployment of advanced telecommunications capability, and earlier this year filed with Congress the Section 706 Report on the Commission's findings. In the Section 706 Report, the Commission defines "broadband" as:

> *the capability of supporting, in both the provider-to-consumer (downstream) and the consumer-to-provider (upstream) directions, a speed (in technical terms, "bandwidth") in excess of 200 kilobits per second (kbps) in the last mile.* [14] *This rate is approximately four times faster than the Internet access received through a standard phone line at 56 kbps*.[15]

The Commission chose 200 kbps because "it is enough to provide the most popular forms of broadband -- to change web pages as fast as one can flip through the pages of a book and to transmit full-motion video." [16] Included in the definition are facilities that "have been upgraded or otherwise altered in ways that make them capable of broadband speeds. Thus, a non-broadband line, like a standard telephone line, that has been conditioned so that it is capable of more than 200 kbps would constitute broadband." [17]

The Definition of Broadband is Elastic and Does Not Include Content

The Section 706 Report also provides that: "broadband service does not include content [itself], but consists only of making available a communications path on which content may be transmitted and received."[18]

The Commission recognized that as technologies evolve, the concept of broadband also would evolve. Thus, the Section 706 Report provides the starting point for an elastic definition of "broadband."

We may consider today's "broadband" to be narrowband when tomorrow's technologies are deployed and consumer demand for higher bandwidth appears on a large scale. [19]

B. Cable Broadband[20]

Changing Architecture

Cable industry architecture is in the middle of a transformation from closed cable systems that feature one-way delivery of analog television signals to two-way, interactive broadband systems, involving a hybrid of traditional coaxial and modern fiber optic technologies. These new networks enable the cable industry to deliver a wide range of services, including digital television, Internet access, and telephony.

Historically, cable networks were constructed to provide only traditional video programming services that required only one-way transmission of signals. Until recently, the traditional one-way cable system provided approximately 50 channels of analog video. The network was a full coaxial system designed with a centralized "headend"[21] and lines called "trunks" leading from the headend to nodes placed in the residential neighborhoods. Distribution lines emanated from these nodes which carried the signals through the residential neighborhood. A coaxial wire called a "drop" line then carried the service from the distribution line to the customer's television set. The distribution and drop lines represent the cable industry's "last mile" of plant into the consumer's home. A traditional 350 MHz coaxial cable systems included many amplifiers to boost the signal along the way to subscribers' homes.

Hybrid Fiber-Optic Coaxial Cable (HFC)

Today, full coaxial systems are being replaced with hybrid systems consisting of fiber-optic and coaxial lines. These cable networks are also referred to as hybrid fiber-coaxial or "HFC." The HFC architecture replaces the previous coaxial trunk with a fiber-optic "trunk." The fiber terminates at the node, where the signal is then carried over an upgraded high bandwidth coaxial cable to the customer premises. HFC networks require fewer amplifiers and offer improved reliability, increased capacity, and clearer signal transmission, all of which facilitate two-way transmission.

Increased Bandwidth, Cleaner Transmission

The replacement of coaxial cable with fiber-optic cable increases the system's capacity and reduces noise, providing cleaner transmission paths that are necessary for two-way interactivity, telephony, and other new services. The use of HFC enables cable operators to deliver applications at very high data rates.

These new networks allow a cable operator to offer more than 100 analog video channels, hundreds of digital video channels, as well as provide capacity for Internet access, telephony and other services. With respect to Internet access, upgraded cable systems can carry data up to several 100 times faster than transmission using dial-up modems over ordinary telephone lines, and 100 times faster than ISDN (integrated services digital network) telephone lines. Because a cable network is a shared medium, these speeds vary depending on the number of actual subscribers using the Internet connection at the same time. As an example, Table 1 compares the transfer rate for downloading a 10 Megabyte file. A 10 Megabyte file is approximately the equivalent of a 10 to 20 minute movie clip. HFC cable architecture can transmit both upstream and downstream packets of information. Cable companies thus can operate as "pipeline" or "conduit" services, or become full-service providers combining both Internet access and other value-added services.

TABLE 1: TRANSFER RATE FOR A 10-MEGABYTE FILE

Modem Speed/ Type	Transfer Time
14.4-Kbps* Telephone Modem	1.5 hours
28.8-Kbps Telephone Modem	46 minutes
56-Kbps Telephone Modem	24 minutes
128-Kbps ISDN Modem	10 minutes
1.54-Mbps T-1 Connection	52 *seconds*
4-Mbps Cable Modem	20 *seconds*
10-Mbps Cable Modem	8 *seconds*

*kbps (kilobits per second) & Mbps (Megabits per second)
Source: http://www.cablemodems.com/whatis.html

Not Without Problems

Despite the expanded capacity, technical problems for providing advanced services over cable HFC networks remain. Return path transmission interference results from noise generated at the connection points between the trunk-distribution line connection and the distribution line-drop connections. In addition, a cable network is a shared medium, wherein subscribers in a particular area share capacity. As a result, data transmissions are potentially more vulnerable to interference and degradation caused by the actions of any individual subscriber's equipment. Further, as previously mentioned, transmission speeds degrade as more subscribers are online.

C. Telephone Company Broadband-- Digital Subscriber Lines (xDSL)[22]

Digital Subscriber Line (DSL)—sometimes referred to as xDSL because of the variety of DSL technologies and implementations—is the telecommunications carriers' version of broadband access. DSL is quickly emerging as an economic solution to provide high speed Internet access to end users—both residential and small to midsized businesses. With DSL, the average analog connection of 56.6 kbps can be upgraded to 1.5 Mbps or higher.[23]

DSL technology upgrades the performance of the standard twisted pair (the copper line connecting most homes and businesses) to carry high capacity data transmission. The technology expands the amount of frequency used over the copper line, whereby the line's higher frequencies are used to transmit the data and the lower frequencies are free to transmit voice or fax transmissions.[24] Thus, DSL is able to function on a line simultaneously with standard voice and fax services and avoids the installation of a new separate line. Because the technology works over the existing telephone plant, DSL is significantly less expensive to deploy on a broad scale than other approaches, such as new fiber or cable construction.[25]

In addition, the cost structure of DSL enables providers to serve both residential and business customers economically.[26] Since phone lines are nearly ubiquitous in the United States, DSL providers are not limited to one market segment (*e.g.* business or residential) as are some other broadband access providers.[27]

Despite the promise of DSL to deliver broadband access to businesses and consumers, there are several technical issues with regard to the widespread implementation of DSL.[28] One of the primary inhibitors is signal attenuation, also known as the distance limitation. Attenuation describes the dissipation of signal strength as it travels over the copper line. DSL utilizes a higher frequency that is more susceptible to attenuation than ordinary voice transmission.[29] Consequently, the various DSL technologies detailed below have distance limitations ranging from 4,000 to 18,000 feet from the telephone company's central office.[30] "These limitations may ease as technologies improve, but as a practical matter, DSL is currently limited to locations within a three-mile maximum loop from the central office."[31]

Although there are several versions of DSL service, there are two general categories, symmetrical and asymmetrical (*see* Table 2). Symmetrical versions offer the same data rates upstream and downstream and are best suited for business applications such as video-conferencing.[32] Asymmetrical versions offer different data rates upstream and downstream and are ideal for residential users who receive a lot of data but do not originate or send much (*e.g.* Internet surfers).[33] One such version is called asymmetric digital subscriber line (ADSL). As ADSL does not interfere with the basic voice service, the user can simultaneously browse the Internet or watch a movie while talking on the telephone.[34] According to some reports, ADSL provides a competitive advantage over cable modem Internet access in the following areas:[35]

- Simultaneous fast Internet and voice/fax capabilities over a single telephone line.
- Data security over a dedicated point-to-point line (from customer to local exchange carrier (LEC), which is not available over a shared medium such as HFC or cable modems.
- Dedicated bandwidth that guarantees performance regardless of the number of users on the network. In the case of cable modems, where the bandwidth is shared, the actual performance deteriorates as the number of users on the network increases.

TABLE 2: DSL TECHNOLOGIES

Acronym	Full Name	Maximum Data Rate		Max. Distance from Central Office to End-User (feet)*
		Downstream	Upstream	
HDSL	High-data-rate DSL	1.5 Mbps	1.5 Mbps	12,000
SDSL	Symmetric DSL	768 kbps	768 kbps	10,000
VDSL	Very-high-data-rate DSL	51.8 Mbps	2.3 Mbps	4,000
RADSL	Rate-adaptive DSL	8 Mbps	1 Mbps	18,000
ADSL	Asymmetric DSL	1.5-8 Mbps	640 kbps	18,000
G.Lite	DSL Lite	1.5 Mbps	384 kbps	22-25,000

Sources: Lehman Brothers; Ferris Baker Watts Research; Company reports.

* For each DSL variant there are slower speed versions that allow greater distances between central office and end-user.

D. Wireless Technologies: Fixed Wireless and Satellite

In the near to medium term, there will be various companies offering local broadband access using a variety of wireless technologies: fixed wireless and satellite. As with cable and telephone (collectively wireline) companies, fixed wireless providers are using their existing microwave networks to transmit high speed Internet services. Unlike their wireline competitors, fixed wireless providers enjoy a few competitive advantages. Because they avoid the high costs and delays associated with laying fiber or upgrading cable networks, fixed wireless companies can enter the market quickly and deliver broadband services at relatively low costs.[36] However, this technology also presents a number of deployment challenges, most notably, the line-of-sight requirements between the transmitter and receiving antenna.[37] The presence of obstacles, such as foliage, buildings, and even heavy rain, can hinder reception.[38]

In addition, broadband service via satellite has been projected for the early part of the millennium.[39] With their unlimited coverage area, satellite systems will offer broadband access to virtually any part of the United States and may be the best method for serving remote regions and locations where telecommunications infrastructures are of low quality or non-existent.[40] There are several satellite providers that are constructing systems and plan to start offering two-way broadband satellite services[41] by 2001.[42] Despite the promise of these broadband satellite systems, there are hurdles to deployment, including time to market and technological complexity. Commercial availability of satellite systems is at least two to three years away and, as a result, satellites might lose potential customers to competing broadband providers who currently offer high speed Internet access (*e.g.* cable and DSL). In addition, the use of two-way satellite services for the mass consumer market presents novel engineering and technology issues that still need to be resolved.[43] Once operational, however, these satellite systems could directly compete against cable modem service, DSL, and fixed wireless in the residential broadband industry.

III. THE BROADBAND INDUSTRY

A. Generally

As Internet usage continues its dramatic rise, the demand for broadband services grows. The market demand to bring high-speed data, video and voice to residential and business customers is reflected in increased levels of investment and faster deployment schedules for various technologies.

Narrowband Still Dominant

With the heightened focus on broadband technologies, the current state of narrowband access often gets overlooked. Due to the ubiquity of the switched telephone network system, the vast majority of residential consumers continue to access the Internet through analog modems. In January 1999, 65% of Internet users were still using analog dial-up modems with an average speed of access of 33 kbps.[44] It is projected that dial-up will remain the principal means of accessing the Internet for the near term. See Chart 1 at Appendix A.

B. Internet Over Cable[45]

As indicated in the Commission's *Annual Assessment of the Status of Competition in Markets for the Delivery of Video Programming*, access to the Internet over cable generally has become easier in the past two years. Most cable operators do not require video subscription as a condition of subscription for Internet-based services.

The most popular way to get online through cable infrastructure is through the use of a personal computer and a cable modem.[46] To deliver data services over the cable network, cable operators using a two-way broadband architecture typically allocate one television channel for downstream traffic and one channel for upstream traffic. Cable operators using a one-way broadband network typically allocate one television channel for downstream, while the upstream path is provided over a telephone line. At the cable headend, a cable modem termination system (CMTS) communicates through the allotted channels with cable modems located in subscriber homes to create a virtual local area network (LAN)[47] connection.

However, to provide Internet access over cable, operators must do more than just install cable modems at the customer premises and CMTSs at the headend. They have chosen to build an entire end-to-end Internet Protocol (IP) networking infrastructure in each community.[48] This includes Internet backbone connectivity, routers, servers, and network management tools, as well as security and billing systems. Essentially, cable operators have constructed sophisticated, community-wide end-to-end "intranets."[49]

Connecting to the Internet over cable infrastructure can offer significant advantages in terms of speed-of-connection as compared with transmission over traditional dial-up telephone access and other technologies. Broadband networks maintain higher capacities than standard telephone lines, and thus allow for faster data-transmission speeds. But since a network connection is only as fast as its slowest link, the benefit of high-speed cable connection is lost for content hosted on a Web server that is connected to the Internet though a 56-Kbps line. The solution is to bring popular content closer to the subscriber. This is done by "caching" or storing copies of popular content on local servers, installed usually at regional distribution centers or hubs.[50] Thus, when cable modem subscribers access certain websites, their requests will be routed to the local server instead of through the public Internet.

In addition to advantages of speed, Internet over cable also offers end users a connection that is "always on," as compared with the more widely-used dial-up services.[51] Furthermore, most Internet over cable providers offer proprietary content. These ISPs are also known as online service providers or OSPs.

Virtually all of the major cable operators offer broadband access in some areas, and they are steadily expanding service areas to meet demand.[52] Currently, however, service is not available in all markets. Notably, cable broadband access will continue to become more widely available as cable system infrastructures are upgraded. In markets where cable broadband is available, the industry is hopeful that the eventual standardization of cable modems will increase subscription levels. To that end, an industry consortium called CableLabs has adopted hardware and software interface standards called Data Over Cable Service Interface Specification System (DOCSIS) to support the delivery of data services over the cable infrastructure.[53] This standard should contribute to lower-cost modems, less complex and time consuming installation procedures, and potentially, self-installation by subscribers.[54] As DOCSIS compliant modems become available at retail outlets, sales of cable modems should dramatically increase.

The cable operators are also partnering with a number of cable ISPs that provide comprehensive networking and systems integration services to support broadband access. For example, Excite@Home and RoadRunner offer their own high-speed data backbone and regional data centers with local caching equipment. Other companies, such as High Speed Access Corporation (HSA) and ISP Channel, are offering basic turnkey Internet packages specifically designed for small cable system operators.

Cable Modem Deployment: Over 1 Million Subscribers

Following are notable measurements of the current cable modem market:

- As of August 1, 1999, cable modem service was available to 32 million homes. This was equal to 30 % of all cable homes passed in the U.S. and Canada.[55]

- The penetration rates for cable modem service averages 3.5 %, as cable operators in North America finished the second quarter of 1999 with 1,052,000 cable modem subscribers (see Table 3).[56]

- More than 90 % of these subscribers are on two-way cable systems, while 10 % are on one-way systems.[57]

- This is a dramatic increase from 1998, where 15 million homes were passed, and there were approximately 300,000 cable modem service subscribers.[58]

- North American cable companies are currently adding more than 2,500 cable modem subscribers per day.[59]

- At that growth-rate, total subscriber count could surpass 1.5 million by the end of 1999.

- The two leading providers of Internet over cable are Excite@Home and RoadRunner. Both are OSPs, offering proprietary content as well as access to the Internet.[60]

- As of August 1, 1999, the Excite@Home subscriber count was estimated at 670,000.[61] RoadRunner's subscriber count was estimated to be 350,000.[62]

- A number of new cable ISPs, such as HSA, Prolog, and ISP Channel, have partnered with cable operators to offer their versions of high speed Internet access.[63]

- High-speed Internet access deployment also has extended to rural and small communities, where the costs of deployment and operation are high.[64] To successfully deploy broadband in such areas, cable operators serving these communities have established partnerships with businesses offering various Internet services.[65]

TABLE 3: CABLE MODEM CUSTOMER RANKINGS JUNE 30, 1999

Cable Operator	Cable Modem Subscribers
Time Warner Cable	186,000
Media One	140,000
Cox Communications	112,000
Comcast	95,000
AT&T	83,000
Shaw Communications (*Canada*)	120,000
Rogers Cablesystems (*Canada*)	100,500
Other	215,000
TOTAL	**1,052,000**

Source: Kinetic Strategies, Company Reports

Industry Projections for Cable Modem Deployment and Plant Upgrades

- Cable modem deployment is expected to dramatically increase in the coming years. The projections for residential cable modem subscribers range from 4 to 6 million by 2002, and over 11 million by 2005.[66]

- The development of the DOCSIS standards for high-speed data delivery over cable will directly accelerate cable modem deployment, because DOCSIS compliant modems will increase the success of retail distribution channels, as well as simplify the installation process.[67]

- Cable operators have adopted an aggressive schedule to upgrade their networks to provide broadband services.[68]

- Under the current schedules, by year-end 1999, the largest cable operators (AT&T, Time Warner, Cablevision, Cox, Comcast) collectively will have upgraded systems that cover 46.7 million (65%) of the 72.4 million homes passed.[69] By year-end 2000, these companies will have upgraded systems that cover at least 61 million (80%) households.

- According to Excite@Home, in order to provide broadband services, the cable industry will need to spend $15 billion to upgrade their systems to reach roughly one half of homes-passed in the United States and $31 billion to upgrade their systems to reach all homes passed.[70]

C. DSL Deployment

Various telecommunications providers, from incumbent local exchange carriers (ILECs) to competitive local exchange carriers (CLECs), recently have adopted aggressive deployment schedules for DSL. There were approximately 160,000 DSL lines in service at the end of the second quarter 1999.[71] This represents a 300% increase since the fourth quarter 1998 and a 100% increase since the first quarter 1999.[72]

The ILECs' aggressive deployment of DSL can be attributed in large part to the deployment of cable modem service. Although the ILECs have possessed DSL technology since the late 1980s, they did not offer the service, for concern that it would negatively impact their other lines of businesses.[73] The deployment of cable modem service, however, spurred the ILECs to offer DSL or risk losing potential subscribers to cable. In various communities where cable modem service becomes available, the ILECs would soon deploy DSL service that was comparable in price and performance to the cable modem offering.[74] Thus, prior to cable modem deployment, the ILECs had little incentive to deploy DSL and the consumer had no choice for high-speed Internet access.

At present, cable modem service has a considerable lead over DSL in terms of total number of subscribers in the residential market. We anticipate DSL will close this lead, with the adoption of new technologies and standards that will improve the performance of DSL. By 2007, the subscriber levels for DSL should be nearly comparable to cable.[75] See Chart 2 at Appendix B.

In addition to the ILECs, a new type of CLECs has begun to focus on the high-speed Internet market. Covad Communications Company (Covad), Rhythms NetConnections Inc. (Rhythms NetConnections), and NorthPoint Communications Inc. (Northpoint) all have raised billions of dollars in their initial public offerings. These companies intend to target DSL services to small and mid-sized businesses, as well as to residential customers.[76]

The adoption of DSL-lite (or G.lite) should further accelerate the pace of broadband deployment in the residential market, because it increases the coverage area of DSL[77] beyond 18,000 feet from the central office and allows more homes to receive high speed Internet access over their existing copper lines. In addition, G.lite can be installed (plug-and-play) by the customer.[78] This plug-and-play feature is an important competitive factor, because it allows for off-the-shelf retail availability and modem pre-installation in PCs, two goals the cable industry hopes to achieve with its DOCSIS cable modem standard.[79] The plug-and-play feature also lowers labor costs, since it reduces the time technicians spend installing the service at the home or business.

Industry Projections & Announcements for DSL

- Actual number of DSL subscribers grew to 159,150 by the end of second quarter 1999, more than tripling since the fourth quarter 1998 and more than doubling since the first quarter 1999.[80]

- Analysts predict that over 30 million telephone lines will be qualified to support DSL services by the end of 1999.[81] (See Table 3).

- Bell Atlantic plans to double the availability of its DSL product to 17 million telephone lines by year-end 1999.[82]

- SBC Communications Inc. (SBC) expects to reach 250,000 DSL subscribers and to increase DSL availability to over 10 million homes by year-end 1999.[83]

- US West expects to reach 100,000 DSL subscribers by year-end 1999.[84]

- GTE announced a new discounted DSL pricing structure, offering its own ISP (GTE.net) for $49.95/ month.[85]

- US West lowers its price on selected DSL offerings to $37.90/ month. This special DSL offering will soon be available in more than 40 cities across US West's region.[86]

- ILECs have entered co-marketing and co-branding agreements with established Internet access companies such as AOL, MindSpring and EarthLink.

- Bell Atlantic and SBC have agreed to provide volume-discounted DSL transport service to AOL in order to tap its 19 million-customer base and brand name.[87]

- BellSouth recently reached a similar agreement with MindSpring, which has a 1.2 million customer base.[88] EarthLink has agreements with GTE and Sprint to offer DSL services nationwide.[89] MindSpring and EarthLink have announced plans to merge. The combined entity will have a subscriber base over 3 million.[90]

- NorthPoint, a wholesale provider of broadband, last-mile DSL connections, states that it has collocation space to serve 30 million residential lines and 4 million business lines.

- Rhythms NetConnections has partnered with VillageNet Inc., a community oriented Internet Service Provider, to currently offer DSL services to New York and Los Angeles and, by year-end 1999, plans to offer these services nationwide.[91]

- Covad is creating a broad network footprint and plans to deploy DSL services in 51 major markets, which will cover 28 million homes and small businesses by the end of 1999.[92]

TABLE 3: PERCENTAGE OF ILEC NETWORKS THAT ARE DSL-READY

RBOCs	Qualified Lines (mil) 1998	1999
Ameritech	n/a	n/a
Bell Atlantic	2.0	7.0
Bell South	2.0	4.0
SBC	3.3	10.0
US West	3.6	5.2
GTE	5.0	6.0
Total:	**15.9**	**32.2**

Source: Donaldson Lufkin & Jenrette--Wireline Communications (June 1999)

D. Wireless Technologies: Fixed Wireless & Satellite

Within a few years, there will be several fixed wireless companies that will be offering broadband access.[93] At present, Teligent, Inc. (Teligent) and WinStar Communications, Inc. (WinStar) offer a variety of broadband services to small and medium-sized businesses in several metropolitan markets. Both companies have plans to further rollout their services to several new markets throughout the U.S. and have negotiated service contracts with numerous Real Estate Investment Trusts (REITs) to serve large apartment and commercial complexes.[94]

In the upcoming months, there are several new fixed wireless systems offering broadband access through either Local Multipoint Distribution Service (LMDS) or Multichannel Multipoint Distribution Services (MMDS) technologies. Nextlink Communications (Nextlink) is the largest holder of LMDS spectrum in North America, with licenses covering 95% of the population in the top 30 markets in the United States.[95] Nextlink intends to use its wireless capabilities to extend the reach of the company's local fiber optic networks to soon offer an array of broadband services.[96] In addition, MMDS systems are being reconfigured to provide two-way high-speed Internet services. Previously, MMDS companies provided one-way video services. As market conditions have changed and the demand for data services has increased, the Commission changed its rules last year to allow MMDS companies to offer two-way broadband services.[97] In recent months, MCIWorldCom and Sprint Communications Company, L.P. (Sprint) have taken advantage of this rule change and have spent collectively over $1 billion to purchase several MMDS systems and plan to

use these systems to offer broadband services directly to business and residential customers.[98] MMDS systems complement these long-distance carriers' (IXC) networks, for they provide the last-mile connection to businesses and residences. Once the networks of MMDS and IXCs become fully integrated, the IXCs will have greater control of the end-to-end transmission and will be able to provide broadband services to subscribers more efficiently.

Two satellite systems with great potential for delivering local broadband access are Spaceway and Teledesic. Spaceway utilizes 16 satellites to provide "bandwidth-on-demand"— the ability to transit and receive voice, video, and data at any time from any place — at speeds up to 6 Mbps.[99] The Spaceway system is expected to cost $4.3 billion to build and launch and should be operational in 2002.[100] Teledesic plans to utilize 288 satellites in low earth orbit (LEO) to provide two-way digital transmission—voice, video, and data — at a low cost, regardless of location.[101] Its system will provide 24-hour seamless coverage to over 90% of the planet's surface and nearly 100% of the Earth's population.[102] The company expects to start service by 2002-2003.[103]

IV. PRELIMINARY FINDINGS

A. The Cable Services Bureau's Monitoring Sessions

At the request of the Chairman, the Cable Services Bureau convened a series of Monitoring Sessions in May and July to study the state of the broadband industry and to identify any potential market failures. The purpose of these meetings was to:

- Ascertain a better understanding of the broadband industry since the submission of the Section 706 Report to Congress.

- Answer the question: "Should the government require cable companies to provide access to their cable plant by unaffiliated on-line service providers and Internet service providers?"

This seemingly simple question raised several complex policy, legal, and economic issues. In order to address these issues, the Commission staff met with a diverse group of representatives from cable, telecommunications, Internet industries, public interest groups, investment analysts and academics. The Monitoring Sessions held thus far were devoted to policy and investment. The Bureau anticipates convening future Monitoring Sessions on the topics of e-commerce, technology, and other relevant issues.

B. Participants

Meeting participants were chosen based on their interest, expertise, or experience in the range of issues related to broadband deployment and technology. By category, these participants included the following:

Multiple System Operators (MSOs)[104]

Local Franchising Authorities (LFAs)[105]

Local Exchange Carriers (LECs)[106]

Competitive LECs (CLECs)[107]

Inter-Exchange Carriers (IXCs)[108]

Internet Service Providers (ISPs)[109]

On-line Service Providers (OSPs)[110]

Industry Trade Groups[111]

Public Interest Groups[112]

Educational Institutions, Think Tanks, Research Organizations, Academics

Investment Analysts[113]

C. Questions Posed to Panelists

The Bureau staff submitted to our panelists a number of written questions concerning the current and future state of the broadband industry. The actual questions submitted to the panelists are reproduced in Appendix C. The questions were designed to facilitate discussion with the panelists on key policy and economic issues pertaining to the broadband industry. Panelists were encouraged to discuss their perspectives on current conditions in the broadband industry, and express an opinion on whether regulation was warranted by these conditions. Factors such as future market developments, technological advances, and ancillary benefits and harms were also offered for consideration. Additionally, panelists were encouraged to discuss the potential benefits and harms that regulation may present.

D. Responses and Preliminary Findings

In this part of the Report, we summarize the positions of the panelists and set forth our very preliminary findings that flow from these positions. We do not attempt to give an exhaustive recitation of the views of the panelists. Rather, we are attempting to convey the major positions articulated by the panelists and distill preliminary findings that can further inform the Commission's policies on broadband.

1. The broadband industry is nascent.

As detailed in Part III of this Report, there are approximately 40 million residential Internet subscribers in North America, approximately one million of whom subscribe to broadband Internet services. It is important to remember that residential broadband Internet subscribers constitute less than 3% of the total Internet subscribers in North America. Although the Bureau expresses no view on whether the residential broadband market is a separate market from the residential narrowband market, a comparison of the numbers between the two is instructive to appreciate the relatively small scale of residential broadband deployment. Even the most optimistic estimates predict that narrowband will still be the dominant subscribed form of Internet access by 2005. One analyst predicted that by 2005, cable will have 34% (23 million subscribers) of the Internet access market, with DSL at 15% (10 million subscribers), and dial-up narrowband at 51%, or 35.7 million households.

There was wide agreement that cable has an early lead in deployment of broadband services. Of the total number of residential broadband subscribers today, nearly 90% subscribe to cable modem service. There were, however, divergent views on whether cable would continue to dominate the residential

broadband industry, as well as which technologies would be serious competitors in that market.

Broadband industry will thrive in absence of regulation

Most analysts stated that competition, while still in its infancy, exists in the broadband industry and is likely to increase in the absence of government intervention. One analyst predicted that by 2005, there would be approximately 23 million cable broadband subscribers, 10 million DSL subscribers, and 1 million satellite broadband subscribers. Analysts also forecasted that DSL penetration could rise to 20% of high-speed data users by 2005 and to 40% by 2006.

Most participants believed that continual monitoring of the market is appropriate and necessary to determine the effect of the Commission's current policy of regulatory restraint on other markets such as e-commerce and e-content.

2. Cable modem deployment spurs alternative broadband technologies.

There was little disagreement among the panelists that cable investment inherently spurs investment in DSL and vice versa. Some participants noted that in the very near term, consumer choices in residential broadband likely would be limited to either DSL or cable modems. Most agreed that there would not be multiple pipes into the home within the next two to five years. Rather, cable and DSL platforms were expected to dominate, with satellites providing an alternative. Given the high levels of investment in non-cable, two-way broadband technologies such as DSL, satellite, MMDS, and electric utilities, there was wide agreement that robust competition in the broadband industry in the long run is likely.

3. Regulation or the threat of regulation ultimately slows deployment of broadband.

Cable interests argued that they have made an enormous investment in the cable plant and have taken on extraordinary amount of risk to create a facilities-based competitor to the local phone market. This investment and risk, according to the cable interests, should not be jeopardized by saddling cable with government regulation. Cable interests also argued that the threat of regulation jeopardizes the incentives to make investments in alternative broadband technologies.

The investment analysts were in wide agreement that market competition is developing in the absence of government intervention. They further agreed that the Commission's current policy of monitoring and restraint facilitates development of a fertile marketplace. The absence of regulation, according to an

analyst and an industry scholar, has been one of the principal factors contributing to the growth of cable modem deployment in the United States. The investment analysts also agreed that consumers would best be served if the broadband industry segments continue to pursue market-based solutions that will speed the deployment of broadband.

In this same vein, there was near unanimous agreement among the cable and investment panelists that government regulation of the terms and conditions of third-party access to cable systems would cast a cloud over investment in both cable and telephony applications.[114] According to these panelists, the cable industry's ability to provide high-speed data services and telephony already is factored into cable company valuations. Government-mandated access, as one cable ISP official noted, "puts a shotgun slug through two inches of Excel spreadsheets that [cable companies] use to generate their rate-of-return calculations."[115] Although warning against the prospect of slowed deployment of advanced services resulting from mandated access, some of the analysts found that current commitments for broadband and the momentum of AT&T's deployment might limit the negative impact of any "open access" regulation.

The cable operators warned that even "light touch" regulation would be a substantial distraction to investment in cable and the rollout of services. The complexities of the Commission's rule making and tariffing processes also would have the same affect. Additionally, the cable operators stated that a slow-down or halt in cable telephony investment could result from government intervention into "open access."

One participant noted that not only does the threat of regulation affect cable modem deployment, but any disincentives that apply to cable are also applicable to telephone company DSL. Analysts pointed out that mandating "open access" to broadband platforms could have an extremely detrimental effect not only on cable stock valuations, but on other industries as well. If investment in cable systems slows, stock prices could fall and affect build-out capital. This in turn could slow the rollout of DSL by ILECs, as the urgency to beat cable to the consumer marketplace would diminish. There likely would be a ripple effect. Such a slow down, according to the analysts, could dramatically slow the development of Internet advertising, e-commerce, and content.

4. Market forces will compel cable companies to negotiate access agreements with unaffiliated ISPs, preventing cable companies from keeping systems closed and proprietary.

There was virtually unanimous support for the proposition that closed proprietary systems generally fail and do not adequately serve the needs of consumers. The panelists' opinions diverged over whether market forces, if left to their own

devices, will create an open and fluid model or whether government intervention is the only way to achieve this model.

The investment analysts were extremely confident that ISPs like AOL would almost certainly strike a deal with AT&T and other cable operators. These panelists posited that AOL's over 18 million subscriber base gives AOL and the cable operators a mutual interest in allying to increase cable's market penetration, protect their video and phone businesses, and eliminate competition. Notwithstanding the existence of the exclusive ISP arrangement AT&T has with Excite@Home, the analysts believed that AT&T and AOL were in the process of negotiating a carriage arrangement. The analysts were less confident, however, of the prospects of AT&T striking a deal with other unaffiliated ISPs in the near term. The prospect of imminent government mandated access, according to the analysts, would skew these negotiations.

5. If market forces fail and cable becomes the dominant means of Internet access, regulation might then be necessary to promote competition.

Some of our panelists warned that the principal harm of government restraint would be the development of a closed proprietary system that is the only viable broadband platform to the Internet. Such a system would restrict the ability of consumers to access the Internet through the ISP of their choice and stifle innovation brought about by small and independent ISPs. According to some LECs, ISPs, and public interest groups, cable companies could become Internet gatekeepers with the power to determine which ISPs consumers could use and what content they could access. These panelists took the view that a "leopard does not change its spots."[116] Cable is a monopoly and will extend its monopolistic behavior into the residential broadband industry, they contended. The Commission's failure to stop the formation of a broadband monopoly, according to these panelists, will render subsequent remedial action useless.

According to this view, cable operators would be able to limit consumers' choice to their affiliated ISPs, thereby freezing out unaffiliated ISPs. Although the larger independent ISPs like AOL and MindSpring may survive, some "open access" advocates warned that the development of a closed proprietary system would limit the innovation that smaller, unaffiliated ISPs can offer consumers. Panelists representing smaller ISPs warned that the government's failure to mandate "open access" will lead to the demise of thousands of smaller ISPs who will not have the bargaining power of the larger independent ISPs.

One investment analyst also warned that cable's current broadband model will have much broader implications on the development of e-commerce and content sites. By controlling the last-mile and vertically integrating its Internet access and content, cable operators have the ability to discriminate against unaffiliated e-

commerce and content providers. This analyst further argued that cable will have the incentive to discriminate against these unaffiliated providers, considering the potential revenue from e-commerce and advertising related to e-content.

Panelists also argued that government inaction might enable cable operators to prevent Internet video services from developing. These participants stated that cable operators will be able to use their gatekeeper function to restrict Internet video streaming over cable broadband networks. Specifically, LEC and local government interests argued that cable operators will be able to control content on the cable system network by restricting Internet video streaming.

6. There was no consensus on how to implement "open access" from a regulatory perspective.

"Why doesn't the Commission adopt a broadband regulatory model comparable to existing models in the Communications Act?"

ISPs and some public interest groups posited that "open access" requires cable operators to grant unaffiliated ISPs non-discriminatory access to their cable plant. This would mean imposing an "open access" requirement similar to the common carrier regime under Title II of the Communications Act. These groups argued that broadband service over cable lines is essentially common carriage, and moving bits between an ISP and a consumer is essentially a transmission service.

Some of these same interests suggested that "open access" also can be defined by reference to the cable communications provisions of Title VI of the Communications Act, which are designed to protect against the potential abuses of cable operators selling programming. These interests stated that Title VI-type regulation (also referred to as "regulation light") would provide unaffiliated ISPs the same access to the cable system as ISPs affiliated with the cable system. It was suggested that the Commission could simply apply its leased access rules[117] or its program access, just as it would in the context of a vertically integrated company who owns both the facilities and the programming carried on the system. One of the advantages cited by these proponents is that tier buy-through restrictions would prevent cable operators from requiring that a subscriber purchase its affiliated Internet access service as a condition of subscribing to cable video service. "Regulation light," according to its advocates, would also avoid the full-blown burdens of Title II-type regulation.

One Internet backbone provider suggested that if the Commission does not choose to apply Title II or Title VI-type definition of "open access," it should consider applying a public interest analysis to define the terms of "open access." This means that the Commission would rely on its ancillary powers under section 4(i) of the Communications Act to perform "any and all acts, make such rules and

regulations, and issue such orders, not inconsistent with [the Act], as may be necessary in the execution of its functions."[118] Advocates of this position, however, did not provide any substantive description of how these "open access" rules would look or operate.

Other "open access" advocates offered what they believe to be a less complex definition of "open access." One academician suggested that the Commission simply impose a basic unbundling requirement, which would permit consumers to purchase only the services they desired, such as high-speed Internet access, video programming, or telephony -- separately or in combination. Under such an "open access" regime, cable companies would be free to establish a price for access and charge the same price to all ISPs.

"Why doesn't the Commission level the playing field for telecommunications service providers and cable operators?"

At least one LEC panelist, an academic, and some public interest groups supported an "open access" regulatory scheme across facilities. Under such an approach, the Commission would impose the same regulatory obligations upon cable operators as those imposed on ILECs. On the other hand, if the Commission refrains from imposing access requirements on cable operators, these panelists argued that the Commission should relieve incumbent LECs of their access requirements.[119] If broadband cable regulation does occur, these panelists argued for non-discriminatory access and arms length dealing for backbone traffic. The panelists expressed concern that a vertically integrated transport and content provider could lead to higher backbone prices.

"Why doesn't the Commission just follow the Canadian regulatory model for 'open access'?"

A technology forecasting group acknowledged that the term "open access" is elusive because the industry is still evolving, but suggested, among other things, that the Commission examine the Canadian experience with "open access" for guidance in enacting a regulatory scheme. In 1996, the Canadian Radio-Television and Telecommunications Commission ("CRTC") required incumbent cable operators to provide non-discriminatory access to the cable platform by unaffiliated ISPs.[120]

"The cable platform is already an 'open' system"

Some cable operators argued that cable systems are, in fact, already open, and there is no need for imposing further requirements. This view posited that cable Internet subscribers can reach any Internet site or portal over the cable platform, and are free to select the ISP of their choice by simply "clicking-through."[121]

"Open access" means providing access to unaffiliated ISPs on mutually acceptable terms, determined by arms-length negotiation. This view of "open access," however, did not enjoy support much beyond the cable interests in attendance.

Unanswered Questions

"Open access" is one of the most well-worn terms in the growing broadband access debate. Private interest groups recently have emerged advocating for and against "open access."[122] Four LFAs recently mandated that cable companies provide non-discriminatory access to unaffiliated ISPs as a condition of approving franchise transfers.[123] Legislation on the subject has been introduced in State legislatures and the U.S. Congress.[124] Yet, despite a flurry of national and grass roots activity concerning "open access," our panelists -- a collection of some of the nation's leading business, government, and public interest advocates on this issue -- were not able to agree upon a single workable definition of the term,[125] much less recommend an appropriate regulatory classification and enforcement mechanism. This fact speaks volumes about the difficulties and appropriateness of establishing a regulatory regime at this early stage in broadband's history.

To date, many questions concerning the specifics of implementing a broadband access requirement remain unanswered. None of the enacted local legislation requiring access has set forth a defined system of interconnection or guidelines for pricing.[126] And most of the enacted or proposed legislation simply mandates that the terms, rates, and conditions of "open access" shall be the same as those the cable operator provides to itself or affiliated ISPs. This "nondiscrimination" standard offers little guidance when a cable operator does not itself offer Internet access service or is not affiliated with an ISP.

Further, even as to cable operators providing Internet access service through an affiliated ISP, a "nondiscrimination" standard leaves many implementation questions unanswered. For example, as cable operators have pointed out, affiliation agreements between cable companies and ISPs have involved the cable operator taking an equity stake in (and revenue split with) the affiliated ISP. Whether these arrangements can and should be used as the basis for a carriage arrangement with unaffiliated ISPs is difficult, at best. Significantly, implementation of the "nondiscrimination" standard for interconnection and access to ILECs' telephone networks under Title II of the Communications Act necessitated the creation of separate, complex sets of accounting and non-accounting rules to govern pricing arrangements between ILECs and CLECs.[127]

Finally, the panelists were vague or declined to offer to explain how imposing a broadband access requirement would be consistent with the de-regulatory goals of the 1996 Act.

7. There was no consensus on how to implement "open access" from a technical perspective.

There seemed to be wide agreement among the panelists that "open access" means a common infrastructure that is competitively neutral. Some consider this to mean choice and competition at every level of Internet access: the backbone level, the ISP level, and the content level. In other words, choice in broadband should be the same as in narrowband.

What was particularly confounding for our participants was the question of where "open access" should occur. One industry analyst said that "open access" is decoupling transport from the rest of the Internet, so that cable does not become the "choke" point. Local government representatives proposed that a local peering arrangement [128] should be made throughout a local high-speed meeting point.

One participant argued that it is the protocol of the Internet that is important, and that the Commission should maintain a protocol independent of the network over which it runs, though no standard was offered.

Aside from the technical obstacle of implementation, some of the analysts noted that one of the greatest logistical obstacles to the deployment of distribution systems is the shortage of engineers and the limited infrastructure necessary to physically create and deploy these systems. It was clear that at the time of the Monitoring Sessions, none of the participants had a definitive idea as to how to account for the critical logistical requirements for wide-scale cable broadband deployment.

8. Rapid nationwide broadband deployment depends on a national policy.

There seemed to be wide agreement among our panelists that consumers would be poorly served by a fractured broadband landscape wherein each locality devises its own set of cable Internet access regulations. All of the financial analysts expressed concern over the prospect of hundreds of LFAs regulating broadband access. The analysts also were concerned that the nascent broadband industry could be negatively impacted if the Portland decision is upheld. The concern is that cable companies would move away from or substantially slow cable modem deployment and focus on telephony, thereby thwarting the public policy objective of rapid deployment of advanced technologies to all Americans. Some of these analysts also feared that LFAs do not have the expertise to develop workable "open access" requirements.

The local government representatives tacitly acknowledged that they did not have the resources or expertise in some cases to develop a comprehensive regulatory

scheme for broadband access. (And privately, some local and state authorities expressed reluctance to devise such regulatory schemes.) Some local representatives expressed a strong desire to see the federal government take the lead on this issue, by providing formal guidance to states and localities, while permitting them to maintain an enforcement role.

V. ANALYSIS

The rapid pace of change and the dynamic developments in broadband communications present great opportunities for both American consumers and the communications industry. Consumers stand to benefit from improvements in technology, which will lead to the provision of greater, faster, and more efficient services—all at affordable costs. Companies providing broadband services and technology stand to benefit from an expanding market, which will lead to increased revenues and a greater number of products and services.

In order for these benefits and opportunities to be realized, however, there must be a competitive marketplace. Government can promote a competitive market by encouraging innovation, investment, and infrastructure buildout. In so doing, government insures that innovative and cost-efficient services will be provided to consumers by a diversity of entities—or multiple pipes to the home.

The Commission's public interest mandate requires it to forbear from regulation and allow market forces to flourish, but to intervene in the event of market failure. In reaching this balance, the Cable Services Bureau's staff recommends that the Commission forbear from imposing regulation and continue to resist the urge to regulate prematurely. This is not to say, however, that the Commission should be passive in the face of anti-competitive behavior. At present, the appropriate balance can be struck by monitoring the market and resisting the urge to fix a system that does not appear to be broken and shows early signs of healthy growth and competition.

A. Risks of the Commission Continuing Its Policy of Regulatory Restraint

To be sure, there are potential risks associated with a continued policy of regulatory restraint and monitoring. We acknowledge that some of the principal risks include the threat of a cable monopoly of broadband, the creation of irreversibly closed cable systems, and inconsistent local regulation.

Threat of Cable Monopoly of Broadband

As mentioned earlier, one of the principal harms cited by "open access" advocates is that the Commission's failure to act now will give cable monopoly control over Internet access. Some "open access" proponents predict that cable will be the leading and perhaps only viable platform for broadband access to the home. In a recent White Paper submitted to the FCC, the openNet Coalition described the potential for cable operators like AT&T to develop a monopoly on broadband access to the Internet. "AT&T's early advantage in broadband would be

entrenched and expanded [if the government continued its policy of monitoring] – end result Ma Web reigns."[129]

In this same vein, some of the panelists warned that AT&T will be in a position to totally dominate cable, Internet access, and Internet content, thus gaining the ability to set standards for the entire industry. Others expressed concern that as infrastructures are built, architectures will be constructed so that it will not be possible to take remedial action at a later time.

The Bureau recognizes that these risks are serious and can potentially undermine the open nature of the Internet. At this point, however, the Bureau is not persuaded that consumers are at risk of cable establishing a bottleneck monopoly in broadband services in the absence of immediate regulatory action. There have been no developments since the release of the Section 706 Report earlier this year to alter the Commission's conclusion that no monopoly exists. Moreover, the monopoly argument wrongly assumes that cable is the only viable broadband pipe available in the near term to provide Internet access to the home. As deployment of DSL, satellite, and wireless advances, in large part spurred by rapid cable modem deployment, consumers will have alternative platforms to use for high-speed data access, telephony, and video services.[130] We have already seen evidence that these alternative technologies are attracting new subscribers at an exponential rate, and that prices for these new services are falling. As stated in the Section 706 Report:

> *By the standards of traditional residential communications, there are, or likely will soon be, a large number of actual participants and potential entrants in this market. Anti-competitive coordination among competitors is difficult in such markets.*[131]

We believe for now that the emergence of alternative broadband providers, with their competitive service offerings, features, and prices, mitigates the risk that cable will become the gatekeeper to the Internet.

We also believe that customer demand for choice ultimately will compel cable operators to open their systems to unaffiliated ISPs. If a cable operator opts for a closed, proprietary system in which consumers have no choice of ISPs or have to purchase unwanted services as a condition of subscribership, these companies will risk losing subscribers in favor of more open systems.[132] These operators also would be susceptible to regulation intended to eliminate monopolistic and anti-competitive practices. We believe that market forces and our ongoing monitoring efforts will persuade cable companies to keep their networks open, even in the absence of regulation.

Moreover, the import of the 1996 Act and the Commission's long-standing policy of non-regulation of the Internet express a strong preference for market-based solutions, not governmentally imposed solutions. Even if there could be some "short-term improvements in retail competition [by the government mandating access], it may also undermine incentives for developing new methods to circumvent the influence of incumbents over distribution."[133] Despite the risks in the balance, our findings support a continued policy of regulatory restraint to facilitate the rapid deployment of multiple broadband technologies, including cable, DSL, wireless and satellite. Unless and until anti-competitive behavior surfaces, it is preferable to allow market forces to propel cable operators and independent ISPs toward an "open access" system. Market-based solutions devised by the parties will likely provide a better framework for consumers.

Threat of Creation of Irreversibly Closed Systems

One of the more troubling prospects brought to our attention is of cable operators designing their networks in a way that irreversibly restricts the ability of unaffiliated ISPs to access the cable plant in a meaningful way.[134] This is a charge that the Commission should take seriously. If cable networks are designed in such a way, the Bureau acknowledges that it may be difficult, from an engineering and economic standpoint, to re-engineer the networks in a way that grants meaningful access to unaffiliated ISPs. We are encouraged, however, that the general consensus among our panelists was that the cable architecture is not irreversibly closed. The Commission's Office of Engineering & Technology is actively monitoring the marketplace to determine if the cable network architecture remains open. If signs develop that cable is pursuing a closed, proprietary network design, the Commission should take immediate and aggressive steps to prevent this result.

Although most cable companies have not provided unaffiliated ISPs with direct access to their networks, we have seen no credible evidence that cable network architecture precludes future modifications to allow such access. The availability of a technology option to require cable companies to provide "open access" in the future, if these companies gain excessive market power and fail to negotiate with unaffiliated ISPs, allows the government to stay its regulatory hand unless such anticompetitive conditions develop.

Threat of Inconsistent Local Regulation

Finally, we address the claim by local governmental interests that the Commission should give broad guidance to localities on how best to encourage the development of open network architecture. Indeed, we have witnessed LFA activity in this area.[135] Inconsistent local regulation potentially can disrupt the Commission's national broadband policy and keep broadband technologies out of

the hands of many Americans. While some LFAs have opted for mandated access, we have been encouraged by the decisions in Los Angeles and San Francisco, for example, where those governments have decided to pursue a policy of monitoring and restraint.[136] We believe these local governments have followed the guidance provided by this Commission in its Section 706 Report and the recent *AT&T-TCI Order.*[137]

The Bureau recommends that the Commission continue to engage in active dialogue with local regulators across the country to make sure that localities and the federal government work together to support a national broadband policy.[138] Local government representatives have participated in these Monitoring Sessions, and we fully expect their continued participation in the Commission's upcoming Section 706 proceeding. Numerous LFAs share the Commission's goal of a national broadband policy. As the Commission's staff and localities continue to work together toward maintaining a national broadband policy, the Bureau is hopeful that we can avert the uncertainty generated by disparate broadband policies in which not all Americans will share in the benefits of broadband.

B. Benefits Of The Commission Continuing Its Policy of Regulatory Restraint

The findings from our Monitoring Sessions highlight the rapid pace of change in the nascent broadband industry and the difficulty of placing broadband services under any existing regulatory framework. The Commission is well aware that "application of existing regulatory categories is difficult, if not impossible to many forms of Internet-enabled communications."[139] Until the Commission has a better view of how broadband technology will be deployed and used by consumers, the Bureau recommends continuing the Commission's policy of regulatory restraint and monitoring. The notion of applying prophylactic "open access" measures – whether they be in the form of Title II, Title VI, or more simple unbundling regulations -- before fuller development of the broadband industry would be unsound public policy that could have the unintended effect of impeding the rapid development of this industry. The market is the only force, at this stage, that is sufficiently dynamic and informed to create a competitive broadband marketplace. We believe that market forces, coupled with ongoing Commission monitoring of the marketplace, are the best hope for creating an open network architecture and discouraging the formation of a closed proprietary architecture.[140]

Even if a regulatory scheme could be devised at this early stage, such a scheme would likely be very complex and burdensome. The Commission's experience from implementation and enforcement of the Title II "non-discriminatory" interconnection and access requirements teaches us that a complex regulatory and tariffing scheme would likely accompany broadband access requirements. For

instance, the seemingly simple dictate in section 251(c)(2) of the Communications Act, which requires ILECs to provide network interconnection and access by telecommunications carriers at any "technically feasible point" on "rates terms and conditions that are just, reasonable, and non-discriminatory," has been the subject of complex and lengthy rulemakings and litigation. This experience has been borne out in Canada, where in 1996, the Canadian Radio-Television and Telecommunications Commission required incumbent cable operators to provide non-discriminatory access to unaffiliated ISPs. It took three years for the CRTC to adopt rules requiring incumbent cable operators to file tariffs and establish conditions for interconnection and resale by independent ISPs. Even with this mandate, trials used to determine rate schedules have not started, and are not expected to be completed until next year. This type of regulatory delay, and its resulting uncertainty, threatens to slow down the nascent broadband industry and would be inimical to the intent of the 1996 Act.

Perhaps most significant, our monitoring efforts have not revealed any monopolistic practices by cable operators that presumably would be the predicate for any type of "open access" requirement. Admittedly, we are in the early stages of the broadband revolution, and although cable has an early lead, its telephone, satellite, and wireless competitors are rushing to close the gap. Against this backdrop, it would be premature for the Commission to establish a national "open access" requirement.

The 1996 Act was enacted to "promote competition and reduce regulation in order to secure lower prices and higher quality services for American telecommunications consumers and encourage the rapid deployment of new telecommunications technologies."[141] The Commission's charge is to find ways to encourage market-based solutions and to avoid direct intervention in competitive and well functioning markets. From the evidence before us and from our independent research, it appears that the prospect of mandated access could have a negative effect on continued investment in broadband technologies and deployment.

Mandated access also could reduce the financial incentives and the build-out capital for cable companies to make the large investments necessary to upgrade their systems. Under such a scenario, AT&T, for example, might opt to focus on deploying telephony services at the expense of deploying Internet broadband services.[142] While we are not persuaded necessarily that cable operators would halt their nationwide broadband deployment in the face of a mandated access requirement, there is a significant and credible risk that rapid deployment of these services to all Americans would be greatly compromised. Thus, faced with no evidence of anti-competitive and monopolistic practices, the Commission should continue to pursue its policy of not regulating cable Internet access.

C. Evidence The Commission's National Broadband Policy Is Facilitating Vigorous Deployment And Competition

The data cited in Part III of this Report indicate that broadband deployment in this country is growing and will likely grow exponentially in the years to come. The rapid deployment of this technology to consumers will depend in large measure, however, on the level of investor interest and regulatory incentives provided to industry by local and federal governments. One of our most significant preliminary findings is that the Commission's policy of restraint on broadband regulation has helped to create a fertile environment for growth.

The early deployment statistics and anecdotal evidence suggest that in areas where cable modems are deployed, the deployment of DSL follows closely. Sometimes DSL deployment spurs cable modem deployment, but it is fairly clear that the rate of deployment of one technology influences the rate of the other. As cable and DSL are deployed in the same markets, we also have observed aggressive price competition. In various markets, DSL prices have been lowered to be competitive with cable modem service.

Moreover, it appears that the lack of an "open access" requirement for cable-delivered broadband services has pushed independent ISPs to enter into agreements with non-cable broadband services providers and thereby has accelerated the pace of deployment. Specifically, there is encouraging evidence that independent ISPs are entering into agreements with LECs, CLECs, and satellite providers to deliver high-speed Internet access. And in the not-so-distant future, the Bureau expects that cable operators and unaffiliated ISPs will successfully negotiate carriage arrangements. Such arrangements are in the best interest of business and the consumers they serve.

VI. CONCLUSION

The Commission's mandate under the 1996 Act is to ensure that advanced telecommunications capability is deployed to all Americans on a "reasonable and timely basis." As part of that mandate, and at the Chairman's direction, the Cable Services Bureau has vigilantly monitored the broadband industry to collect information as to how this industry is developing. A finding of market-based harm, however, would be a necessary predicate for regulatory action. In the absence of such a finding, the Bureau cannot recommend that the Commission take regulatory action of any kind at this time.

Far from finding harm, the Bureau's monitoring efforts have revealed a nascent residential broadband market containing a number of existing and potential competitors. Cable, telephone, wireless, and satellite companies are rushing to provide broadband services to the home. As a result of this competition, consumers will have a wide selection of broadband features, capabilities, and pricing from which to choose. It is questionable that this multiplicity of choices would exist if the government were to intervene at this early stage of the race.

Perhaps most importantly, government has provided the numerous incentives to broadband companies to invest in and deploy their technologies. By forbearing from imposing "open access" regulations on cable operators, the Commission has fostered an environment that encourages investment not only in cable, but also in the alternative broadband technologies, such as wireless, satellite, and DSL.

The Commission should be mindful of the concerns and dangers cited by the advocates of mandated access. It should be prepared to act swiftly if the evidence of harm actually materializes. The Bureau believes that the Commission should continue to monitor developments in the broadband industry, resist the pressure to regulate this new and innovative industry, and consider regulation only if competitive harms arise.

ENDNOTES

[*] The following staff of the Cable Services Bureau contributed to the research, drafting and production of this Report: Tasha Browning, Sunil Daluvoy, Donnie Fowler, Jay Heimbach, Adonis Hoffman, William Johnson, Anne Levine, John Norton, Clint Odom, Mike Perko, Michelle Russo, Quyen Truong, and John Wong.

[1] *See* John Schwartz, *How Much Room in the Fat Pipe?*, The Washington Post, at H01 (Sept. 19, 1999).

[2] *Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps To Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996*, CC Docket No. 98-146, Report, 14 FCC Rcd. 2398 (1999) (Section 706 Report).

[3] *Id.* at 2415 ¶ 36.

[4] *Id.* at 2423-24 ¶ 48.

[5] *Id.* at 2449 ¶ 101.

[6] *Applications for Consent to the Transfer of Control of Licenses and Section 214 Authorizations from Tele-Communications, Inc. to AT&T Corp.*, CS Docket No. 98-178, Memorandum and Order, 14 FCC Rcd. 3160, 3198 ¶ 75 (1999).

[7] *Id.* at 3207 ¶ 96.

[8] Telecommunications Act of 1996, Pub.L.No. 104-104, 110 Stat. 56 (1996) (1996 Act).

[9] The Internet is a worldwide system of public and private computer networks that allows for the exchange of information--voice, video, data--through a universal language (protocol) called TCP/IP. To access the Internet, the customer generally needs a computing device and a subscription to either an ISP or an OSP. The computing device translates the information from TCP/IP into a format that is recognizable (e.g. text, image, sound). The ISP or OSP provides the physical connection to the Internet, as well as Internet-related services (*e.g.*, Web-hosting, e-mail and proprietary content).

[10] *See* Chairman William Kennard, Connecting the Globe: A Regulator's Guide to Building a Global Information Community (1999), available at <http://www.fcc.gov/connectglobe/sec9.html>.

[11] 1996 Act, § 706 (c)(1), 47 U.S.C 157 note.

[12] *Id.*

[13] *Id.*

[14] Section 706 Report, 14 FCC Rcd. at 2406 ¶ 20. We believe that Congress intended broadband to be faster than Integrated Services Digital Network (ISDN) service, which operates at a data rate of 128 kilobits per second (kbps) and was widely available at the time the 1996 Act was enacted.

[15] *Id.*

[16] *Id.*

[17] *Id*. at 2406 ¶ 20 (citing Comments of Cincinnati Bell Tel. Co. at 7).

[18] Id. at 2407 ¶ 23 (citing Comments of e-spire Communications, Inc. at 4; Comments of Information Technology Association of America at 2 n.3).

[19] *Id.* at 2407-08 ¶ 25.

[20] The information in this section is drawn primarily from Barbara Esbin, *Internet Over Cable: Defining the Future in Terms of the Past*, OPP Working No. 30, at 75-79 (Aug. 1998) (Esbin White Paper) (citing National Cable Television Association (NCTA), *Telecommunications and Advanced Services Provided by the Cable Television Industry* at 3-26 (April 1996); and NCTA, *The Cable Television Handbook*, Section 3 (January 1997)).

[21] The headend is the technological center of the system, where many programming operations and functions are processed, such as the reception of satellite delivered programming and broadcast signals. It includes facilities for descrambling incoming signals from satellite and broadcast programming networks, assigning them channel numbers, and processing them for retransmission over cable lines. The headend also contains electronic equipment for inserting advertising at the local level, encrypting signals for security purposes, and playing or producing public access/local origination programming.

[22] DSL comes in numerous varieties but fall into two general categories: symmetrical (SDSL) and asymmetrical (ADSL). ADSL is the most common form of DSL for the residential market.

[23] Jonathan Atkin, Ferris, Baker Watts, Inc., *Bring on The Bandwidth . . .*, at 45 (July 1999) (FBW Report).

[24] Salomon Smith Barney Telecommunications Services, *xDSL Breaking the Loop*, at 11 (April 1999) (Salomon Report).

[25] FBW Report at 45.

[26] *Id.*

[27] *Id.*

[28] Salomon Report at 15. Some of these implementation issues include: load coils; cross-talk; signal attenuation; digital loop carriers; and bridge taps.

[29] *Id.*

[30] FBW Report at 54.

[31] *Id.*

[32] Salomon Report at 5

[33] *Id.*

[34] *Id.*

[35] PriceWaterhouseCoopers, *Technology Forecast: 1999 (10th ed.),* at 88 (1999); Salomon Report at 18.

[36] FBW Report at 63; Salomon Report at 20.

[37] *See* FBW Report at 63. Fixed wireless providers must also address the challenge reaching full production status on equipment that is necessary for large-scale commercial deployment.

[38] *Id.*

[39]*See* Section 706 Report at Appendix A.

[40] Salomon Report at 22.

[41] The transmissions for these broadband satellite systems would be sent and received using two-way antennas. In other words, both the downstream and upstream transmissions are provided through the satellites. Although DirecPC currently offers high-speed Internet access, it is a one-way system that utilizes the satellites for downstream transmissions and the existing telephone lines for upstream transmissions.

[42] *See* 706 Report at Appendix A; ING Baring Furman Selz LLC, *The Satellite Communications Industry*, at 140-41 (May 1999) (ING Barings Report). The following list identifies several global broadband satellite projects (and their start of service date): Astrolink (2001); CyberStar (2000); Skybridge (end 2001); Spaceway (2002-3); Teledesic (2003).

[43] Some of the technology and engineering concerns include the following: developing affordable customer premises equipment; addressing signal attenuation during inclimate

weather; in the case of low earth orbiting (LEO) systems, launching into space several dozen satellites.

[44] PWC Report at 54 (1999).

[45] Information in this section is drawn primarily from *Fifth Annual Assessment of the Status of Competition in the Market for the Delivery of Video Programming*, CS Docket No. 98-102, Report, 13 FCC Rcd 24284, 24313-24321 ¶¶ 52-59 (1998) ("1998 Competition Report"), and <http://www.cabledatacomnews.com/cmic/cmic1.html>

[46] *See generally* <http://www.cabledatacomnews.com/cmic/cmic1.html> A "cable modem" is the equipment that converts data transmissions from the cable headend for use in the subscriber's premises. In the home, a cable modem connects the cable television coaxial wiring to the user's personal computer. Despite its name, a cable "modem" is, in fact, not a MOdulator-DEMOdulator (MO-DEM) at all. Instead, most cable modems are simply "external devices that connect to a personal computer (PC) through a standard 10Base-T Ethernet card and twisted-pair wiring." These Ethernet connections enable a subscriber's computer to become part of the cable operator's virtual local area network (LAN).

[47] *See* <http://cabledatacomnews.com> A LAN is a computer network limited to an immediate area. An Ethernet is a very common method of networking computers in a LAN. An Ethernet will handle about 10,000,000 bps and can be used with almost any kind of computer.

[48] Many operational issues exist including capacity management, traffic engineering, fault detection and clearance, failure recovery, provisioning, customer servicing, network administration, traffic policy management, etc. These areas are new and complex in a shared media, public high-speed data communications network. *See* <http://www.matisse.net/files/glossary.html>

[49] An Intranet is a private network inside a company or organization that uses the same kinds of software that you would find on the public Internet, but that is only for internal use. As the Internet has become more popular, many of the tools used on the Internet are being used in private networks. For example, many companies have Web servers that are available only to employees. *See* <http://www.matisse.net/files/glossary.html>

[50] Owned and operated by the ISPs, a regional distribution center or hub usually connects several cable headends to the public Internet.

[51] Dial-up services require the user to place a telephone call connection to the ISP/OSP each time access to the Internet is desired.

[52] *See* 1998 Competition Report, 13 FCC Rcd. at 24416-17, App. B, Tbl. B-9.

[53] CableLabs is a membership organization consisting of cable system operators in North and South America. <http://www.cablelabs.org/start_here/index.html> In 1998, the

International Telecommunications Union (ITU) approved the Data Over Cable Service Interface Specification System (DOCSIS) developed by CableLabs, as an international standard for the transmission of data over cable. CableLabs® *International Telecommunications Union Approves DOCSIS Modem Standard*, (news release) (March 19, 1998). The ITU standard sets forth definitions for high-speed, two-way data transmissions over cable.

[54] Currently, cable modems are available in some retail outlets, but these modems may not be technically compliant with DOCSIS standards, and may not be interoperable with modems that will appear after DOCSIS certification.

[55] *Cable Modem Subscriber Count Tops 1 Million*, Cable Datacom News (Aug. 1999), available at <http://www.cabledatanews.com/cmic>

[56] *Id.*

[57] *Id.* Traditional cable networks are one-ways systems wherein the video signals travel in one direction: from the cable headend to the subscriber's home or business. In the context of cable modem service, one-way systems utilize the cable wires for downstream transmissions and existing telephone wires for upstream transmissions

[58] 1998 Cable Competition Report, 13 FCC Rcd. at 24316 ¶ 55.

[59] *See* <http://www.cabledatanews.com/cmic>

[60] *See* <http://www.cabledatacomnews.com/aug99/aug99-1html> AT&T (formerly TCI), Cox Communications, and Comcast are the major cable partners in Excite@Home. Time-Warner Cable and MediaOne Group are the major cable partners in RoadRunner.

[61] *Id.* Approximately 275,000 of Excite@Home subscribers are in Canada, bringing its U.S. total to 395,000.

[62] *Id.*

[63] <http://www.cabledatacomnews.com/cmic/cmic7.html>

[64] *Imposing Common Carrier-Style Regulation on Cable Would Impede Deployment of Cable's High Speed Internet Service To Rural and Small Communities*, NCTA *ex parte filing* (May 1999). *See* High Speed Access Corp. homepage, <www.hsacorp.net/pages/pnrl/mnr.html>; ISP Channel homepage, <www.ispchannel.com/press/01jul99.html>. In rural and small communities where computer penetration is generally lower than the national average, the high fixed costs related to establishing high speed networks are spread over a smaller customer base.

[65] *Imposing Common Carrier-Style Regulation on Cable Would Impede Deployment of Cable's High Speed Internet Service To Rural and Small Communities*, NCTA *ex parte*

filing (May 1999). The following list provides few examples of cable systems offering broadband and/or high speed Internet access to rural and small markets:

- In North Dakota, Cable Services Inc. has recently partnered with ISP Channel to offer residential and business broadband services to Jamestown and Valley City.
- Midcoast Cable, in partnership with High Speed Access (HSA) Corp., is offering one-way high speed Internet service in its El Campo and Edna, Texas systems, which pass approximately 5,700 homes.
- TCA Cable TV, through its subsidiary TCA Communications, Inc., has launched broadband service in Bryan/ College Station, Tyler and Amarillo, Texas.
- Sjoberg's Cablevision Inc., has partnered with ISP Channel to offer high-speed cable modem service over a two-way hybrid fiber/coax network to its community in Thief River Falls, Minnesota, which has a population of approximately 8,200.
- Lakes Cable in Spirit Lake, Iowa has deployed the InterTECH IDS system to bring high-speed cable modem service to its cable system serving approximately 4,000 customers.

[66] Lehman Brothers, *ADSL v. Cable Modems: And the Winner Is . . .*, at 6 (June 1999) (Lehman Report). Even conservative estimates indicate that cable should have over 4 million broadband subscribers by 2002. Based on the current subscriber total of 1 million, cable broadband market should experience an annual growth rate of over 100 % for the next 3 years.

[67] FBW Report at 78.

[68] AT&T stated that plant upgrades to support broadband should reach nearly 60% of homes passed by the end of 1999 and 90% of homes passed by the end of 2000. Similarly, MediaOne has stated that its plant upgrades will reach 70% by the end of 1999 and over 90% by the end of 2000.

[69] Lehman Report at 17.

[70] *See* <www.home.net/source>

[71] DSL figures available at <http://www.telechoice.com/content/pressreleases/08171999.asp>.

[72] *Id.*

[73] The deployment of DSL could have an adverse impact on the telephone companies' T1 business. T1 is a form of high-speed access that was sold primarily to business customers. With a price range of $300 to $3000 per month, the T1 business generated high profit margins for the telephone companies. Since the price point of DSL was lower, ranging from $50 to $1000 per month (depending on the type of DSL), the deployment of DSL service would undercut the T1 business. *See* Banc of America Securities, Equity Division, *Wireline Telecom Services*, at 3 (April 1999). (BofA Report).

[74] DSL offerings have followed cable modem service in the following areas: Denver, San Diego, Phoenix, Los Angeles, and Salt Lake City.

[75] Lehman Report at 6. According to Lehman Brothers estimates, cable will capture 14.5 million subscribers and DSL will capture 10.5 million subscribers by end of year 2007.

[76] BofA Report at 15, 25; Salomon Report at 26. For example, by year-end 1999, Covad plans to have its DSL service available nationwide to 26 million homes and 2.6 million businesses.

[77] Bear Stearns Report; *Cable Industry Outlook*, at 67, 71-78 (1999) (BSR); Donaldson, Lufkin & Jenrette, *Cable Report*, at 19 (Spring 1999) (DLJ Cable Report). DSL technology is distant sensitive, meaning that the signal degrades after travelling certain distances—normally 18,000 feet from the central office. G.lite does not degrade as fast as DSL when travelling lengths of up to 18,000 feet. Having less degradation of the signal, G.lite effectively increases the telephone company's coverage area for DSL.

[78] BSR at 67. G.lite does not require installation of a voice/data splitter at the subscriber's home or business.

[79] DLJ Cable Report at 19.

[80] *DSL Deployment Surges Well Beyond Projections; Grows 5 Times Faster Than Cable in 6-Month Period*, at <www.telechoice.com/content/pressrelease/08171999.asp>

[81] DLJ Wireline Report at 23.

[82] Bill Menezes, *Lucent Says Solution Will Accelerate DSL Further*, Multichannel News--Broadband Week (Aug. 2, 1999).

[83] BSR at 77; Communications Daily, July 21, 1999 (citing SBC 2Q Earnings Report; SBC is signing up 1,500 new subscribers per week in California alone); Lehman Report at 6.

[84] BSR at 77. At the end of the first quarter 1999, US West had 30,000 DSL subscribers, of which 85% were residential subscribers. *DSL Access Race—May 1999*, available at <http://www.telemagazine.com/issues/199905/tci/dsl.html>

[85] *Id*. GTE's discounted pricing structure is 20% lower than its then existing lowest priced DSL service. This discounted DSL pricing is also comparable with cable modem pricing.

[86] US West's News Release, *US West New 'MegaBit Select'. . .* (July 7, 1999).

[87] DLJ Wireline Report at 23.

[88] *Id*.

[89] *EarthLink Taps GTE Internetworking For National DSL Network Services*, available at <http://www.xdsl.com/newsrelease/xdsl/4698.asp?mode=welcome>

[90] News Release, *EarthLink and MindSpring Announce Strategic Merger*, available at <http://www.mindspring.net/aboutms/press-releases/1999/0923.html>

[91] *Villagenet Inc. Enters National DSL Market*, available at <http://www.xdsl.com/newsrelease/xdsl/4750.asp?mode=welcome>

[92] *Covad Introduces New Services to Help Power the Next-generation Internet*, available at <http://www.xdsl.com/newsrelease/xdsl/4703.asp?mode=welcome>

[93] These fixed wireless providers have licenses operate at specific parts (or bands) of the spectrum. The following list details the various types of fixed wireless companies and their bands of operation: Multichannel Multipoint Distribution System (2.1-2.7 GHz); Local Multipoint Distribution Service (28-31 GHz); Teligent (24 GHz); and Winstar (38 GHz).

[94] *See,e.g.*, Salomon Report at 21; *Winstar To Provide Boston Properties With Advanced Broadband Telecommunications Services*, July 8, 1999, available at <www.winstar.com/PressRelease/78_boston_properties.htm>; <www.teligent.com>. According to some industry estimates, ILECs are failing to meet the data needs of 750,000 multi-dwelling units in the United States—needs that could be quickly and inexpensively addressed with broadband wireless services. , *The 3G Force*, Red Herring No. 69 at 88 (Aug. 1999).

[95] Nextlink's Website at <www.nextlink.com/ra/info/rainfo.html>.

[96] *Id.*; Salomon Report at 21.

[97] Previously, the Commission only licensed MMDS systems to provide one-way video services. In the fall of 1998, the Commission changed its licensing rules and permitted MMDS systems to offer two-way services, such as broadband access.

[98] Hoexeter's CLECtive Notes, Issue #16, Goldman Sachs (July 1999). Following its purchase of WBS America in July, Sprint now has access to almost 30 million households nationwide. Sprint plans to offer its broadband product called ION (Integrated Online Network) over its MMDS systems. As of the writing of this Report, MCI WorldCom and Sprint announced their intention to merge. Press Release, MCI *WworldCom and Sprint Create Pre-eminent Global Communications Company for 21st Century* (Oct. 5, 1999), available at <http://www.wcom.com/cgi-bin/pr/display.pl?cr/19991005>. The combined entity plans to offer a unique nationwide broadband access alternative to both cable and traditional telephony through a combination of DSL facilities and fixed wireless access using the combined company's nationwide MMDS spectrum.

[99] ING Barings Report at 145.

[100] *Id.*

[101] *Id.*

[102] *Id.*

[103] *Id.* at 143.

[104] Cable operators are considered MSOs if they own and/or operate more than one cable system. MSOs are rapidly upgrading their hybrid-fiber coaxial cable networks to provide for two-way broadband services. Once upgraded, MSOs will be able to offer their subscribers an array of communication services, including digital video, telephony, and high-speed Internet. Examples include AT&T/TCI, Comcast, Cox, Cablevision, and Time-Warner Cable.

[105] Cable companies are regulated both by the federal government and LFAs. LFAs' authority includes jurisdiction over certain types of cable rates, rights-of-way, and franchise transfers. When a cable system is sold, its cable franchise must be transferred to the new owner. The LFA approves the franchise transfer. As part of the transfer process, some LFAs recently have decided to impose certain requirements on cable operators' provision of broadband services.

[106] Telecommunications companies that provide local telephony or voice services qualify as LECs. There are several variations of LECs. ILECs are the established local telephony providers in a given market. In most cases, GTE or the former Bell Operating Companies (Bell Atlantic, SBC, US West, BellSouth or Ameritech) are the ILECs, and they are subject to a host of regulatory requirements that include interconnection, unbundling, and resale obligations. Through a technology called Digital Subscriber Lines (DSL), ILECs are offering high-speed access through their existing telephone network.

[107] CLECs are new entrants to the local telephony market and compete against the ILECs for customers. CLECs focusing on providing data services are called DLECs. These companies are also utilizing DSL technology to provide high-speed Internet access to customers.

[108] Telecommunications companies that provide long distance telephony and data services are called IXCs. Many of these companies provide Internet backbone services that route Internet traffic among Internet service providers and other backbone providers. Examples include MCIWorldCom, Sprint, Qwest, and AT&T.

[109] ISPs generally offer businesses and consumers access to the Internet and other related services such as, e-mail, Web-site building and hosting. ISP offerings typically include dial-up analog, ISDN, dedicated and frame-relay based Internet connections. Although most ISPs currently offer only narrowband connections to the Internet, ISPs are

partnering with various ILECs and DLECs to offer broadband connections. Examples include Earthlink, MindSpring, and Flashcom.

[110] OSPs provide the same functions as ISPs, but they also bundle those services with original and proprietary content. Like ISPs, OSPs have an interest in gaining access to as many broadband facilities as possible in order to offer new multimedia rich content and applications over the Internet. Examples include AOL, CompuServ Inc., Netcom, and Microsoft Network.

[111] Trade groups represent the viewpoint of their members in a particular industry. There are several trade groups that focus on Internet access issues, specifically cable broadband access. For example, the Association of On-Line Professionals and the openNet Coalition favor government action to compel access to the cable broadband networks. Commercial Internet Exchange and the NCTA oppose government mandating access to cable broadband networks.

[112] Public interest groups generally advocate on behalf of cable, telecommunications, and Internet consumers. Examples include Consumer Federation of America, Media Access Project and the Center for Media Education.

[113] These organizations and individuals conduct academic research, studies, and programs on public policy issues.

[114] According to Wall Street analyst reports, cable company stock prices have downturned in recent weeks due, in part, to investor uncertainty created by the "open access" activity in local franchising areas. *See* Communications Daily at 1 (Aug. 4, 1999).

[115] Randy Barrett, Karen J. Bannan, & Louis Trager, Inter@ctive Week Online (Aug 2, 1999).

[117] Internet service provider Internet Ventures, Inc. (IVI) has petitioned the Commission to issue a declaratory ruling confirming that ISPs are entitled to leased cable access under section 612 of the Communications Act. *See* Public Notice, *Petition Seeking Declaratory Ruling That Internet Service Providers Are Entitled to Commercial Leased Access to Cable Facilities under Section 612 of the Communications Act of 1934, as Amended*, DA 99-1104 (June 8, 1999). IVI proposes to offer its subscribers the ability to download video programming from the Internet, as well as the ability to retrieve data such as Web pages and e-mail.

[118] *See* Section 4(i) of the Communications Act, 47 U.S.C. § 154.

[119] In its recent Unbundled Network Elements (UNE) Order, the Commission declined, except in limited circumstances, to require incumbent LECs to unbundle the facilities used to provide high-speed Internet access and other data services, specifically, packet switches and digital subscriber line access multiplexers (DSLAMs). Given the nascent

nature of this market and the desire of the Commission to do nothing to discourage the rapid deployment of advanced services, the Commission declined to impose an obligation on incumbents to provide unbundled access to packet switching or DSLAMs at this time. The Commission further noted that competing carriers are aggressively deploying such equipment in order to serve this emerging market sector. Press release available at <http://www.fcc.gov/Bureaus/Common_Carrier/News_Releases/1999/nrcc9066.html>.

[120] *See* Regulation Under the Telecommunications Act of Cable Carriers' Access Services, Telecom Decision CRTC 99-8, File No. 8697-C12-02/98 (July 6, 1999) (requiring incumbent cable carriers to file proposed tariffs for high speed access services with supporting cost information).

[121] *Excite At Home Shares Decline 11% on Report*, Wall Street J., at B6 (Aug. 10, 1999) ("AT&T maintains that it is committed to open access, and stressed that users can reach any Internet-service provider by clicking through Excite At Home's home page.").

[122] For example, the openNET Coalition is a group of ISP and LEC interests "dedicated to promoting the rights of consumers to obtain affordable, high-speed access to the Internet from the provider of their choice." <http://www.opennetcoalition.org/who/>. Hands Off The Internet is a coalition of Internet users "united in the belief that the Internet's phenomenal growth stems from the ability of entrepreneurs to expand customer choices without worrying about government regulation." <http://www.handsofftheinternet.com/mission.asp>.

[123] *See* Part I.C. of this Report.

[124] *See, e*.g., Mich. Sen. Bill No. 667, 90th Leg. (June 17, 1999) ("Each wireline broadband internet access transport provider who is, or is an affiliate of, an internet service provider shall provide any other requesting internet service provider access to its broadband internet access transport services, unbundled from the provision of content, on rates, terms, and conditions that are at least as favorable as those on which it provides the access to itself, to its affiliate, or to any other person. . . . The access required . . . shall be provided at any technically feasible point selected by the requesting internet service provider."); *but see* Minn. Senate File No. 1647, 81st Legis. Sess. (March 24, 1999) ("Every municipality shall refrain from exercising or attempting to exercise regulatory authority over the Internet . . . or high speed data and Internet access services offered to subscribers over a cable communications system"). H.R. 2637, 106th Cong., 1st Sess. (July 29, 1998) (proposing to mandate non-discriminatory access by cable network by unaffiliated ISPs, including interconnection, on same terms and conditions as affiliated ISPs).

[125] In fairness to the parties advocating "open access," there does now appear to be a clearer meaning of the term. According to the openNet Coalition, "open access" refers to "the ability of consumers to choose the Internet service provider of their choice . . . Enabling consumers and their chosen Internet service providers to reach each other requires that Internet service providers not chosen by the cable company have the ability

to purchase, on a nondiscriminatory basis, the use of 'last mile' communications facilities to reach consumers who are requesting their service." openNet White Paper at 23.

[126] Federal legislation is pending in the House of Representatives that would address this issue. *See* H.R. 2637, 106th Cong. (1999).

[127] *See, e.g., Implementation of the Telecommunications Act of 1996; Accounting Safeguards Under the Telecommunications Act of 1996,* CC Docket No. 96-150, Report and Order, 12 FCC Rcd. 2993 (1996) (and subsequent history); *Implementation of the Non-Accounting Safeguards of Sections 271 and 272 of the Communications Act of 1934, as amended*, CC Docket No. 96-149, First Report and Order and Further Notice of Proposed Rulemaking, 11 FCC Rcd. 21905 (1996) (and subsequent history).

[128] A peering arrangement describes the situation where firms exchange data traffic without charging one another (bill-and-keep). A local peering arrangement is when the exchange occurs at a site close to the end-users. This proximity essentially improves the performance and speeds of the Internet connection, as data traffic travels less distance.

[129] Frequently Asked Questions About AT&T's Acquisition of MediaOne, Open Access, and the Public Interest, CS Docket No. 99-251, at 24 (Sept. 17, 1999) <http://www.opennetcoalition.org/news/937594756.shtml>.

[130] Corey Grice, *The Next Wave in Fast Net Access*, CNET News.com (July 28, 1999) ("The development of new high-speed conduits for Internet access may mute Internet service providers' call for access to cable wires, one of the main broadband technologies available today. Federal regulators, ultimately responsible for refereeing the open-access battle, are pushing to see as many broadband options as possible to enter the market.").

[131] *See* Section 706 Report, 14 FCC Rcd. at 2423-24 ¶ 48.

[132] David B. Kopel, *Access to the Internet: Regulation or Markets?*, Heartland Institute Policy Study No. 92, at 12-14 (Sept. 24, 1999). "The clear lesson of the past 20 years is that companies with leading products stay in the lead only if they continue to produce superior products. There is no realistic danger that cable companies will dominate the broadband industry, unless the companies consistently deliver better value to the consumer than does the competition." <http://www.heartland.org/studies/kopel-sum.htm>.

[133] *See* Section 706 Report, 14 FCC Rcd. at 2469 (separate statement of Commissioner Michael K. Powell).

[134] Letter dated July 29, 1999, from Jeffrey Chester *et al.* to Chairman William Kennard at 1 ("the cable broadband networks can be intentionally manipulated to provide wide bandwidth to the user for commercially affiliated content, but significantly less bandwidth for generic and cable-unaffiliated Internet traffic.").

[135] *See* Part I. C. of this Report.

[136] We note also that San Francisco and Los Angeles would be bound by any pronouncement by the U.S. Court of Appeals for the Ninth Circuit, and that the pendency of the *Portland* appeal has some influence on these cities decision to refrain from mandating an access requirement. Other municipalities outside of the Ninth Circuit's jurisdiction may also be awaiting guidance on the legality of "open access" before they adopt any such measures.

[137] 14 FCC Rcd. 3160 (1999).

[138] *See* Chairman William Kennard, Address at the National Association of Telecommunications Officers and Advisors 19th Annual Conference (Sept.17, 1999).

[139] Esbin White Paper at 112. *See also* Jason Oxman, *The FCC and the Unregulation of the Internet*, OPP White Paper No. 31, at 25 (July 1999) ("The Commission should not, and has not, respond to the advent of innovative category-challenging services by squeezing them into existing regulatory categories.").

[140] AT&T Chairman C. Michael Armstrong stated that, "We believe our cable customers should be able to access any portals and content they want to reach, [b]ut it should be done on the basis of a sound commercial relationship, not through regulation" of the Internet or communications industry at large. Leslie Cauley, *AT&T to Shun Exclusive Pacts for Cable TV*, The Wall Street J., at B8 (June 15, 1999).

[141] *See* 1996 Act, Preamble.

[142] As a CLEC, AT&T would be required to provide interconnection for competing providers of telephony services under section 652(a) of Title II, but would not be required to provide competitors with access to AT&T's network in the same way as ILECs under section 652(b). *See* 47 U.S.C. 652(a) & (b). The regulatory burden on AT&T's provision of telephony services thus would be substantially less than a cable "open access" requirement on its provision of broadband services.

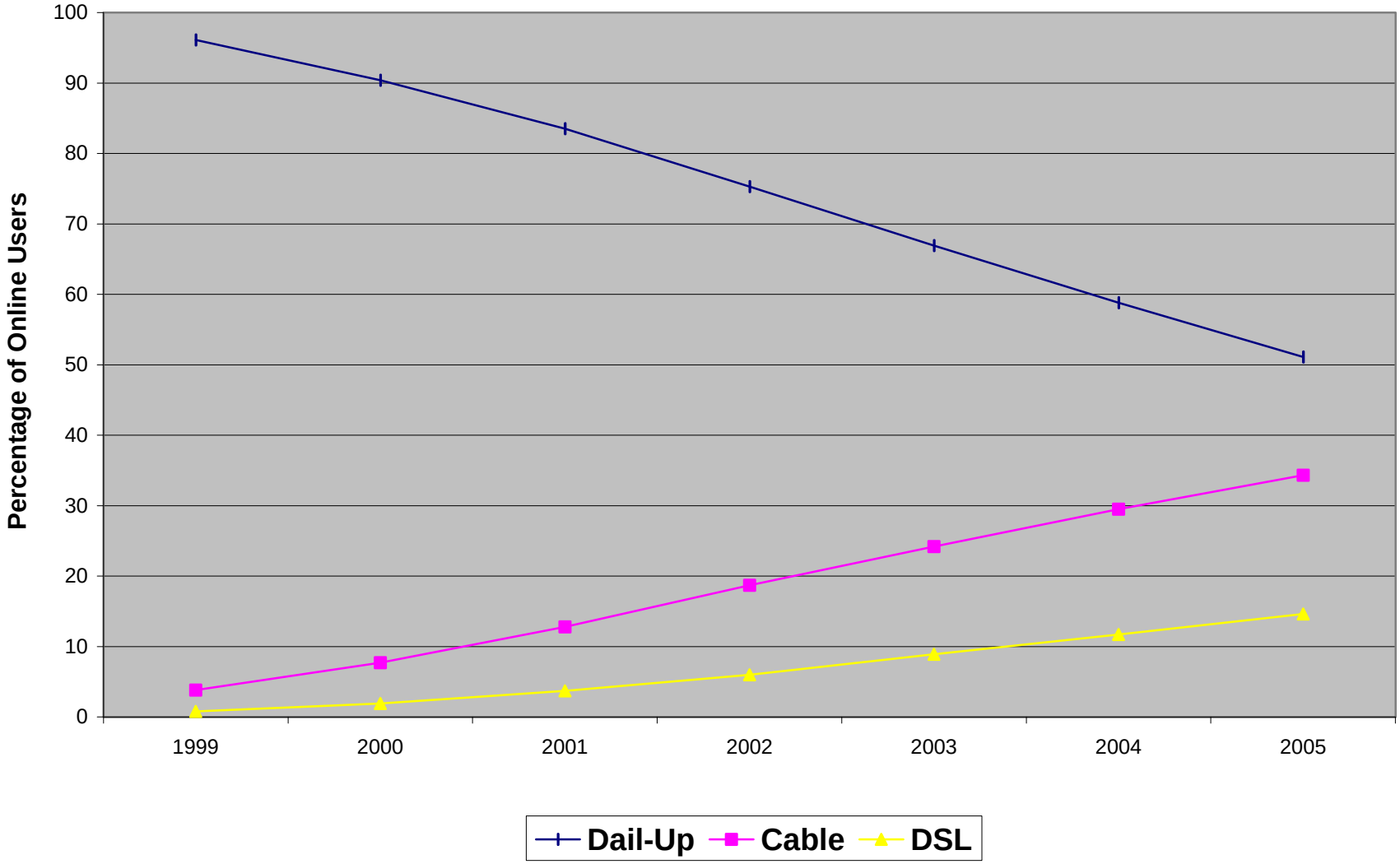
APPENDIX A:

Breakdown of Online Universe

Breakdown of Online Universe

1999E--2005E

Source: Donaldson, Lufkin & Jenerette Estimates, IDC



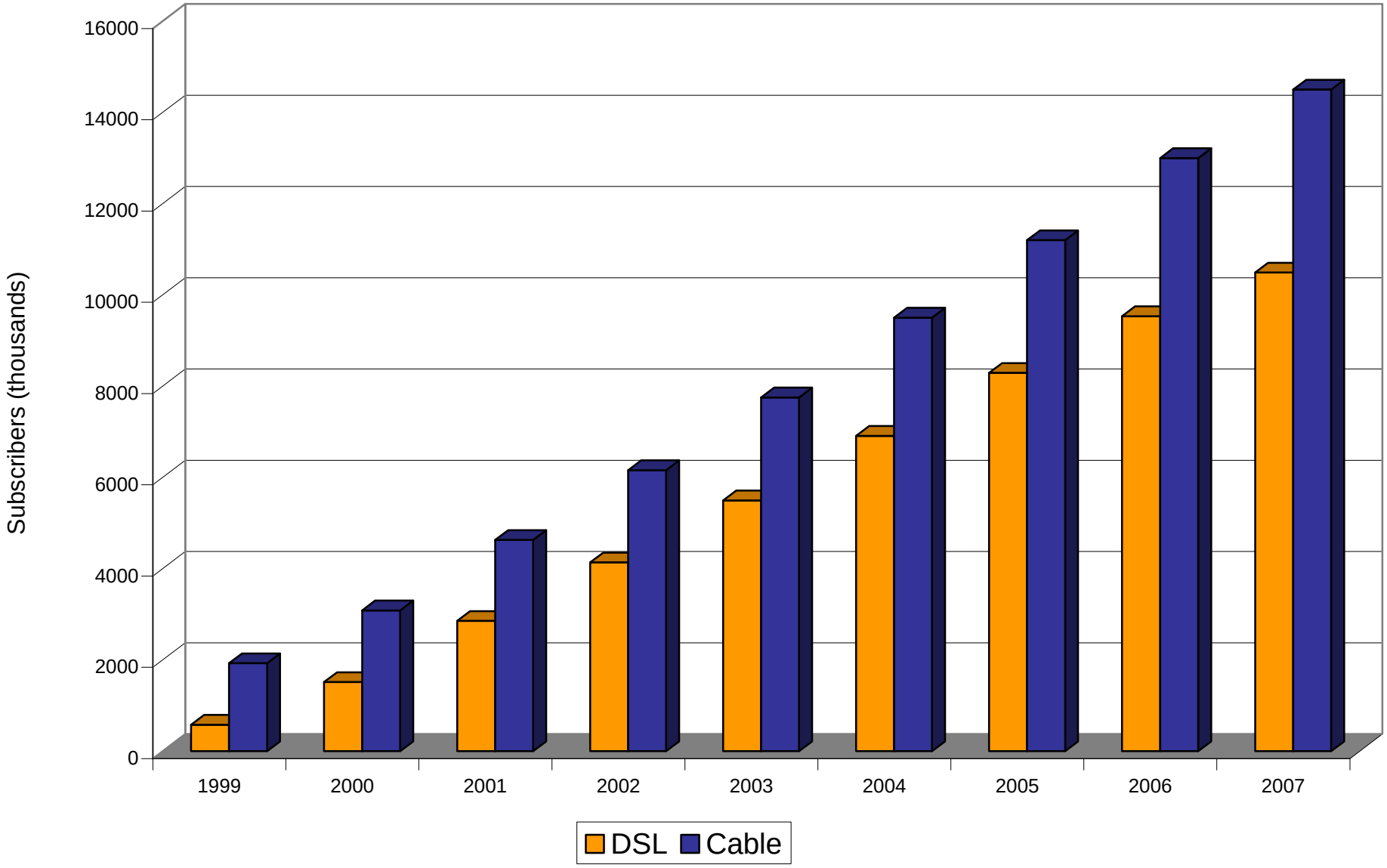
APPENDIX B:

Residential Broadband Subscribers
1999 - 2007

Chart 2

Residential Broadband Subscribers, 1999-2007
(Cable & DSL Growth Estimates)

source: Lehman Brothers



BROADBAND GLOSSARY

A

Access: The service provided by local exchange carriers or alternate access providers, that enables a user to enter a circuit and connect with an interexchange carrier.

Access Channels: Channels set aside by a cable operator for use by third parties, including the public, educational institutions, local governments, and commercial interests unaffiliated with the operator (see also PEG and LEASED ACCESS).

(ACD) Automatic Call Distributor: A device that is able to distribute incoming calls to a certain group of terminals.

(A/D) Analog to Digital Converter: A device that constantly converts varying analog signals to digital signals.

(ADI) Area of Dominant Influence: A television market as delineated by the Arbitron Company.

Addressable: Capable of being activated or accessed remotely by signals sent from a cable system's headend (addressable usually refers to descramblers and other set-top boxes).

(ADSL) Asymmetrical Digital Subscriber Line: A modem technology that provides greater bandwidth from ordinary telephone lines. Asymmetrical is able to provide faster one way speed connectivity between the central office and the customer premises.

Aerial Plant: Cable that is suspended above ground on telephone or utility poles.

(AIN) Advanced Intelligent Network: A network architecture that allows major foreign and US telecommunications companies to direct telephone calls based on activating points to the database used in Signaling System 7 (SS7).

Amplifier: A device that boosts the strength of electronic signals.

Analog: A mechanism or method in which data is represented by continuous variable physical quantities and that uses nondiscrete variations in frequency, amplitude or location to carry sounds, signals, mathematical data or other information.

(ANI) Automatic Number Identification: A function by which the directory number of a calling unit is automatically obtained.

(ARPA) Advanced Research Project Agency: An agency of the U.S. Department of Defense that funded the ARPANet as a research network.

Aspect Ratio: The ratio of a television screen's width to its height (4:3 for NTSC, 16:9 for HDTV).

(AT) Access Tandem: A switching system that provides an interexchange carrier with access to more than one end office.

(ATM) Asynchronous Transfer Mode: A high-speed multiplexing and switching technique that uses fixed size of cells to support several types of traffic such as voice, data and video.

(ATV) Advanced Television: A series of digital television technologies that are designed to improve the current commercial-quality television system.

B

Basic Cable: Primary level or levels of cable service offered for subscription. Basic cable offerings may include retransmitted broadcast signals as well as local and access programming. In addition, regional and national cable network programming may be provided. Basic service offerings at the system level may be offered as more than one tier.

Bipolar Signal: A signal that can take on two polarities, of which neither is zero.

Box: Electronic equipment used to process television signals in a consumer's home, usually housed in a "box" that sits atop a TV set or VCR. See also CONVERTER and DESCRAMBLER.

(BPS) Bits Per Second: Transmission rate for digital information expressed as the number of bits (zeroes or ones) sent or received per second.

Broadband Communications System: A network such as a cable system capable of delivering multiple high capacity services simultaneously.

(BS) Base Station: A fixed land station in the land mobile service that relays signals to and from mobile voice and data terminals or handsets.

(BSS) Business Support System: A system that supports and manages information of various telecommunication functions such as billing, data warehousing, customer care, network management and account receivables.

(BW) Bandwidth: A measure of the capacity of a channel of communications in the broadcast spectrum. A range of frequencies or the amount of spectrum used to transmit pictures, sound, and data (In the United States, the Federal Communications Commission has assigned broadcast television channels a bandwidth of 6 megahertz).

Bundling: Combining goods and/or services into a single package, often for a discounted price.

C

Cablecasting: The use of cable systems by federal, state, and local officials to disseminate information and television programming to their constituents.

Cable Modem: A communication device connected to a personal computer which offers customers access to the Internet over a cable system at speeds 50-100 times faster than a telephone connection.

Cable Ready: Label for consumer electronic devices, such as television sets and VCRs, that are designed to allow direct connection to a cable television network.

Cable System: A localized communications network that distributes television, Internet, and telephone services by means of coaxial cables and/or fiber optics.

(CABS) Carrier Access Billing System: A software application also known as Integrated Access Billing System (IABS), that enables local exchange carriers (LECs) to measure minutes of use on access and thereby be able to bill LECs for it.

(CAP) Competitive Access Provider: Companies that provide connections to long distance providers while bypassing local telephone companies.

(CARS) Community Antenna Relay Service: Microwave facilities used to relay television, FM radio, and other signals from a cable television headend to a reception site for distribution over cable.

Cash Flow: A measure often used in the cable industry to assess a company's financial performance. Generally, cash flow is a company's earnings before non-cash expenses, such as depreciation and amortization, are taken into account.

(CATV) Community Antenna TV: Also known as Cable TV, it uses several TV units connected by cable to a common antenna to serve a community.

(CBR) Continuous Bit Rate: A transmission rate that is uniform.

(CCIS) Common Channel Interoffice Signaling: The basis for intelligent networks, it routes information to and from specialized databases stored in the network carriers' computers and uses a separate data line to route interoffice signals, thereby providing a faster call set-up.

(CCITT) Consultative Committee International Telephony and Telegraphy:
Presently known as the International Telecommunications Union (ITU), the ITU sets and develops standards for telecommunications.

(CDMA) Code Division Multiple Access: A digital cellular communications technology used as a multiplexing and multiple access technique in which multiple calls are individually coded for transmission over one channel simultaneously.

(CDPD) Cellular Digital Packet Data: Developed by IBM as a way to transmit short wireless data messages, such as credit card verification, over cellular providers' analog network.

(CDR) Call Detail Record: A system feature that tracks details about calls, such as type, time, duration, originator and destination. CDRs can be used for network monitoring, accounting and billing purposes.

(CELP) Code Excited Linear Prediction: An analog to digital speech coding method that provides near toll quality audio by utilizing smaller samples that are processed faster.

Central Office: A telecommunications facility (generally serving 10,000 telephone lines) where local calls are switched.

(CENTREX) Central Exchange: This is an exchange system run from the central office that routes and switches calls for commercial and non-profit organizations, while providing them with comparable services provided by private branch exchanges.

(CG) Character Generator: Device that electronically displays letters and numbers on the television screen.

Channel Capacity: Maximum number of television channels that a cable system can carry simultaneously.

(CLASS) Custom Local Area Signaling Services: A number translation service available within a Local Access and Transport Area (LATA).

(CLEC) Competitive Local Exchange Carrier: A company that has been allowed to offer local telephone service, in competition with the regional Bell companies.

(CMIP) Common Management Information Protocol: The protocol used in order to manage remote systems through an application process that interchanges information and commands.

(Coax)Coaxial Cable: A transmission line 1/4 to 1 inch thick with an inner wire to conduct signals and an outer aluminum coating to act as a ground. The two metal layers are separated by insulation and may be wrapped in a protective plastic sheathing.

(CODEC) Coder/Decoder: A device that converts digital codes to analog and vice versa.

Collocation: Placing a competitor's communications equipment in one's own facilities to allow efficient interconnection of different networks.

Committed Information Rate: The bandwidth committed by the carrier for the port connection that is assigned to a permanent virtual circuit in a frame relay network.

Common Carrier: A communications provider, such as a telephone company, which offers its services to all members of the public for a set fee (tariff). Common carriers are regulated by federal and state agencies and exercise no control over the content of the messages they carry.

Compression: A technique for reducing the number of bits that make up a digital television signal and reducing the amount of bandwidth required to carry it. By reducing the bandwidth necessary to carry compressed digital signals, cable companies and others can greatly increase the number of channels they offer to consumers.

Compulsory License: Statutory license (section 111 of the Copyright Act) which allows cable and MMDS operators to retransmit, for a prescribed fee, programming broadcast by television stations (see also SHVA).

Converter: Device which increases the number of channels that a TV set can receive by converting the large number of signals carried on a cable or satellite system to a single channel tuned by the TV set, e.g., channel 3 or 4.

(CPE) Customer Premise Equipment: The equipment at the customer's premises that connects with a carrier's communication network, such as terminals and inside wiring.

(CRIS) Customer Record Information System: A system that is used to maintain customers' usage records for billing purposes by many local exchange carriers (LECs).

(CSMA/CD) Carrier Sense Multiple Access with Collision Detection: A protocol by which all nodes attached to the network contend for access and listen if another PC is transmitting. If not, it starts to transmit or it waits to retransmit if it detects another station's jam signal.

(CSR) Customer Service Record: A detailed printout of a subscriber's monthly equipment and service charges billed by the local telephone company and uses corresponding USOC codes.

D

(DBS) Direct Broadcast Satellite: A TV broadcast service from a small satellite dish antenna that offers similar services, like that of cable TV, and which transmits highly compressed digital signals.

(DCS) Digital Crossconnect System: A high-speed data channel switch that in response to dialing instructions independent of the data traveling through, switches transmission paths.

(DDD) Direct Distance Dialing: A switched service that allows for whomever originates a call to directly place long-distance calls without assistance.

(DDS) Digital Data Service: A synchronized digital service that interconnects digital transmission centers.

(DE) Discard Eligibility: An indicator in a frame relay that identifies which frames can be discarded in case of network congestion.

Descrambler: Electronic circuit that restores a scrambled video signal to its original form. Television signals, especially those transmitted by satellite, are often scrambled to protect against theft and other unauthorized use.

Dialing Parity: The ability to reach a residential or business phone by dialing the same number of digits no matter which company's network is used.

(DID) Direct Inward Dialing: A feature that allows calls to the ten-digit DID telephone number to reach that specific extension without human interference.

Digital: An intelligence-carrying signal consisting of a stream of bits of zeros and ones for sound, video, computer data or other information.

Digital Cable: Cable services, programming, and equipment that use digital, not analog, formats (see DTV and HDTV).

Dish: A parabolic antenna used to receive satellite transmissions at home. The older "C band" dishes measure 7-12 feet in diameter, while the newer "Ku band" dishes used to receive high-powered DBS services can be as small as 18 inches in diameter.

Distant Signal: Television signal from another city that is imported and carried locally by a cable television system.

(DLC) Digital Loop Carrier: The supplies and equipment that are used for digital multiplexing of telephone circuits. This would include the lines.

(DLCI) Data Link Connection Indicator: The number sequence that identifies public data networks.

(DMA) Designated Market Area: A television market as delineated by the A.C. Nielsen Company.

(DMT) Discrete Multitone Technology: A technology that uses digital signals to transmit multiple signals over the present pair of copper wiring.

(DN) Directory Number: A 10-digit number assigned by the local telephone provider. Generally referred to as an individual's telephone number.

(DOCSIS) Data Over Cable Service Interface Specification: The leading standard for cable modems.

(DOD) Department of Defense: The United States federal agency overseeing the military.

Downstream: Flow of signals from a cable system's headend through its distribution network to a customer.

(DQPSK) Differential Quadra Phase Shift Keying: A phase modulation technique used in modems to code relative changes of a carrier signal phase in the transmitted waveform.

Drop Cable: The final stretch of coaxial cable that connects a customer's home to the cable system.

(DS-O) Digital Signal Level 0: A classification of digital circuits with a rate of transmission rate of 64 kb/s.

(DS-1) Digital Signal Level 1: The rate of transmission of a DS-1 (or T -1) is of 1 .544 Mb/s and 24 channels are associated with it.

(DS-3) Digital Signal Level 3: The rate of transmission of a DS-3 (or T -3) is of 44.736 Mb/s and is associated with 672 channels.

(DSC) Digital Selective Calling: A synchronous system that is used to set up contact by radio with a station or group of stations.

(DSP) Digital Signal Processors: A special programmable device used for digital signal processing by providing ultra-fast instruction sequences.

(DSU) Data Service Unit: An apparatus used to link data terminal equipment to the carrier's digital services, such as T -1.

DTH (Direct-To-Home): All satellite service providers, including C-band and Ku band (DBS).

(DTMF) Dual Tone Multi-Frequency: A type of double-frequency audio signals that are generated by a push-button device like those on a touch-tone telephone.

DTV (Digital TV): Television signals transmitted and received in digital format (discontinuous zeroes and ones; compare with ANALOG). Digital TV has several formats and varying degrees of resolution, from 480 lines per screen progressively scanned to 1080 lines interlaced. DTV includes HDTV, but not all DTV is HDTV since the bandwidth required for HDTV can be broken down to accommodate several DTV signals of lesser resolution.

Dual Cable: Two wires or coaxial cables operating side-by-side to provide extra channel capacity and interactivity.

(DWDM) Dense Wavelength Division Multiplexing: A technique by which multiple light signals (generally using four or more signals) of different wavelengths, are simultaneously transmitted in the same direction over a single optical fiber.

E

Earth Station: A large dish used for sending and receiving signals from a communications satellite. A one-way, receive-only earth station is known as TVRO.

(EB) Electronic Bonding: The ability to forge an interface between the operations support systems of the local and long distance service providers, thereby enabling the seamless exchange of information concerning network needs and customer orders.

(EDI) Electronic Data Interchange: An electronic messaging system for the trading and interchanging of information.

(ES) Earth Station: A satellite communications center, including the antenna, receiver and electronics necessary in receiving satellite transmitted signals.

(ESS) Electronic Switching System: It is a switching system for the telephone network that is based on time-division multiplexing of digitized analog signals.

Ethernet: The Institute of Electrical and Electronic Engineers' (IEEE) widely used access method for the local area network (LAN) protocol.

Exclusivity: Contractual right to be the sole exhibitor of a television program in a particular area at a specified time.

Extranet: The part of a company or an organization internal computer network which outside users and which uses the public Internet as its transmission system, but requires passwords to gain access.

F

(FCC) The Federal Communications Commission: Established by the Communications Act of 1934, the FCC is the federal agency in charge of overseeing interstate telecommunications, as well as all the communications services originating and terminating in the United States.

(FDDI) Fiber Distributed Data Interface: An ANSI define standard by which computers can communicate at 1 00 million bits per second over fiber-optic token ring network.

(FDDI-LAN) Fiber Distributed Data Interface- LAN: An American National Standards Institute (ANSI) and ISO defined standard for high-speed (100 MBPS) local area network (LAN) communications using fiber-optic cable as the transmission medium.

(FDMA) Frequency Division Multiple Access: A multiplexing and multiple access technique for sharing of a spectrum band where each user is assigned a single transmission channel.

(FEC) Forward Error Correction: A data transmission technique that is able to correct for bad data transmitted on the receiving end by using the correction bits and a predetermined algorithm sequence.

Feeder Line: Intermediate distribution line (fiber or coaxial cable) that connects a trunk from the headend to the drop cables serving individual homes.

Fiber Optics: Thin transparent fibers of glass or plastic that are enclosed by material of a lower index of refraction and in which Light-Emitting Diodes (LED)s send light through the fiber to a detector that turns the light into an electrical signal.

Firewire: An interface based on the IEEE–1394 standard which allows OpenCable™ set-top boxes to be connected to digital television sets without signal degradation.

Forbearance: A regulatory body's decision not to exercise its authority over a given market or company, usually because there is competition.

(FPS) Fast Packet Switching: A packet-oriented switching technique that uses short and fixed length packets to increase the throughput.

(FR) Frame Relay: A packet access protocol primarily used to interconnect distant LANs and routers together, to Internet access via T -1.

Franchise: Contractual agreement between a cable operator and a governmental entity that defines the rights and responsibilities of each in the construction and operation of a cable system within a specified geographic area.

Franchising Authority: Governmental body (city, county, or state) responsible for awarding and overseeing local cable franchises.

(FTP) File Transfer Protocol: Widely used prior to 1995, it is a protocol that enables the user to log onto computers at other sites and transfer or retrieve files. These files were retrieved/transferred in text format.

G

(GEO) Geostationary Earth Orbit: A satellite orbit for communications satellites 22,300 miles above the earth and whose speed is the same as the earth's rotation, so thereby appearing stationary.

(GS) Gateway Server: A station on the local area network that has devices necessary to provide system interoperability between one or more network users.

(GSM) Global Standard for Mobile Telecommunications: A TDMA standard set by the European Union for all European countries and increasingly used throughout the world, for two-way digital cellular systems. It operates in the 1.8 to 1.9 GHz band in North America.

H

H.323: An ITU standard for videoconferencing over packet-switched network which is widely supported for Internet telephony.

Hardware: Equipment involved in the production, storage, distribution, and reception of electronic signals, such as computers, amplifiers, cameras, and VCRs.

(HDSL) High Data Rate DSL: A digital subscriber line technology that allows for upstream data transmission at T -1 of fractional T -1 speeds and quality over copper wires.

Headend: Facility that originates and distributes cable service in a given geographic area. Depending on the size of the area it serves, a cable system may be comprised of more than one headend.

(HDTV) High Definition Television: Digital television which offers twice the resolution, wider screens, better sound, and better color than the NTSC format. “True” HDTV involves a 16:9 aspect ratio and at least 720 lines per screen.

(HFC) Hybrid Fiber/Coax: A network architecture developed by the cable industry which uses a blend of fiber and coaxial cable to bring consumers interactivity, greater channel capacity, increased signal strength, and improved
reliability.

Home Shopping: Cable and broadcast television programming which allows customers to view and order merchandise at home.

Homes Passed: Households with the ability receive cable service and which may opt to subscribe.

(HQ) Headquarters: A center of administration or operations.

I

(ILEC) Incumbent Local Exchange Carrier: A term used to refer to a Bell Operating Company.

Independent: An individually owned and operated cable television system (compare with MSO).

(I-NET) Institutional Network: A private, dedicated network built and/or operated by a cable TV system for local schools, businesses, or government.

Interactive: Two-way communications allowing a person to both send and receive information (compare with passive or receive-only systems, such as broadcast television).

Interconnection: The linking of two or more telecommunications networks, such as a cable system to a local exchange company or a long distance carrier.

Interlaced: A scanning format for televisions which blends two separate images, alternatively scanned on odd and even numbered lines, into one frame (compare with PROGRESSIVE scanning).

Internet: A global data network supporting research, engineering, commercial, information, and educational services.

Intranet: An in-house company network Web site that serves the employees of the enterprise and which offers similar features and services as the Internet.

(IP) Internet Protocol: An International Standards Organization (ISO) standard that implements the network layer 3 of an open system interconnection (OSI) model that contains a network address and is utilized in directing a message to a different network.

(IS) Information Service: The department in a company which oversees the computers, networking and data management. This term has been updated to IT (Information Technology).

(ISDN) Integrated Services Digital Network: A standard and integrated digital network that allows users to simultaneously send voice, data and video over multiple multiplexed communications channels from a common network interface.

(ISN) Internet Service Node: An interconnection point in the Internet network to other specific entities.

(ISP) Internet Service Provider: A service provider that has its own network (or leases) to which end-users dial into to connect to the Internet.

(ITSP) Internet Telephony Service Provider: A company that provides users with telephony service via the Internet through standard telephone wires.

(ITU) International Telecommunications Union: An international organization within which governments and private sectors set communications standards.

IXC (Interexchange Carrier): A long distance telephone company linking separate local exchanges.

K

(Kft) Kilofeet: A thousand feet.

(Km) Kilometer: A thousand meters, or 0.62 miles.

L

(LAN) Local Area Network: A data communications network that links together computers and peripherals to serve users within a confined area.

Leased Access: Commercial channels made available by a cable operator to third parties for a fee, as required by the Cable Acts of 1984 and 1992.

(LATA) Local Access Transport Area: The area in which Regional Bell Operating Companies were allowed to provide local telephone and exchange access services as a result of the divestiture of AT&T in 1984.

Layer-1: In networking, the fist phase of the communications protocol of the open system interconnection (OSI) model, also referred to as the physical layer, which provides the transmission of bits over the network medium.

Layer 2: The second layer of the open system interconnection (OSI) model that contains the physical address of a client or server station, also called the data link layer.

Layer 3: The third layer of the open system interconnection (OSI) model, which contains the logical address of a client or server station.

Layer 4: Also known as the transport layer, it is the layer of the open system interconnection (OSI) model which provides end-to-end management of the communications session.

Layer 5: The fifth layer of the open system interconnection (OSI) model that initiates and manages the communications session.

(LCD) Liquid Crystal Display: An electro-optical display technology that uses rod-shape molecules that flow like liquid and bend light.

(LDAP) Lightweight Directory Application Protocol: A protocol that is implemented in querying directory databases.

(LEC) Local Exchange Carrier: Any authorized carrier that has been given permission by the state PUC to provide local voice-level telecommunications services within a predetermined area

(LEOS) Low Earth Orbit Satellite: Satellites that orbit the earth at lower altitudes.

(LID) Line Information Database: These databases contain all valid telephone and calling card numbers, and when a user places a calling card call, these databases can provide validation.

(LMDS) Local Multipoint Distribution Service: A wireless cable system that enables greater upstream bandwidth than most other wireless services from a fixed station for entertainment video and CLEC services.

(LNP) Local Number Portability: A feature that allows customers to maintain their present telephone numbers when they change carriers for incoming calls.

(LO) Local Origination Programming: Material developed by an individual cable television system specifically for the community it serves.

Local Loop: The wire that connects a home or business to a telephone company's central office.

Local-To-Local: The retransmission by DBS of local TV signals back into their local broadcast markets.

Long Distance: A call in the public switched telephone network that goes beyond the local calling area.

Loop: A pair of wires that connects the central office to the telephone set. The telephone set is the location of the telephone.

M

(MAE) Metro Area Exchange: Major access points in a network in the Internet.

(MAN) Metropolitan Area Network: A communications network that covers a large portion of a city or a large campus through which two or more LANs interconnect.

(MDF) Main Distribution Frame: A unit that connects between outside plant cables and internal lines or line equipment in the central office (CO).

(MDS) Multipoint Distribution Service: A pay-TV broadcast delivery service through microwave frequencies from a fixed station to multiple small dish antennas.

(MF) Multi-Frequency: A frequency composed of two or more frequencies.

Miles of Plant: Number of cable plant miles laid or strung by a cable system; the cable miles in place.

(MM) Millimeter: A unit of measure for one thousandth of a meter.

MMDS (Multi-Channel/Multi-Point Distribution System): A wireless cable service using microwaves to transmit multiple television signals to customers.

MODEM (Modulator–Demodulator): An electronic device that allows users to connect computers and other equipment in their homes, schools, or businesses to a network for the purpose of sending and/or receiving data.

(MPEG) Moving Picture Experts Group: An international group that sets standards for compressing video images.

(MPLS) Multiprotocol Label Switching: A technical description for layer 3 switching using labels of fixed-Length to quicken the pace in traffic paths.

(MSO) Multiple System Operator: A major cable TV organization that has franchises in multiple locations.

(MUX) Multiplexer: A device that combines many input devices into one compiled signal to be carried over one telephone line.

Must Carry: A policy, developed by the FCC in the 1960s and codified by Congress in 1992, requiring cable systems to carry the analog signal of a local television station if that broadcaster so chooses (see also RETRANSMISSION CONSENT). The Supreme Court voted 5-4 in 1997 to uphold must carry for analog broadcast television signals.

N

(NAP) Network Access Point: Also known as the Internet Exchanges (IXS), it is a point where major Internet service providers come together and interconnect with each other.

Narrowcasting: Delivery of programming that addresses a specific need or highly focused audience.

Near Video On Demand: The practice of offering the same programming on different channels at different times so that customers do not have to wait long for a desired show to begin.

(NEL) Network Element Layer: The layer of an integrated digital network whose function and capabilities include the information necessary for billing and collection, for routing or transmission of a telecommunications service.

Network Non-Duplication Rules: FCC rules prohibiting a cable operator from importing a network's broadcast signals from a distant television market when they are available simultaneously from a local network affiliate.

(NIC) Network Interface Card: An interface card that interconnects all the adapters in a computer to provide access to the network.

Node: A connection point in a cable system (often where a fiber enters a neighborhood and connects to coaxial cables serving 200-1000 individual homes).

Noise: Static and other distortions to an electronic signal which degrade the quality of television pictures and sound received by the consumer.

(NPA) Numbering Plan Area: The first three digits of a North American telephone number, often an "area code", in which the first digit cannot be a 1 or a 0 and that the remaining numbers can be 2 through 9.

(NPAC) Number Portability Administration Center: A national database that keeps track of all ported number at the national and regional levels.

(NSP) Network Service Provide: An Internet provider that offers high-speed backbone services.

(NTSC) National Television System Committee: Responsible for the specifications administered by the FCC for commercial broadcasting.

Number Portability: The right of telephone customers to keep their existing phone numbers if they change locations or service providers.

O

Off The Air: Refers to the reception of broadcast television signals with a local antenna (either roof-top or set-top) instead of through a cable or satellite dish.

OpenCable: An initiative of the cable industry (through CableLabs) to develop and label a new generation of interoperable digital boxes available through retail stores that will provide subscribers with video, data, and interactive services.

Operating Income: Generally defined as a company's income before interest payments and taxes.

Optical Amplifier: A device that receives an optical signal and amplifies it and retransmits it as an optical signal to the system.

(OSI) Open System Interconnection: A logical structure developed by the International Standards Organization to enable devices from multiple vendors to communicate with any other OSI-compliant system.

OSP (On-Line Service Provider): An interactive computer service such as Road Runner, @Home, or AOL which provides subscribers with proprietary information as well as access to the Internet (compare with ISP).

(OSS) Operations Support Systems: A system that processes telecommunications information which supports various management functions like network management, inventory control, maintenance, trouble ticket reporting, surveillance and service provisioning.

P

Packet: A group of bits switched as a unit block of data used for transmission in a packet-switched network.

Pay Cable: A network or service available for an added monthly fee. Also called premium. Some services, call mini-pay, are marketed at an average monthly rate below that of full-priced premium.

Pay Cable Unit: Each premium service to which a household subscribes is counted as one unit.

Pay-Per-View: Pay service that enables a subscriber to order and view events or movies on an individual basis.

(PBX) Private Branch Exchange: A private telephone system switch that interconnects telephone extensions to each other, as well as to the outside telephone network.

(PCM) Pulse Code Modulation: The sampling of a signal and each sample is then digitized so as to have it transmitted over a medium.

(PCN) Personal Communications Network: A kind of wireless communications system that transmits through low-power antennas and uses lightweight and inexpensive handsets.

(PCS) Personal Communications Service: A wireless service concept that allow users to communicate with the combination of terminal and personal mobility. The allocation of spectrum in the 1800-1900 MHz band is called the PCS band.

PEG (Public, Educational, and Governmental): See ACCESS CHANNELS.

Penetration: The number of homes actually served by cable in a given area, expressed as a percentage of homes passed (e.g. cable penetration in November 1998 was 67.4 percent nationwide).

(PIC) Primary Inter-Exchange Carrier: The carrier for interstate and international calling that can be accessed without being required to dial extra digits. Calls get automatically routed to the customer's "PIC".

Point of Presence: A site where telecommunications companies (such as cellular and long distance providers) physically interconnect their systems with other networks (such as local telephone companies or cable companies).

Pole Attachment: The place where, for a fee, cable systems attach their wires to telephone or utility poles.

(POP) Point of Presence: The location at which a line from a long distance carrier (IXC) connects into a local telephone carrier's switching network facility.

(POTS) Plain Old Telephone Service: The basic telephone lines connecting most residential and small business users to the public telephone network.

(PPP) Point-to Point Protocol: A data link protocol that is popular for Internet access and for carrying higher level protocols, while supporting both asynchronous and synchronous lines.

Premium Services: Individual channels such as HBO and SHOWTIME which are available to cable customers for a monthly subscription fee.

Progressive: A scanning format used by computer monitors and some television sets where each picture frame is presented sequentially and is scanned continuously from the top left of the screen down to the bottom right corner (compare with INTERLACED).

(PRI) Primary Rate Interface: An interface standard for integrated services digital network providing a total of 1.544 MBPS.

(PSC) Public Service Commission: Also known as the Public Utilities Commission (PUC), a state regulatory body that oversees public utility service providers.

(PSN) Packet Switching Node: A node in a packet-switching network, supporting the formatting, transmitting and routing packets.

(PSTN) Public Switched Telecom Network: The common domestic telecommunications network that is access by private branch exchange trunks, telephones, and Centrex systems.

(PTM) Packet Transfer Mode: A technique of packet switching and transmission that enables more effective sharing of network resources by various users.

(PUC) Public Utility Commission: A state regulatory body that is responsible for establishing and implementing public policy and regulating intrastate utilities.

(PVC) Permanent Virtual Connection: A point-to-point virtual connection scheduled ahead of time for a long-term connection between data terminal equipment.

R

(RADSL) Rate Adaptive DSL: A modem technology (DSL) that maximizes the digital speed of copper lines and adjusts speeds in reference to signal quality.

(RBOC) Regional Bell Operating Company: The regional holding companies that resulted from the divestiture of A T& T. The previous 22 bell telephone companies were combined into 7 regional companies in 1984.

Regional Hubs: Fiber optic rings that link several adjacent or regional headends, thus improving reliability, lowering costs, and expanding cable's offerings to include Internet access and telephone service.

Retransmission Consent: A policy enacted by Congress in 1992 requiring cable operators to secure the consent of local television stations before retransmitting their signals. Instead of retransmission consent, broadcasters may choose MUST CARRY.

(RF) Radio Frequency: The range on the electromagnetic frequencies with radio transmission.

(RJ-11 Jack) Registered Jack -11: The type of phone jack that local telephone companies wire for most residential homes and which can only hold one line.

Router: A device that forwards data packets of a specific protocol type from one logical network to another logical network, based on routing tables and routing protocols.

(RSVP) Resource Reservation Protocol: A network protocol that signals a router to reserve a resource along the data path for real-time transmission.

(RT) RingbackTone: Also known as an audible ringing tone, it is the signal that the calling party hears during the ringing interval as an audio tone interrupted at a slow repetition rate.

(RTP) Real Time Protocol: An Internet protocol for the transmission of voice and video.

S

Satellite: Communications device usually located in geostationary orbit, which receives transmissions from earth and retransmits them to different parts of the globe.

(SBC) SBC Communications Inc: A regional telecommunications company made up of Southwestern Bell, Pacific Bell, Nevada Bell and Cellular One.

(SCE) Service Creation Environment: Software for inputting comprehensive and elaborate enhanced service specifications.

(SCP) Service Control Point: Software that enables carriers' computers to offer enhanced services by handling 800 numbers, collect and third-party billing calls, as well as calling cards, while involving the customer with data interaction.

Scrambling: An electronic security technique used to render a TV signal unviewable unless it is processed and restored by an authorized decoder or descrambler.

Set Top Box: see BOX, CONVERTER, and DESCRAMBLER.

Share: The percent of television households tuned to a particular program or category of programming.

SHVA (Satellite Home Viewer Act): Federal law (section 119 of the Copyright Act) which gives direct-to-home satellite distributors such as DBS a compulsory license for the retransmission of broadcast television programming. The SHVA will expire on December 31, 1999, unless extended by Congress.

Signaling: The transmission of electrical signals that contain switching information between stations, user's premises, offices and various central offices.

(SLIP) Serial Line Internet Protocol: A protocol that enables a computer to utilize Internet Protocol via high-speed modem and a telephone line.

SMATV (Satellite Master Antenna Television): Small-scale, private cable system using a central rooftop antenna to serve the TV sets in an apartment building, hotel, or multiple dwelling unit.

(SMDS) Switched Multimegabit Data Service: A fast packet-switching service offered by local telephone companies to provide cross-premises communications services between LANs.

(SMS) Service Management System: A system that coordinates all of the national 800 telephone numbers for all the US telephone companies through service control points (SCP).

(SONET) Synchronous Optical Network: An American National Standards Institute (ANSI) standard for high speed, fiber optical transmission on the network.

Spot Revenue: Revenue from advertising placed on a cable system by a local or national advertiser.

(SS7) Signaling System #7: An addressing protocol for setting up calls and providing a faster processing of a call by operating out of band, for transaction services such as caller ID, automatic recall and call forwarding.

(SSP) Service Switching Point: Software capable of sending triggering signals to service control points and queering these databases for information to process telephone calls.

(STP) Shielded Twisted Pair: A two-wire twisted metallic transmission line that is protected by a sheath of conductive material.

(STPs) Signal Transfer Points: Packet switches that routes signals over paths completely separate from the voice paths.

(STS) Synchronous Transport Signal: The signal rate carried over a Synchronous Optical Network (SONET).

Subscriber: This term is used interchangeably with household.

Switch: A mechanical or electronic device for making, breaking, or changing the direction flow of electrical or optical signals from one side to the other.

Syndicated Exclusivity (SYNDEX): Federal requirement that cable systems black out syndicated programming from distant signals (out-of-town television stations) for which a local broadcaster has exclusive contractual rights. For example, cable operators cannot import "I Love Lucy" as part of a distant TV signal if a local broadcaster has purchased the syndication rights for that program in its market. (The FCC eliminated this requirement in 1980 and subsequently reimposed it in 1990.)

System: Facility that provides cable service in a given geographic area, comprised of one or more headends.

T

T-I: Two pairs of copper wire that can carry 24 DS-O signals at a rate of 1.544 MBPS.

(TA) Terminal Adapter: An external device, which connects computers to an ISDN line.

TANDEM: A special ILEC switch which interconnects local ILEC switches directly serving providing dial tone to users with IXC or CLEC switches and/or networks.

(TCP/IP) Transmission Control Protocol/Internet Protocol: A communications protocol developed by the Department of Defense to inter-network dissimilar systems and operates at layers 3 and 4 (network and transport, respectively) of the OSI model.

(TDM) Time Division Multiplexing: A digital multiplexing method to merge signals from two or more channels, such as telephones, computers, and video, into a common channel for transmission over telephone lines.

(TELCO) Public Telephone Company: A company that provides telecommunication services.

Teleradiology: A system that enables the viewing and processing of images within a hospital's nuclear medicine departments or remote image viewing from home computers or remote sites.

(TELNET) Virtual Terminal Protocol: An Internet service that allows a user to create an interactive session with a computer on a different network as if they were actually on that system.

Tier: A package of television channels offered to customers for a single price. Most cable systems have more than one tier, e.g., a basic package including local broadcast stations, and one or more expanded tiers featuring popular cable program networks. In addition, cable operators offer premium subscription services, such as HBO and SHOWTIME, and pay-per-view events such as movies, boxing matches, and concerts.

(TMN) Telecommunications Management Network: A network using a set of international standards that interconnects and interfaces with a telecommunications network in order to interchange information in order to control and maintain the telecommunications network.

Translator: Relay system that picks up distant television signals, converts the signals to another channel to avoid interference, and retransmits them into areas the original television station could not reach.

Transponder: The part of a satellite that receives and retransmits a signal.

Transport: The transfer access service to and from a point of presence (POP) serving wire center and a customer's serving wire center or end office (EO).

Trunk: A communications network that can be used to connect circuits between switches or to interconnect switches themselves to form a network.

Trunking: Transporting signals from one central point in a cable system (such as a headend) to another site without serving customers directly. Trunking can be accomplished by using fiber optics, coaxial cable, or microwave, although fiber is now the norm for the cable industry.

(TV) Television: An electronic system of transmitting transient images and sound by means of electronic signals transmitted through wires and optical fibers.

Twisted Pair: The wire traditionally used by telephone companies to connect customers to their central offices. It consists of two or more strands of color-coded copper wire bound together in a protective sheath.

Two-Way: See INTERACTIVE.

(TWTA) Traveling Wave Tube Amplifiers: The main microwave repeaters or transmitters on a satellite.

U

(UDP) User Datagram Protocol: A host-to-host protocol, which allows an application program on one computer to send a datagram to an application on another computer via packet-switched communications network.

Unbundling: Requiring local exchange companies to separate the various components of their telephone service into independently available and separately priced features, such as the local loop, switching, operator assistance, and billing.

Underground Installation: Installing coaxial and fiber cable underground as opposed to hanging it from poles (compare with AERIAL PLANT).

(UNE) Unbundled Network Elements: Parts and components of a system that are sold separately, including local loops, OSS, local and tandem switches, as well as network interface devices.

Universal Service: A fund to which interstate carrier must contribute in order to provide access to the advanced interexchange telecommunications services to those people living in rural areas and where it world otherwise not be cost-efficient to invest.

Unserved Area: See WHITE AREA.

Upstream: Flow of information from a customer back up through a cable system to the headend.

V

(VCR) Video Cassette Recorder: A recording and playback machine that takes signals from a television camera via a television receiver and records them on magnetic tapes.

Video On Demand: The ability to provide television programming to customers upon request (see also NEAR VIDEO ON DEMAND).

(VOD) Voice Operated Device: A device that is operated by a system with speech recognition.

(VPI/VCI) Virtual Path Identifier Virtual Channel Identifier: The combination of the address of a virtual circuit and of a virtual path, thereby identifying a connection on an ATM network.

(VPN) Virtual Private Network: A private switched network that allows sites that are connected with one another to contact each other without dialing all eleven digits.

(VRU) Voice Response Unit: A device that is capable to form a spoken message from an assortment of stored words.

(VSAT) Very Small Aperture Terminal: A small earth station for satellite transmission and which is made up of one master earth station and several two-way satellite terminals. Commonly used by multinational firms in the transmission of fax, voice, and data throughout a widespread area.

W

(WAN) Wide Area Network: A network that connects two or more LANs in multiple cities via telephone lines.

(WDN) Wavelength Division Multiplexing: A technology that utilizes the transmission of multiple light signals simultaneously through the same optical fiber, while preserving the integrity of each individual signal.

White Area: An area unserved by a local, over-the-air broadcast signal (outside its grade B contour).

(WLL) Wireless Local Loop: A system that uses radio waves, as a substitute for copper in making telephone connections from your home or office to the public switched telephone network (PSTN).

(WWW) World Wide Web: A basic way of communication through the Internet for world-wide hypertext linking of multimedia documents.