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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
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

Adopted: January 28, 1999 **Released: February 2, 1999**

By the Commission: Chairman Kennard and Commissioners Ness, Furchtgott-Roth, Powell, and Tristani issuing separate statements.

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I. INTRODUCTION

A. Executive Summary

1. One of the fundamental goals of the Telecommunications Act of 1996[1] (the 1996 Act) is to promote innovation and investment by multiple market participants in order to stimulate competition for all services, including broadband communications services.[2] In this Report, we consider the deployment of broadband capability -- what Congress has called "advanced telecommunications capability."[3]

2. Increasingly, all electronic communications are becoming digital. Print, audio, video, voice, and data can all be transmitted in digital form, as collections of ones and zeros. Broadband makes it possible to send and receive enormous amounts of digital information at

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

[2] In the interests of simplicity, in this Report we sometimes use the single term "broadband" to refer to facilities that have "advanced telecommunications capability" and/or services provided at retail to consumers on such facilities. We define these terms further in ¶¶ 20-25 *infra*.

[3] The principal section of the 1996 Act concerning advanced telecommunications capability is Section 706, Pub.L. 104-104, Title VII, § 706, Feb. 8, 1996, 110 Stat. 153, reproduced in the notes under 47 U.S.C. § 157. It provides:

SEC. 706. ADVANCED TELECOMMUNICATIONS INCENTIVES.

(a) IN GENERAL.--The Commission and each State commission with regulatory jurisdiction over telecommunications services shall encourage the deployment on a reasonable and timely basis of advanced telecommunications capability to all Americans (including, in particular, elementary and secondary schools and classrooms) by utilizing, in a manner consistent with the public interest, convenience, and necessity, price cap regulation, regulatory forbearance, measures that promote competition in the local telecommunications market, or other regulating methods that remove barriers to infrastructure investment.

(b) INQUIRY.--The Commission shall, within 30 months after the date of enactment of this Act, and regularly thereafter, initiate a notice of inquiry concerning the availability of advanced telecommunications capability to all Americans (including, in particular, elementary and secondary schools and classrooms) and shall complete the inquiry within 180 days after its initiation. In the inquiry, the Commission shall 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.

(c) DEFINITIONS.--For purposes of this subsection:

(1) ADVANCED TELECOMMUNICATIONS CAPABILITY.--The term "advanced telecommunications capability" is defined, without regard to any transmission media or technology, 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.

. . . .

high rates of speed.[4] Widespread access to broadband capability can increase our nation's productivity and create jobs. Access to broadband can also meaningfully improve our educational, social, and health care services.

3. As discussed further below, the demand for broadband capability is growing rapidly. For consumers, access to broadband capability means that many new services and vast improvements to existing services will be available. These services could include real-time video in addition to telephony, so that families that connect over the phone can see each other as well as talk to each other. They could also include the ability to download feature-length movies in a matter of minutes. In addition, access to broadband capability means being able to change web pages as fast as changing the channel on a television. As a result of these services, new possibilities will open up for electronic commerce. There may also be increased prospects for at-home learning and working at home (a special help for those who are home-bound due to age or disability),[5] platforms for entrepreneurs to launch new information-based businesses and home-based businesses, great improvements in medical treatment, and health care at home in emergencies and for the chronically infirm[6] -- all potentially at prices that large numbers of consumers are likely to willingly pay. Some of these services will be possible with enhancements to today's cable, telephone, and other facilities. Others, however, will require the deployment of entirely new technologies, especially in the last mile to the home.

4. As Congress directed, we intend to ensure that broadband capability is being deployed on a reasonable and timely basis to all Americans.[7] We are encouraged that, as the demand for broadband capability increases, methods for delivering this digital information at high speeds to consumers are emerging in virtually all segments of the communications industry -- wireline telephone, land-based ("terrestrial") and satellite wireless, and cable, to name a few.

5. Congress has instructed us to assess the availability of advanced telecommunications capability to all Americans, including in particular elementary and secondary schools and classrooms; and to take "immediate action" if we find that such capability is not being deployed to all Americans in a reasonable and timely manner. We are

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[4] The term "broadband" is generally used to convey sufficient capacity -- or "bandwidth" -- to transport large amounts of information.

[5] *See* Comments of Randall Wolf.

[6] *See, e.g.*, Comments of MediaOne Group, Inc., at 10.

[7] *See supra* note 3.

committed to following this instruction while also promoting the deregulatory and procompetitive goals of the 1996 Act. Our role is not to pick winners and losers, or to select the best technology to meet consumer demand. We intend to rely as much as possible on free markets and private enterprise.

6. We certainly have not reached the ultimate goal that all Americans have meaningful access to advanced telecommunications services. Indeed, at such an early stage of deployment of many broadband services, it is difficult to reach any firm judgment about the state of deployment. Nonetheless, we are encouraged that deployment of advanced telecommunications generally appears, at present, reasonable and timely. We base this conclusion, in part, on the large investments in broadband technologies that numerous companies in the communications industry are making. We expect that these investments will lead, in the near future, to greater competition in the broadband market and to greater deployment of these services in a manner that is more efficient and includes all Americans.

7. Although we conclude that, at present, deployment of advanced telecommunications capability appears to be reasonable and timely, we note that this conclusion is based partly on actual deployment and partly on certain assumptions and predictions regarding the future. For instance, this Report uses actual subscribership as a proxy for "deployment" and "availability." Although we find this to be a reasonable approach, we acknowledge that it may not be a precise estimate of actual deployment and availability. In addition, the Report compares the deployment of advanced telecommunications capability to the deployment of other communications-related services. Although deployment of another communications-related technology may not necessarily furnish a perfect analogy to deployment of advanced telecommunications capability, we believe that such empirical comparisons may be useful as one objective method to evaluate deployment of broadband. Finally, assertions of companies regarding their plans for deployment, while helpful, may not ultimately prove accurate. Given that this Report presents a snapshot at the early stages of deployment, we remain cautious about drawing definitive conclusions regarding the deployment of broadband services. We will continue to monitor the situation through annual reports and, in future reports, we hope to improve and expand upon the data we receive and our tools of analysis.

8. Where necessary, we are already taking steps, partly in proceedings described in Section V below, to ensure that overall market conditions for local telecommunications are conducive to investment, innovation, and meeting consumer demand. In another proceeding, for example, we are considering measures to promote the deployment of wireline advanced services by both incumbent Local Exchange Carriers (LECs) and new entrants. We will continue to monitor closely the deployment of broadband capability by providers using all technologies. We will not hesitate to reduce barriers to infrastructure investment and to promote competition so that companies in all segments of the communications industry will

have market-based incentives to innovate and invest in new technologies and facilities. We are committed to carrying out Congress' directive to ensure that advanced telecommunications capability is deployed in a reasonable and timely manner to all Americans.

B. Statutory Framework

9. Section 706 of the Act[8] is a Congressional mandate to the Commission to examine the availability of advanced telecommunications capability to all Americans.[9] The statute defines "advanced telecommunications capability," "without regard to any transmission media or technology, 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."[10]

10. In section 706(b), Congress specifically directs the Commission to begin this inquiry, within thirty months of enactment of the 1996 Act, to find out whether advanced telecommunications capability is being deployed to all Americans in a "reasonable and timely fashion." The Commission must complete the inquiry within 180 days, and must take "immediate action to accelerate the deployment" of advanced telecommunications capability by removing barriers to infrastructure investment and by promoting competition in the telecommunications market if the inquiry determines that such capability is not being deployed in a reasonable and timely fashion.

C. Overview

11. In this Report, we consider the deployment of broadband to "all Americans" to determine whether the pace of deployment is "reasonable and timely." After defining some statutory terms in Section II, we examine in Section III the deployment of broadband capability. Many large and medium-sized business and government customers have had access to broadband for years, and in this proceeding we have heard few complaints from such customers that they, as a group, do not have access to broadband technologies. Therefore, this Report concentrates on the consumer market.

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8 *Id.*

9 "Section 4 of the Bill [later section 706 of the 1996 Act] states clearly that this bill is intended to establish a national policy framework designed to accelerate rapidly the private sector deployment of advanced telecommunications." S. Rep. 104-23 at 27, March 30, 1995.

10 Section 706 (c)(1), *supra* note 3.

12. Numerous companies in virtually all segments of the communications industry are starting to deploy, or plan to deploy in the near future, broadband to the consumer market. Current providers include cable television companies, incumbent LECs, some utilities, and "wireless cable" companies. In many areas, too, competitive LECs that serve large and medium-sized business customers start with loops provided by incumbent LECs and add broadband enhancements of their own, thus constituting another supplier of broadband for those customers. They also serve residential customers in the "small office, home office" market. In addition, other companies are considering providing broadband services to the consumer market, including interexchange carriers (IXCs), information service providers (ISPs), cellular companies and providers of broadband Personal Communications Services, and relatively recent licensees of spectrum using both satellite and terrestrial "fixed wireless" technologies.

13. In Section III, we first examine trends in investment in broadband technologies and facilities to determine whether companies are making the investment necessary to supply the consumer market with broadband capability. We consider investment in both backbone facilities and the "last mile."[11] We find that broadband backbone facilities are being deployed in a reasonable and timely manner. We then focus in particular on deployment of facilities that serve the "last mile," because the connection to the consumer has historically been the least competitive, and most bandwidth-constrained, part of the communications network. If all Americans are to have meaningful access to broadband capability, there must be a solution to the problem of the "last mile." No matter how fast the backbone or network is, if the last mile to the consumer is slow, then the consumer cannot take advantage of the network's high-speed capabilities.

14. After examining the investments in and deployment of advanced telecommunications capability in general, we next consider deployment of broadband capability to specific classes of users, including people in rural and low-income areas, and schools and classrooms. We discuss elementary and secondary schools and classrooms first, and then people in rural areas, low-income people, libraries and rural health care facilities.[12]

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[11] As we stated in the Notice herein, for simplicity's sake, in this Report we will use the terms "backbone" and "last mile" as shorthand for interoffice/long distance/international and local facilities and services, respectively. *Cf.* Comments of BellSouth Corp. at 9 (distinguishing between "advanced access services, which connect the user to broadband networks, and advanced end-to-end networking, including backbone transport services"). Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable & Timely Fashion, & Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, *Notice of Inquiry*, 13 FCC Rcd 15280, 15286 n.9 (1998) (Notice).

[12] Section 706 specifically mentions elementary and secondary schools and classrooms. *See supra* note 3. Section 254 of the 1996 Act, which concerns universal service, specifically mentions those users and also low-income consumers, those in rural, insular, and high cost areas, health care providers, and libraries. *See* 47 U.S.C.

In this section, we examine the deployment of broadband capability to ensure that such services are made available to all Americans as called for in section 706(b) of the 1996 Act.

15. We next consider the demand for broadband capability. We recognize that the demand for such capability will turn on its price; demand for broadband capability will tend to increase as its price declines. In order to determine whether broadband capability is being deployed in a reasonable and timely fashion, we must examine whether communications companies are meeting demand.

16. Overall, we find that, although the consumer broadband market is in the early stages of development, it appears, at this time, that deployment of broadband capability is reasonable and timely. Nevertheless, this is an early snapshot of a fledgling market. We find that there is already a significant initial demand for broadband capability and we expect demand to grow substantially in the coming years. We are committed to ensuring that deployment of broadband capability to the consumer market remains timely and reasonable as the market for broadband develops, and that the supply of broadband meets consumer demand.

17. In Section IV, we discuss a number of key issues that may have a significant impact on the deployment of broadband capability in the near future. These issues are (1) access to broadband systems; (2) access to multiple dwelling units for the provision of broadband services; and (3) Internet peering arrangements. Although we do not take action on these issues at this time, we intend to monitor these issues closely.

18. Finally, in Section V, we discuss some of the specific proceedings in which the Commission is already taking steps to promote the availability of broadband capability. In no respect are we considering regulating the Internet. Rather, through these and other proceedings, we seek to reduce barriers to competition so that companies in all segments of the communications industry have the incentive to innovate and to deploy new technologies and services to all Americans.

19. Consistent with Congress's directive that we examine these issues "regularly," we plan to issue reports such as this one each calendar year.

§ 254 (b)(3,6), (c)(3), (h)(2)(a).

II. TERMINOLOGY

A. Definition of "Advanced Telecommunications Capability"

20. Section 706 (b) of the 1996 Act defines "advanced telecommunications capability" 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." For purposes of this Report, we define "broadband" as having 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.[13] This rate is approximately four times faster than the Internet access received through a standard phone line at 56 kbps. We have initially chosen 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. We also include in broadband 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.[14]

21. We interpret "enabl[ing] users to originate and receive . . . telecommunications" as requiring two-way telecommunications. Thus, neither a conventional cable television system nor a digital television signal, by itself, would be broadband within the statutory definition, for they are both one-way.[15]

22. We define broadband as including a service in which the upstream and downstream communications paths are not in one self-contained system or offering.[16] Thus, broadband could include an upstream path supplied by a LEC and a downstream path supplied by a satellite company. This takes account of the fact that telecommunications in this country consists increasingly of a "network of networks." Both paths, however, must be capable of supporting a speed in excess of 200 kbps in the last mile, as we discussed in paragraph 20

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[13] We believe that Congress intended broadband to be faster than ISDN service, which operates at a data rate of 128 kbps and was widely available at the time the 1996 Act was enacted. Re ISDN service, *see also infra* ¶ 2 in Appendix A.

[14] *See* Comments of Cincinnati Bell Tel. Co. at 7.

[15] Another reason that neither a conventional cable television system nor a digital television system, by itself, would fit the statutory definition is that neither permits "switched" communications. *See supra* ¶ 20.

[16] *See, e.g.*, Comments of Personal Commun. Indus. Ass'n at 8 n.11; Comments of Paging Network, Inc., at 5-6.

above.[17]

23. We further find that broadband service does not include content, but consists only of making available a communications path on which content may be transmitted and received.[18] In addition, we emphasize that whether a capability is broadband does not depend on the use of any particular technology or nature of the provider.[19]

24. Some facilities and services may not be "telecommunications" within the precise terms of the Communications Act of 1934, as amended,[20] but may as a practical matter be competitive with advanced telecommunications capability. One such service is broadband provided over cable television systems, which we describe in paragraph 55 and Appendix A, paragraph 6, below. There is disagreement over the status of such services under the 1934 Act.[21] We do not decide such issues, but we do consider such services in this Report. By way of analogy, a study of the future of "mass transit" between New York and Washington would need to consider travel by car between the same points even if cars are not "mass transit."

25. Finally, we recognize that as technologies evolve, the concept of broadband will evolve with it: 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. For example, we may find in future reports that evolution in technologies, retail offerings, and demand among consumers has raised the minimum speed for broadband from

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[17] Certain services, such as Hughes's DirecPC, are capable of affording the customer rates of speed in excess of 200 kbps in the downstream direction, but rely on standard telephone company lines, with speeds far less than 200 kbps, in the upstream direction. Such services are not advanced telecommunications capability, because Section 706 requires broadband rates of speed in both directions. See § 706 (c)(1), *supra* note 3 (defining advanced telecommunications capability as "broadband telecommunications capability that enables users to originate and receive high-quality voice, data, graphics, and video telecommunications"). Nevertheless, we find services such as DirecPC to be useful and we encourage their deployment, although not as advanced telecommunications capability.

[18] *See* Comments of e.spire Commun., Inc. at 4; Comments of Information Technology Ass'n of America at 2 n.3.

[19] For example, a government-owned public utility that deployed broadband would not, because of its ownership, be considered differently from any other broadband provider. *See* Comments of American Public Power Ass'n at 14.

[20] *See, e.g.*, 47 U.S.C. § 153 (43)).

[21] *Compare, e.g.*, Reply Comments of MindSpring Enterprises, Inc., at 21-23 *with* Reply Comments of Cox Commun., Inc., at 5-7.

200 kbps to, for example, a certain number of megabits per second (Mbps).[22]

B. Standard for What Is "Reasonable and Timely"

26. Business Customers. Broadband services are available to most business customers -- and have been for years in many cases.[23] BellSouth, for example, states that "[h]igh-end business users, especially in densely populated areas, already have access to a wide array of broadband networking and access capabilities."[24] The Progress and Freedom Foundation states in more detail that:

> Businesses have been using digital bandwidth much longer than residences. Electronic Data Interchange, a protocol for computer-to-computer transaction of billing, purchasing, invoicing, and other business functions, pre-dates the Internet. . . . Until the rise of the Internet, many businesses were served by expensive private or leased facilities, obtained from value-added network (VAN) providers such as GE Information Services (GEIS) and IBM, as well as from local telephone companies, competitive access providers and long-distance carriers. . . . It is estimated that over 90 percent of Fortune 1000 companies have either established or plan to establish a corporate Intranet. . . . Leased T1 lines are increasingly used to access the Internet and public switched networks. According to analyst Dataquest, the number of installed T1 lines will surge by about 23 percent per year during the next two years.[25]

The majority of commenting parties appear to agree that the deployment of broadband for large and medium-sized business customers as a group is reasonable and timely, and we agree.

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[22] *See, e.g.*, Comments of ADC Telecommun., Inc., at 6; Comments of Bell Commun. Research, Inc., at 2 n.1; Comments of the Commercial Internet Exchange Ass'n at 6; Comments of Virtual Hipster at 2; Comments of the Rural Policy Research Inst. at 3; Comments of SBC Commun. Inc., at 14.

[23] It is not surprising that advanced services were first provided to business customers. In general, business customers are less geographically dispersed than residential customers, use a greater volume of telecommunications, and are more lucrative to serve.

[24] Comments of BellSouth Corp. at i. *See also* Comments of Bell Atlantic at 7 ("Winstar and Teligent are building nationwide broadband wireless systems that will reach the majority of business customers."). *But see* Comments of Ameritech, Appendix B (statements from a few business customers that they are not satisfied with their present broadband options).

[25] *See, e.g.*, Comments of the Progress & Freedom Foundation at 17-20 *passim* (footnotes omitted; underlining in original).

By that we do not mean that every business in America is receiving all the broadband it wants at prices it likes. Rather, we interpret "reasonable and timely" to mean that businesses, on the whole, either have access to broadband or, according to the best evidence, will have it soon.[26] Accordingly, in this Report we focus on the consumer market.

27. The Consumer Market. In Section III below, we evaluate whether deployment of broadband to the consumer market is reasonable and timely by considering the state of investment in broadband facilities, the extent to which last mile facilities have actually been deployed, deployment to "all Americans," and the state of demand.

28. We define "the consumer market" as consisting of small business and residential customers, to whom we sometimes refer collectively as "the residential consumer."[27] Because there is little data in our record about small business customers, and because small business customers share significant characteristics with residential customers, in this Report we will treat residential customers as a surrogate for small business customers.[28]

29. In addition, we believe it is useful to compare the initial deployment of broadband with the deployment of other technologically advanced services whose deployment occurred through profit-driven private enterprise in market conditions and ultimately reached all, or the vast majority of, Americans.[29] Using objective data about comparable services that have actual histories reflects how long it takes in the real world to raise capital, lay lines or build radio towers or launch satellites, build marketing and sales and other operational staffs and skills, establish brand identity and a good reputation with millions of consumers, and stimulate demand.

30. We note that section 706 concerns not only the deployment of advanced

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[26] In addition, many satellite-based and terrestrial wireless broadband systems plan to focus on business customers. *See, e.g.*, Comments of Teligent, Inc., *passim*, and *infra* note 92.

[27] In theory, small business and residential consumers have been able to subscribe to the broadband services that medium-sized and large business subscribers have subscribed to for years. Those services, however, were neither designed for, marketed to, or taken by small business and residential customers in any significant numbers.

[28] We are aware, however, that two terrestrial wireless carriers, Winstar and Teligent, are targeting their broadband at small business customers. *See* Comments of Teligent, Inc., at 1, 4; Reply Comments of WinStar Communications, Inc., at 3 n.7.

[29] We will not use a subjective measurement, such as the state of deployment that would occur in a hypothetical market. *See, e.g.*, Comments of Ameritech at 8.

telecommunications capability, but also its availability.[30] The record before us focuses on deployment of advanced capability, such as investment and construction plans, and generally lacks information about availability, which we believe refers to a consumer's ability to purchase a capability that has been deployed.

31. As comparable services, we have chosen the original telephone in the 1870s, over-the-air black-and-white television in the late 1940s, color television in the 1950s, and cellular service in the mid-1980s.[31] We recognize that no two products or services are the same or are deployed in exactly the same conditions. Thus, while we make certain comparisons here, we hope the parties in future proceedings of this type will assist us in refining the basis on which to make such comparisons and, more generally, in measuring objectively whether deployment is reasonable and timely. We especially welcome suggestions about how to measure the market demand for broadband by taking into account such actual indicia as prices, willingness to pay, specific desired services, and the other complexities of consumer markets.

32. The first regular, sustained commercial offerings occurred for the telephone in 1876,[32] for post-World War II over-the-air black-and-white television in 1946,[33] for color

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[30] *See* section 706 (a, b), *supra* note 3.

[31] The dates stated in the text above are after the regulatory gestation preceding the actual commercial offering of over-the-air television and cellular service.

We are aware, of course, that none of the four services we have chosen is precisely the same as broadband. That is one reason we have chosen four of them. The similarities, however, are substantial. These four services and broadband share a majority, and in some cases all, of the following characteristics: they require the deployment of new, complex networks of facilities, they give consumers a capability they previously lacked, they entail interactivity, and they require each consumer to make an up-front payment and to make an additional recurring payment. In addition, all four services we have chosen are, in a sense, evolutionary. Just as broadband Internet access was preceded by narrowband (56 kbps) Internet access, cellular service was preceded by paging, with voice messages and visual displays of data in some offerings, and by citizen's band radios, which allowed people in cars to communicate over radio waves. The telephone was preceded by the telegraph, to which the telephone was originally considered an adjunct. Post-War black-and-white television was preceded by radio broadcasting and movies, and by mechanical television in the late 1920s and early electronic television in the late 1930s. Color television was an enhancement of black-and-white television. Even the radio-based technologies on our list required the deployment of new networks, and ones that involved more than the erection of radio transmitters. For example, although over-the-air television broadcasting (both black-and-white and color) and cellular service did not require new *wire* lines to be laid to every home or car, it was years before their *radio* lines and the rest of those technologies overcame the limiting factors of distance, hills and valleys, and buildings, and allowed high-quality transmission and reception everywhere.

[32] ALAN STONE, WRONG NUMBER: THE BREAKUP OF AT&T at 30 (1989).

television in 1954,[34] for cellular service in 1983,[35] and, for broadband for residential customers, apparently in 1996.[36] For broadband, therefore, we have just completed the second calendar year of commercial offering. In 1878, twenty-six thousand telephones were being rented, most of them for business customers;[37] in 1948, over-the-air black-and-white television had a residential penetration of .4%;[38] in 1956, there were approximately 160,000 color televisions in use;[39] in 1985, there were approximately 340,000 cellular customers,[40] almost all of them business-based.[41] If the use of broadband by the consumer market, with adjustments to reflect the smaller population of this country in previous decades, equals or exceeds the deployment of these similar technologies at the same point after they were first offered to consumers on a regular, commercial basis, then there is a strong indication that the deployment of broadband to the consumer market is reasonable and timely.

33. The rates of residential 'penetration' of these services are shown below in

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[33] *Compare* ERIC BARNOUW, TUBE OF PLENTY: THE EVOLUTION OF AMERICAN TELEVISION at 100 (1990), *and* WILLIAM BODDY, FIFTIES TELEVISION: THE INDUSTRY AND ITS CRITICS at 46 (1993), *with* CHRISTOPHER H. STERLING & JOHN M. KITROSS, STAY TUNED: A CONCISE HISTORY OF AMERICAN BROADCASTING at 278 (1978).

[34] KENNETH BILBY, THE GENERAL: GENERAL SARNOFF & THE RISE OF THE COMMUNICATIONS INDUSTRY at 208 (1986).

[35] Implementation of Section 6002(B) of the Omnibus Budget Reconciliation Act of 1993, *First Report*, 10 FCC Rcd 8844, 8848 (1995).

[36] Reply Comments of TCI at 8; http://www.rr.com/rdrun/company/index.html ("In September 1996, the first commercial broadband online service was delivered to customers . . . . "), *visited* Nov. 16, 1998; Robert W. Crandall & Charles L. Jackson, *Eliminating Barriers to DSL Service* at 11 (July 1998), Ex Parte Presentation by United States Telephone Association, Aug. 12, 1998 (USTA Presentation).

[37] STONE, *supra* note 32, at 30.

[38] JAMES L. BAUGHMAN, THE REPUBLIC OF MASS CULTURE: JOURNALISM, FILMMAKING, AND BROADCASTING IN AMERICA SINCE 1941 at 41 (1992); WILLIAM BODDY, FIFTIES TELEVISION: THE INDUSTRY AND ITS CRITICS at 51 (1993). *Compare* Bureau of Census, U.S. Department of Commerce, Historical Statistics of the United States, Colonial Times to 1970, Vol. 1 at 42 (Series A 335-349, Number of Households) *with Id.*, Vol. 2 at 796 (Series R 93-105, Households with Television Sets).

[39] FCC, 23RD ANN. REP. at 114 (1957).

[40] Implementation of Section 6002(B) of the Omnibus Budget Reconciliation Act of 1993, *First Report* 10 FCC Rcd 8844, 8874 (1995).

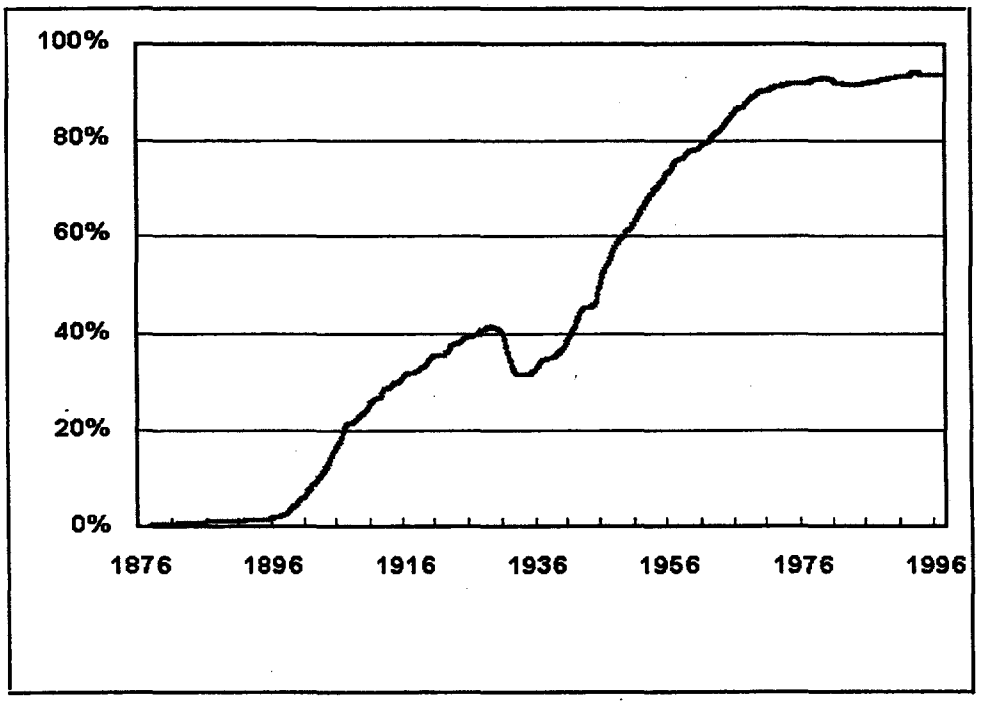
[41] As late as 1994, most cellular customers were business customers. Craig O. McCaw, *Memorandum Opinion & Order*, 9 FCC Rcd. 5836, 5862 (1994).

Chart 1.[42]

CHART 1

RESIDENTIAL PENETRATION RATES OF NEW SERVICES[43]

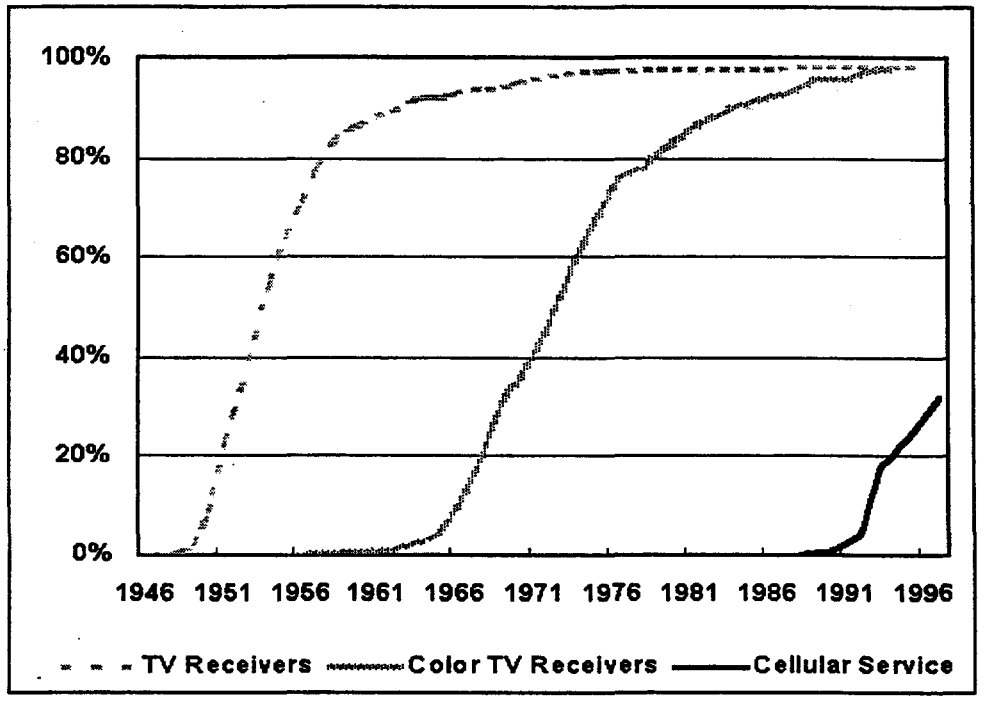
A: Telephone Service



[42] Note that most of the data in the preceding paragraph includes both business and residence users, and that Chart 1 shows estimates of residential penetration.

[43] Source: Common Carrier Bureau, Industry Analysis Division.

B: Other



The data in paragraph 32 and Chart 1 lead us to two conclusions. First, among residential customers, all these services spread slowly in their initial years, at the beginning of the so-called "S Curve."[44] Broadband for residential customers is today in a comparably initial stage. Therefore, although today all Americans do not have access to broadband, that fact alone does not mean that deployment is not reasonable and timely. Second, all these technologies eventually -- and, in the case of over-the-air black-and-white television, very quickly -- achieved nationwide penetration.

[44] SHARON M. OSTER, MODERN COMPETITIVE ANALYSIS at 125-26, 293-95 (Oxford Univ. Press 1994). Typically, a successful product's "S Curve" reflects (a) very few sales during its "launch period," which may last for years, (b) a steep rise in sales during the product's "take off" period as "positive feedback" from consumers stimulates additional sales and additional sales lower costs and prices per unit, and then (c) sales levelling off as the market approaches saturation. Carl Shapiro & Hal R. Varian, INFORMATION RULES: A STRATEGIC GUIDE TO THE NETWORK ECONOMY at 178 (Harvard Business School Press 1999).

III. DEPLOYMENT OF ADVANCED TELECOMMUNICATIONS CAPABILITY

A. Introduction

34. Before broadband capability can be made available to customers, communications companies must modify existing facilities or construct new ones, both of which can require substantial investment. In assessing the growth in the supply of broadband capability (deployment to all Americans), we first consider trends in investment in broadband facilities, including both backbone and "last mile" facilities. We then examine deployment of facilities that serve the "last mile" to the consumer market, because the connection to ordinary consumers has traditionally been the least competitive and bandwidth-constrained part of the communications network. Third, to ensure that broadband capability is being deployed to all Americans, we examine whether investment is occurring in areas, and broadband is becoming available to groups, that have been thought unlikely to be served in a reasonable and timely way. Finally, we consider the demand for broadband capability to ensure that consumer demand is being met.

B. Deployment of Broadband Capability

1. Investment in Broadband Facilities

35. Although precise dollar figures and construction plans for broadband are not generally available,[45] publicly available data show that many companies in virtually all segments of the communications industry have made tens of billions of dollars of investment in broadband facilities.[46] These sums are large even by the standards of America's communications business. For example, Ameritech plans to spend $3 billion in 1999 in

[45] Companies generally do not segregate such expenses and plans in their records (*e.g.*, broadband and narrowband, backbone and last mile). Also, many companies consider such data to be of competitive value and therefore do not publish them.

[46] This Report discusses companies in groups (cable television, satellite, public utilities, *etc.*) solely for convenience. We are aware that the different companies of the same type may employ different broadband technologies, and that companies of different types may use the same one. Indeed, one of the most attractive prospects that broadband creates is the blurring of previously distinct regulatory categories and the blending of old monopolies and oligopolies into a competitive "broadband market." *See* Comments of U S West Commun., Inc., at 3.

capital for all its communications networks (wireline, wireless, and cable television).[47] Investment on this scale indicates strongly that, at the level of technological development and manufacturing, advanced telecommunications capability is available at reasonable cost.[48]

36. Deployment of broadband, both backbone and last mile, is occurring on a major scale, for both business and consumer markets. American business and the capital markets are obviously betting that broadband will be successful in the business and consumer markets and many companies are rushing to seize part of that success. We expect that this sizeable investment by numerous companies will translate in the near future into significant deployment of broadband capability. In the following paragraphs, we discuss the investments made by various segments of the communications industry.

37. The National Cable Television Association states that the cable industry's spending on the deployment of two-way broadband via high-speed cable modems in 1997 alone totaled $6 billion.[49] One estimate is that 63% of all cable systems will be broadband-ready by 2001.[50] TCI has committed to spend $1.8 billion to upgrade its plant, in part to provide broadband services. TCI's upgrades are expected to be 60% completed by the end of 1999 and 90% completed by the end of 2000.[51] Another major cable operator, Comcast, has spent over $1.2 billion over the past three years to upgrade its cable systems, largely to be able to offer broadband.[52] In addition, Microsoft's investment of $1 billion in Comcast, the investments of $210 million each by Microsoft and Compaq in Road Runner,[53] and AT&T's

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[47] *Ameritech to Invest $3 billion in Capital Expenditures for Communications Networks During 1999*, Jan. 13, 1999, *available at* http://www.ameritech.com/media/release/view/0,1495,2309/1_1,00.html?,*viewed* Jan. 14, 1999.

[48] Kathleen M.H. Wallman, *Higher Ground: Reconceptualizing the Debate Over Deploying Advanced Telecommunications Capability Under Section 706 of the Telecommunications Act of 1996* at 21-23 (Dec. 1998) (quoting 1995 legislative history, S. REP. NO. 23, 104th Cong., 2nd Sess. at 50, stating that the Commission's inquiry "shall include an assessment by the FCC of the availability, at reasonable cost, of equipment needed to deliver advanced broadband capability.").

[49] Comments of National Cable Television Ass'n at 2. Cable modems are described *infra* in note 116 and in Appendix A, ¶ 6.

[50] Comments of Bell Atlantic at 6 & n.3, *citing* Allied Business Intelligence Press Release, www.alliedworld.com at CATV98.pdf release.

[51] Comments of AT&T Corp. at 14; Reply Comments of Tele-Commun., Inc., at 6.

[52] Reply Comments of Comcast Corp. at 8.

[53] *See infra* ¶ 54.

purchase of TCI for $48 billion all appear to be motivated in part by a desire to enter broadband via cable television systems.[54]

38. Long distance companies have recently constructed and upgraded enormous amounts of broadband backbone. AT&T already has built 40,000 route miles of fiber[55] in this country, and it continues to boost its capacity.[56] In 1997, AT&T spent $7 billion to build SONET rings[57] and improve its network.[58] It is also testing a technology that may increase the transport capacity of its existing network by a factor of ten without requiring it to lay any additional fiber-optic cable.[59] MCI quadrupled the speed of its Internet backbone, to OC-12 (622 Mbps), in 1996[60] and doubled that capacity in 1997.[61] Another long distance carrier, Qwest, has invested $2.5 billion in, and is currently constructing, a broadband Internet Protocol[62] network of nearly 20,000 miles. It will operate at OC-48 (2.5 Gigabits per second or gbps) or faster, and is scheduled to be completed in the second quarter of 1999. When

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[54] Comments of BellSouth Corp., Exhibit A (The Forrester Report, *Broadband Hits Home* at 5, http://www.forrester.com/cgi-bin/cgi.pl, *visited* Sept. 14, 1998). For more information about cable television companies' broadband activities, *see* Annual Assessment of the Status of Competition in Markets for the Delivery of Video Programming, CS Docket No. 98-102, *Fifth Annual Report*, FCC 98-335 at ¶¶ 37-41, 48-57, released Dec. 23, 1998 (*Fifth Cable Competition Report*).

[55] Fiber facilities can carry communications at broadband speeds.

[56] Comments of AT&T Corp. at 18-19.

[57] SONET, or Synchronous Optical Network, is a standard of fiber-optical transmission rates above 51.84 Mbps, created to provide the flexibility needed to transport many signals with different capacities, and to provide a design standard for manufacturers. *See* HARRY NEWTON, NEWTON'S TELECOM DICTIONARY at 663 (1998) (NEWTON).

[58] *See* Comments of AT&T Corp. at 18-19.

[59] Comments of AT&T Corp. at 19.

[60] OC, or Optical Carrier, refers to a SONET (*see supra* note 57) optical signal. Optical carrier level is the optical counterpart of the basic rate, 51.84 Mbps, on which SONET is based. All higher levels, *e.g.*, OC-12, are direct multiples of OC-1. NEWTON, *supra* note 57, at 508.

[61] Comments of AT&T Corp. at 20-21, *citing* http://www.mc.com/aboutyou/interests/technology/icn/network.shtml. MCI recently divested its Internet backbone to Cable & Wireless.

[62] Internet Protocol is part of a family of protocols describing software that tracks the Internet address of nodes, routes outgoing messages, and recognizes incoming messages. *See* NEWTON, *supra* note 57, at 377-78. It is a standard that describes how a packet of data is transported across the Internet and is recognized as an incoming message.

completed, the network will reach 130 cities, which account for approximately 80% of all the voice and data traffic in the United States.[63] Level 3 plans to invest $3 billion in broadband deployment, including construction of a 15,000 mile fiber-optic cable network.[64] UUNet Technologies announced in October 1997 a $300 million investment in backbone network infrastructure that will be leased to Internet service providers, large corporations, and organizations with large Web sites.[65] In addition, one company, IXC, has built an OC-48 switched network that is fifty times faster than the common speed on backbone today.[66] Sprint also claims that its use of fiber optic technologies in its backbone should, by 2000, enable one pair of Sprint fibers to handle seventeen times today's combined volumes of AT&T, MCI, and Sprint without having to construct any new fiber.[67] According to one industry participant, three years ago available bandwidth on the Internet's backbone doubled every year, but today it doubles every four to six months.[68]

39. Since 1993, over $20 billion has been invested in the space industry, of which much has gone into the broadband satellite telecommunications sector.[69] Some estimates reveal that approximately $65 billion in financing will be required over the next five years to

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[63] *Qwest Expands Network Infrastructure; Deploys Three DMS 250 Switches From Nortel*, http://www.qwest.com/press/12998.html, *visited* Nov. 24, 1998. *See* also Comments of Qwest Commun. Corp. at 1-2, 6.

[64] Comments of Level 3 Commun., Inc., at 7; Reply Comments of Comcast Corp. at 9.

[65] *See* UUNET First to Offer High-Capacity OC-3 Internet Access, http://www.us.uu.net/press/1997/oc3.shtml, *visited* Dec. 8, 1998. UUNet is now owned by MCI/WorldCom.

[66] Comments of Commercial Internet Exchange Ass'n at 11, *citing* http://www.psi.net/news/pr/98/ixccomplete.html.

[67] Comments of Sprint Corp. at 6. High-capacity fiber goes into almost every telephone central office in this country, and new Dense Wave Division Multiplexing technology will increase its capacity hugely. Otis Port, *Through a Glass Quickly: Advances in Optical Fiber Are Revolutionizing Telecom*, BUSINESS WEEK, Dec. 7, 1998, *available at* 1998 WL 19885338 (Wave Division Multiplexing "jacked up the data rate of each laser to 10 gigabits (10 billion bits) per second, four times today's usual drumbeat. . . . That's more than enough to accommodate all of North America's telecom needs. . . . Hollywood could deliver movies to theaters in the blink of an eye. Product development could be greatly accelerated because engineers could instantly access huge three-dimensional models of components and manufacturing operations.").

[68] Statement of Alan Taffel, UUNET Technologies, at Spring Internet World Conference, Los Angeles, March 19, 1998, *cited in* Comments of Commercial Internet Exchange Ass'n at 11 n.19.

[69] Space Publications & A.T. Kearney, STATE OF THE SPACE INDUSTRY, at 10 (1998).

fund the next generation of satellites, including broadband satellite systems.[70] Satellite infrastructure revenues for the time period 1997-2001 are estimated at $277 billion.[71] The Commission has granted fourteen Ka-band licenses, including thirteen geostationary systems and one non-geostationary system, Teledesic, which will deploy a low earth orbiting system.[72] Teledesic, for example, has committed to spend $9 billion building world-wide satellite networks for broadband service.[73]

40. As of 1997, utilities had installed 40,000 route miles of fiber optic cable representing over 750,000 fiber miles,[74] and they intend to install another 36,000 route miles in the next few years.[75] Actual and planned utility-affiliated ventures in Boston, New York, Philadelphia, Washington, and San Francisco areas have a capital budget for 1998 and 1999 that is estimated at $850 million.[76]

41. Competitive LECs have played a major role in the introduction of fiber rings and new broadband technologies such as Asynchronous Transfer Mode,[77] frame relay,[78] and

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[70] *Id.*

[71] *Id.* at 8.

[72] These geostationary Ka-band licensees include systems owned by Comm Inc., EchoStar Satellite Corp., GE American, Hughes Space & Communications, KaStar Satellite Communications, Loral Aerospace Holdings, Inc., Lockheed Martin Corp., MorningStar Satellite Co., NetSat 28, Orion Atlantic, Orion Network Systems, PanAmSat Corp., and VisionStar, Inc.

[73] Comments of the Progress & Freedom Foundation at 21; Comments of Teledesic LLC *passim.*
The construction of satellite projects has been robust, as seen by estimates that revenues of companies in the business of constructing satellite infrastructure will increase from $49 billion in 1997 to $63 billion in 2001 -- an overall growth rate of almost twenty-nine percent. Space Publications & A.T. Kearney, STATE OF THE SPACE INDUSTRY, at 8 (1998). Not all of these projects will deliver broadband service.

[74] One route mile of fiber, made up of many strands of fiber, can represent many fiber miles.

[75] American Public Power Ass'n Comments at 12; Comments of UTC at 5.

[76] Reply Comments of RCN Telecom Services, Inc., at i, 3.

[77] Asynchronous Transfer Mode or ATM is a very high speed, low-delay, connection-oriented, packet-like switching and multiplexing technique. NEWTON, *supra* note 57, at 67-68. Asynchronous, in data communications, refers to a transmission method in which information is sent one discrete character at a time. Each letter, number or other character is delineated by start and stop indicators at the beginning and end of the character. After a time interval, another character is sent." *See* Telecom Publishing Group, TELECOM LINGO GUIDE, http://www.telecommunications.com/lingo/a.htm, *visited* Jan. 25, 1999.

DSL.[79] Competitive LECs, both wireline and radio-based, have raised between $15 and $20 billion to invest largely in broadband.[80] The Commission's most recent report on fiber deployment states that the amount of fiber owned by competitive LECs has been growing rapidly.[81] For example, the members of DSL Access Telecommunications Alliance (DATA)[82] have raised over $1 billion in private markets for DSL ventures. Another competitive LEC, Intermedia, has raised $2.5 billion in the last eighteen months with which to build broadband facilities.[83]

42. All this investment, especially that by cable television companies and competitive LECs, appears to have spurred incumbent LECs to construct competing facilities.[84] Incumbent LECs, mainly the Bell Operating Companies (BOCs) and GTE, are

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[78] Frame relay is a wideband (64 kbps to over 1.5 Mbps) high-speed packet-based data switching interface standard that transmits bursts of data over wide area networks. Frame relay packets vary in length from 7 to 1024 bytes. Because frame relay is data oriented, it is not usually used for voice or video. *See* The Communications Library, http://www.wcom.com/tools-resources/communications_library, *visited* Dec. 8, 1998.

[79] DSL, or digital subscriber line, is a generic name for a family of evolving digital services to be provided over local telephone facilities. Such services propose to give the subscriber up to 8 Mbps downstream to the customer and somewhat fewer bits per second upstream. NEWTON, *supra* note 57, at 220 (1998). For a description of how DSL technology operates, *see* Comments of Coalition of Utah Ind. Internet Service Providers at 1. DSL is also described in Appendix A, ¶¶ 4-5.

[80] *See* Comments of the Association for Local Telecommun. Services at 9.

[81] J. Kraushaar, FIBER DEPLOYMENT UPDATE END OF YEAR 1997 at 38-39, released Sept. 8, 1998.

[82] They include Rhythms NetConnections, Inc., FirstWorld Commun., Inc., and First Regional TeleCOM, LLC.

[83] Comments of Intermedia Commun., Inc., at 11.

[84] It is widely believed that incumbent LECs' recent moves to offer broadband to residential customers are primarily a reaction to other companies' entry into broadband. *See* Comments of AT&T Corp. at 10 ("ILECs plainly can and will deploy ADSL when a competitor emerges to challenge their bottleneck control over last mile facilities," then giving examples of SBC and U S West reacting to initial moves by competitive LECs and cable television systems). *See also id.* at 25, n.42 at 28, and Appendix B ("Non-ILEC Deployment of Broadband Services and ILEC Responses"); Comments of Information Technology Ass'n of America at 7 & n.18, *citing in part* Merrill Lynch, *Wireline Communications Equipment: Trends in xDSL Deployment* at 2, 4 (June 22, 1998); Joint Comments of MCI Commun. Corp. & WorldCom, Inc., at 18 ("Only now, after some CLECs have begun to experience limited success in a few niche markets, and several cable operators have announced high-speed Internet access using cable modems, have the ILECs awakened to discover the promise of xDSL services.") (footnote omitted); Comments of Virtual Hipster at 2; Comments of Retail Internet Service Providers at 5; Comments of Telecommun. Resellers Ass'n at 9, 10, 15.

U S West notes that when cable television-based broadband was available in three cities it served, it

also investing billions of dollars in broadband technologies.[85] BOCs and GTE, for example, have announced plans to offer broadband to approximately twenty million homes this year.[86] SBC has announced a "massive rollout" of ADSL, "targeting more than 500 central offices and 9.5 million residential and business customers by year-end.[87] In Bell Atlantic's service area, ADSL is available now to some customers in the Washington, D.C., area and in Pittsburgh, with plans to add Philadelphia and the Hudson waterfront of New Jersey next year. Bell Atlantic has formed a marketing alliance with America Online, Inc., in which Bell Atlantic hopes, by the end of 1999, to make ADSL available to seven million subscribers.[88] Its goal is to offer ADSL to fourteen million customers by the end of 2000.[89] And BellSouth has announced plans to offer ADSL service available to 1.7 million customers in 30 markets by the end of 1998, and in 23 additional markets in 1999.[90]

43. In addition, the Commission has allocated and licensed high bandwidth radio spectrum that can readily be used to deliver broadband terrestrially. Providers using this spectrum are beginning to deliver a range of fixed services, including voice, data, and video, using frequencies in the 24, 28/31, 38 and 39 GHz bands.[91] Although the marketing focus for most fixed wireless companies is currently on small and medium-sized businesses, some may

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announced a competing service in 14 states and 43 cities. Reply Comments of U S West Communications, Inc., at 6 n.9. Accordingly, incumbent LECs' entry into broadband, though motivated by cable's entry, may go beyond it. That may, in turn, spur further expansion by cable and others.

[85] Comments of National Cable Television Ass'n at 15.

[86] *See* Comments of MediaOne Group, Inc., at 12 & Appendix A (detailing projections of the five BOCs and GTE).

[87] *Telephony*, COMMUN. DAILY, Jan. 13, 1998. *See also* Comments of SBC Commun. Inc., at 5; *Bell Atlantic & SBC Push Merger Plans to Analysts*, COMMUN. DAILY, Nov. 17, 1998, *available at* 1998 WL 10697764.

[88] *Telephony*, COMMUN. DAILY, Jan. 13, 1998; Bill Alpert, *Getting On the 'Net, and Fast: No More Traffic Jams*, BARRON'S, Dec. 7, 1998, *available at* 1998 WL-BARRONS 21715357.

[89] *Bell Atlantic to Offer Special ADSL Service for AOL*, COMMUN. DAILY, Jan. 14, 1999; *ZDNet, AOL, Bell Atlantic to Offer Speedy Access, available at* http://www.zdnet.com/zdnn/stories/news/0,4586,2186782,00.html, *visited* Jan. 14, 1999.

[90] *BellSouth Rolls Out ADSL to ISP, CLEC, & IXC Business Sectors*, RBOC UPDATE, Oct. 1, 1998, *available at* 1998 WL 2078284.

[91] Some of these providers are carriers, mentioned in previous paragraphs, who are primarily wire-based.

begin offering limited residential service on this spectrum within five years.[92]

44. In sum, it appears that a substantial investment in broadband technologies is taking place across virtually all segments of the communications industry.[93] As one commenter states, "[a]ccess to capital is very plainly not an obstacle to the effective provision of DSL services."[94] MCI echoes this perception, saying "[i]f there have been any capacity constraints [in backbone], it is not for lack of investment. Instead, it has been because exponential growth in Internet usage has surpassed expectations, although, in the end, supply has generally kept pace with such demand."[95] In light of these facts, we disagree with the claim that there is a significant, nationwide, and likely persistent shortage of Internet backbone.[96] As the text above makes clear, supply, especially of backbone, is increasing rapidly. We find that backbone facilities for broadband are being deployed in a reasonable and timely fashion. It appears to us that any shortages are relatively small in scope and duration and reflect not lack of capital, construction, or technologies, but the unforeseeable and enormous increases in demand for one of the most successful technologies in recent history.[97] We expect that the sizeable investment will alleviate any short-term "shortages" in

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[92] *See* Reply Comments of WinStar Communications, Inc., at 3 n.7. *See also* Ray Tiernan, *Look Ma, No Wires*, Dow Jones News Service, Dec. 23, 1998 ("Teligent . . . is looking to [provide] wireless phone service that will offer small businesses wireless Internet access at speeds as fast as a T1 or higher, ... Teligent's system uses a single base station to communicate with several subscriber antennas on the sides of homes and apartment buildings, ...").

[93] Certain additional activity investment in broadband, which is directed primarily at future deployment of last miles, such as Third Generation CMRS, is discussed in the following section.

[94] Comments of DSL Access Telecommun. Alliance at 7 (emphasis in original). *Accord*, Comments of NorthPoint Commun., Inc., at 1; Comments of Transwire Commun., Inc., at 11.

[95] *See* Joint Comments of MCI Commun. Corp. & WorldCom, Inc., at 20 n.31.

[96] *See* Comments of Bell Atlantic at 16-18.

[97] *See* Comments of Data Access Telecommun. Alliance at 6 ("there are multiple backbone providers . . . all in rigorous competition with each other to provide the market with still more bandwidth capacity for the backbone. . . . [T]here are no signs of any impending collapse in spite of the ravenous consumer appetite for bandwidth."); Comments of e.spire Commun., Inc. at 4-6; Comments of the Information Technology Ass'n of America at 4 ("there is no shortage of Internet backbone facilities."); Comments of Intermedia Commun., Inc., at 6-7 ("ILEC claims of 'bandwidth famine' are seriously overstated -- even in rural areas of the nation."); Comments of PSINet Inc., at 5-9; Comments of Qwest Commun. Corp. at 22; Reply Comments of MCI WorldCom, Inc., at 8 ("Supply by the industry is generally keeping up with demand, even though demand is growing at rates that are extraordinary and hard to predict."). *Cf.* Comments of Sprint Corp. at 6 (attributing congestion on the Internet to "the LEC network or . . . the ISPs' modem pools").

broadband backbone.

2. The Last Mile to the Residential Consumer

45. The last mile to the residential consumer, historically served by telephone and cable television incumbents, has generally been the least competitive and most bandwidth-constrained part of the communications network. Compared to a long distance line, a facility serving the last mile is likely to be expensive on a per customer basis to deploy, to have linear rather than exponential growth in use, and to require high maintenance per user. In addition, existing telephone and cable facilities were largely paid for in past decades, when construction costs were lower. They were also paid for by captive ratepayers, under regulatory protection from competition and/or inherent economic conditions that conferred a *de facto* monopoly and ensured recovery of costs, however slowly. The incumbent LEC in each area is also financially strong and well staffed. These factors, among others, have combined to make entry against telephone and cable incumbents very difficult. This has denied residential consumers all the benefits of competition, which lowered prices, increased choices and usage, and sped up innovation in telephones, long distance, and mobile services over the past decades.

46. Broadband, however, opens the possibility of new facilities to serve the last mile to the home. Although telephone and cable incumbents already have facilities serving the last mile, traditional telephone and cable plant are not ideally suited for broadband.[98] Ameritech, for example, estimates that xDSL will not work on 45% of its loops today, and may never work on 20% of them.[99] Similarly, today's cable television plant, even after upgrading for two-way broadband operations, may not be capable of providing all users in a neighborhood with very high speeds.[100] Also, cable television systems are not now deployed

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[98] *See* Comments of Cincinnati Bell Tel. Co. at 9; Comments of Bell Atlantic at 12, *citing Networks: XDSL, ADSL: What to Expect*, LAN MAGAZINE (Sept. 1, 1997); Comments of BellSouth Corp. at 2 ("providing widescale broadband capability is a considerable feat, even for an ILEC. It requires developing technologies, retrofitting loops or laying new networks, investing in costly new equipment and training service personnel."), 13-14.

[99] Ameritech Comments at 7 nn.9-10. *See also* Comments of AT&T Corp. at 8-9 ("Most ILEC loops can be upgraded to support ADSL. . . . With [digital loop carrier] lines included, an estimated 60-80% of RBOC access lines are ADSL qualified") (footnote omitted); Comments of Bell Atlantic at 12; Comments of SBC Commun. Inc. at 5-7. In the same vein, another commenter states that "with the appropriate regulatory incentives, Bell Atlantic's new xDSL service can reach up to 80 percent of telephone subscribers in the Bell Atlantic region." Comments of United Homeowners Ass'n at 12.

[100] Comments of the Progress & Freedom Foundation at 8-9, 27. *See also infra* Appendix A at ¶ 6.

in many business districts. Indeed, it may be that no one current technology is capable of meeting all residential consumers' demands for broadband. These factors may be an impediment to all Americans receiving advanced services.

47. A pessimistic observer might predict that the limitations of some broadband technologies will lead to a patchwork of local broadband monopolies, with most new entrants remaining fringe players. In the consumer market, in this view, DSL will be the only successful technology in one neighborhood, cable-based broadband in the next neighborhood, and satellites in rural areas. In addition, certain commenters argue that if economies of scale and scope in broadband for the consumer market are significant, the present headstart of the cable companies will give them an insuperable first mover advantage and leave them with the kind of dominance they still enjoy in their core market for multichannel video program distribution (MVPD).[101] While this pessimistic view may include broadband reaching all Americans, it does not foresee competition for most residential consumers.

48. We believe it is premature to conclude that there will not be competition in the consumer market for broadband. The preconditions for monopoly appear absent.[102] Today, no competitor has a large embedded base of paying residential consumers. The record does not indicate that the consumer market is inherently a natural monopoly.[103] 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. The facts that different companies are using different technologies to bring broadband to residential consumers[104] and that each existing broadband technology has advantages and disadvantages as a means of delivery to millions of

[101] Comments of Bell Atlantic at 6 & nn.5-6 (citing two independent estimates that eventually cable television companies will have an 80% market share); Comments of BellSouth Corp., Exhibit A (The Forrester Report, *Broadband Hits Home* at 2, http://www.forrester.com/cgi-bin/cgi.pl, *visited* Sept. 14, 1998); *Fifth Cable Competition Report*, *supra* note 54, at ¶ 126 ("Local markets for the delivery of video programming . . . continue to be highly concentrated and characterized by substantial barriers to entry . . .").

[102] *See, e.g.*, Comments of BellSouth Corp. at 3; Reply Comments of Bell Atlantic at 9-10. Incumbent LECs do, however, have market power in the related market for narrowband residential telecommunications.

[103] If it were, it is unlikely that there would be as much entry, investment, and construction in the last mile segment as there is. *See infra* ¶¶ 54-60.

[104] *See, e.g.*, Comments of GTE at i; Comments of National Tel. Coop. Ass'n at 3 & n.5. *See also* Comments of Kielsling Consulting LLC at 2 ("Each technology is being embraced by different interests.").

customers[105] opens the possibility of intermodal competition, like that between trucks, trains, and planes in transportation.[106] By the standards of traditional residential telecommunications, 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.[107]

49. Moreover, it is very likely that the imperfections of existing broadband technologies will lead to new technologies that will improve broadband.[108] Improvements may be most notable in the use of wireless-based broadband technologies to reach isolated rural homes and other high-cost areas,[109] to avoid the expense of laying wire for the last

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[105] Comments of AT&T Corp. at 13 & n.18, *citing* IDC Flash, *DSL Market Gains Direction* at 5, Jan. 1998 ("cable modem operators need to install fiber in their access networks at a fixed cost that IDC estimates to be on the order of $100 billion to cover all of the cable systems in the U.S. . . . In contrast, DSL does not require massive investments to upgrade the [LEC] access network. In addition, most of the costs to deploy DSL are variable rather than fixed -- the service provider can deploy new equipment as new subscribers come on line."); Comments of Comcast at 11; Comments of DSL Access Telecommunications Alliance at 6; Comments of Mindspring Ent., Inc., at 24; Comments of Kielsling Consulting LLC at 6; Comments of Grant Nodine (Bell Atlantic now unable to offer ADSL service to customer with a Macintosh PC); Comments of the Progress & Freedom Foundation at 23-29; ; Comments of SkyBridge at 8-9 (outlining advantages of SkyBridge's satellite system); Comments of United Homeowners Ass'n at 13 (describing limitations of xDSL).

[106] Comments of the Progress & Freedom Foundation at 2-3, 7-10, 23-39.

[107] *See* Brooke Group Ltd. v. Brown & Williamson Tobacco Corp., 509 U.S. 209, 238 (1993) ("Tacit coordination is facilitated by a stable market environment, fungible products, and a small number of variables upon which the firms seeking to coordinate their pricing may focus.").

[108] *See* Comments of ALTS at 14 ("Anyone who has followed telecommunications and information technologies for any period will recognize that the technology that is touted this year may end up either preempted by an entirely new or different technology, [which was earlier] not of use or of interest to consumers, or too difficult or costly to implement.") (footnote omitted); Joint Comments of MCI Commun. Corp. and WorldCom, Inc., at 11. *See also* Comments of Moultrie Ind. Tel. Co. at 4 ("Moultrie views xDSL as an interim and temporary technology, similar to 8-Track audio cassette."). *Cf.* Comments of Bell Atlantic, Attachment A at 3 (quoting Salomon Smith Barney (First Call, Aug. 26, 1998) that "anywhere between 66%-75% of business access lines in U.S. are in buildings where radio frequency will be the more economic alternative relative to either Bell copper loops, T-1s or fiber."). For descriptions of developing technologies, *see* Comments of Media Fusion Corp., New World Paradigm, Ltd. & Khamsin Technologies, and Comments of Northern Telecom, Inc., at 12.

[109] Comments of PSINet Inc., at 2 ("PSINet is actively exploring satellite and wireless delivery mechanisms for broadband delivery in rural and other unserved areas"); Comments of the Organization for the Promotion and Advancement of Small Telecommun. Cos. (OPASTCO) at 7-8; Comments of PSINet Inc., at 8 ("PSINet is actively exploring satellite and wireless delivery mechanisms as a way for ISPs serving rural and other high-cost areas to connect to PSINet's backbone at high speeds."); Comments of SkyBridge at 4 ("new satellite technologies such as SkyBridge can provide . . . the availability of broadband telecommunications to literally

mile,[110] and to provide wireless "last hundred feet" that avoid extensive work inside apartment buildings and other multi-dwelling settings.

50. The consumer market for broadband should be characterized by new products and services being offered and costs falling as a result of technological change. At the retail level, in addition, competition among providers of broadband service may occur on price (different prices and different rate structures (flat-rate and usage-sensitive)), quality of service (different volumes and speeds[111] of transmission in one or both directions), warranties against outages, technical features (symmetrical and asymmetrical bandwidth, storage space), geography (one technology working best in one kind of topography), and user-friendliness (some customers wanting just easy-to-use e-mail and fast web access and others wanting their own personal web pages and major multimedia applications).[112]

51. Indeed, new broadband technologies might even be capable of creating competition for the telephone and cable incumbents in the core markets of narrowband telephone and MVPD that they dominate today. It may be that their rivalry in broadband will lead to each entering the other's core market. Or, perhaps these core narrowband markets will become shrinking adjuncts to a larger, more rivalrous broadband market.[113]

52. Thus, we do not foresee the consumer market for broadband becoming a

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everyone"), 6; Comments of TDS Telecom. Corp. at 7 (expressing doubt that broadband will ever reach rural America through existing wireline technology).

[110] *See* Comments of Personal Commun. Ind. Ass'n at 4; Comments of the Rural Telecommun. Group at 12; Comments of Teligent, Inc., at 2. Sunk investment, in this case, is investment that cannot be re-used for another customer. A wire laid to someone's home cannot be used to serve another person's home. This customer-specific "sunk" nature of the investment in such lines makes would-be providers reluctant to lay them unless the customer has made a long-term commitment. Radio-based last miles, however, can be re-used to serve any customer within range of a radio tower or other central facility. A dish used at one home can be moved to another home and re-used there. Central antennas can be re-focused in another direction.

[111] Some forms of broadband, such as those based on geostationary satellites, can transmit large amounts of information, but only with a few seconds of delay. They might, therefore, be very suitable for transmitting documents, but not for interactive video games that require hair-trigger reactions.

[112] *Cf.* Comments of Retail Internet Service Providers at 4.

[113] JOSEPH A. SCHUMPETER, THE THEORY OF ECONOMIC DEVELOPMENT at 83 (Oxford Univ. Press 1963) ("The opening up of new markets . . . illustrates[s] the same process of industrial mutation -- if I may use that biological term -- that incessantly revolutionizes the economic structure *from within*, incessantly destroying the old one, incessantly creating a new one. This process of Creative Destruction is the essential fact about capitalism.") (italics in original, footnote omitted).

sustained monopoly or duopoly. We will fight any attempt to make residential broadband such a market, because it would not perform well for consumers. Economic theory teaches that, in countries that are rich in resources and in which products can continually improve in quality, consumers benefit from relatively fast innovation.[114] Innovations arrive sooner when many, rather than few, firms enter.[115] Therefore, consumer welfare will be increased by more entry into the market for broadband facilities and services.

53. Our experience in communications markets teaches that entry by many competitors is the best paradigm by which to bring broadband to all Americans. Entry by many competitors is more likely to bring low prices, high quality, constant innovation and improved price-performance ratios, a variety of different retail services, and as many ISPs and content providers as the market will support. In the following paragraphs, we outline the current deployment of improved and entirely new broadband facilities that serve the last mile to residential consumers. We begin with those that seem most advanced in deployment at this time.

54. Cable television companies, as noted in paragraph 37 above, have begun upgrading their cable facilities to provide broadband capability. The most popular offering of broadband to residential consumers is via "cable modems,"[116] offered by cable television companies within their cable service territories. These include services such as @Home and Road Runner. @Home's base of homes with access to two-way upgraded plant increased from 7.9 million on June 30, 1998, to 10 million on September 30, 1998.[117] As noted above,

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[114] *See* Gene M. Grossman & Elhanan Helpman, *Quality Ladders in the Theory of Growth*, REV. ECON. STUDIES 43-61 (Jan. 1991).

[115] *See* Tom Lee & Louis L. Wilde, *Market Structure & Innovation: A Reformulation*, Q.J. ECON. 429-436 (March 1980); Glenn C. Loury, *Market Structure & Innovation*, Q.J. ECON. 395-408 (Aug. 1979); James M. Zolnierek, *Firm Level Behavior in Repeated R&D Races*, EASTERN ECON. J. 293-308 (Summer 1998).

[116] A cable modem is a modem designed for use on a television coaxial cable circuit. Cable modems provide asymmetric bandwidth, with more capacity in the downstream direction (to the customer premises). There are several characteristics of cable modems which distinguish them from dial-up modems and most other data devices used in public wide-area networks: (1) they are capable of handling multimegabit speeds, (2) they require relatively little call set-up (their so-called "always on" feature), and (3) the bandwidth to which they have access is shared by end users. This last characteristic means that cable modem systems are potentially susceptible to congestion occurring as many users attempt to share a common bandwidth. In contrast, in the DSL solutions that LECs are deploying, the last mile bandwidth to the user is dedicated. NEWTON, *supra* note 57, at 118-19.

[117] *See* @Home Network Reports Subscriber Base Grows to 210K Upgraded Homes Passed Increases[sic] to 10M, http://www.home.net/corp/news/pr_981013_01.html, *visited* Nov. 16, 1998.

"deployment" does not necessarily mean that service is available in a practical sense.[118] At this time, we lack information on how many homes passed are actually capable of obtaining the service. According to most estimates, cable television companies now have at least 350,000 residential customers for their broadband offerings,[119] although other estimates are as high as between 425,000 and 700,000.[120]

55. A growing number of public utilities are offering broadband within their utility service territories. They generally offer broadband capability in joint ventures with software and content providers.[121] Utility-based offerings have begun in major northeastern cities, San Francisco, and have begun or are under study in smaller cities such as Cedar Falls, Iowa (population 34,298), Glasgow, Kentucky (population 12,351), and Batavia, Illinois (population 17,016).[122] Generally, these ventures provide high-speed Internet access on their own fiber inside the utilities' existing conduits. According to one estimate, they have passed 122,000 homes with "advanced fiber,"[123] although no customer numbers are available.[124]

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[118] *See supra* note 100.

[119] *See* Comments of AT&T Corp. at 13-14, *citing* Cable Datacomm News, September 1998 (in mid-1998 there were approximately 300,000 cable modem subscribers in North America, the vast majority of them presumably in the United States); Chris O'Malley, *No Waiting on the Web*, TIME MAGAZINE at 76 (Nov. 16, 1998) (about 350,000, according to Jupiter Communications, a research firm); Comments of the Progress & Freedom Foundation at 33, *quoting*, Bowermaster, *Cable Modems Outpace ADSL* (450,000, compared to approximately 25,000 ADSL users). *See also* Comments of U S West Commun., Inc., at 6, *citing* Forrester Research, High-Speed Internet Access to Reach 16 Million U.S. Households by 2002, http://www.forrester.com/press/pressrel/98901.htm; Letter to the Editor, from Matt Wolfrom, Public Relations Director for @Home Network, BOARDWATCH Dec. 1988 at 14 (in unspecified geographic territory, "cable Internet services reach more than 300,000 subscribers").

[120] Comments of BellSouth at 32-33 & Exhibit A at 5. *See also* Catherine Yang, *Filling the Need for Speed*, BUSINESS WEEK at 50, 51, Dec. 28, 1998 (less than 500,000); Telecommunications Industry Association, *The Future of Broadband: A Case for FCC Action to Spur Deployment of Advanced Telecommunications Capability* at 13, filed Dec. 23, 1998 (approximately 700,000 subscribers to cable modem service, citing Multimedia Telecommunications Association and The Yankee Group). For more about cable television companies' broadband offerings, *see Fifth Cable Competition Report*, *supra* note 54, at ¶¶ 48-57.

[121] Several such ventures involve RCN, which owns Erols and other Internet service providers. Comments of Bell Atlantic at 5.

[122] *See* Comments of American Public Power Ass'n, Appendix A *passim*. All local population figures in this Report are taken from the 1990 Census, U.S. Bureau of the Census, CENSUS OF THE POPULATION: 1990.

[123] Comments of Bell Atlantic at 7 & Attachment A at 3.

56. A number of competitive LECs, such as Covad, Rhythms NetConnections, e.spire, and Network Plus are providing broadband to residential consumers, chiefly in the "small office, home office" submarket.[125] Sprint plans in early 1999 to offer its Integrated On Demand Network (ION) service, which uses DSL[126] and which it says will greatly increase the speed and bandwidth of its own and other LECs' facilities.[127] In addition, at least one competitive LEC, MachOne, has announced that it intends to concentrate on mass market residential customers.[128] At this time, we lack information on the number of homes passed by competitive LEC capability as well as the number of homes to which such capability is available as a practical matter.

57. In a significant number of cities, so-called "wireless cable," MDS, or MMDS companies are using spectrum around 2 GHz to offer broadband services to residential consumers.[129] These cities include not only New York City and the San Francisco Bay area, but also such smaller cities as Jackson, Mississippi (population 196,637), and Sherman, Texas (population 31,601). One estimate is that several million residential consumers could now obtain broadband from such companies.[130] We lack information on the actual number of households subscribing to broadband service from MMDS providers.

58. Incumbent LECs have improved their narrowband lines and assert that they are planning to offer broadband on a large scale. Their plans for expansion in 1999 and beyond,

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[124] Some utilities that wish to enter the broadband market are municipally owned. As we have said before, we encourage states to avoid enacting absolute prohibitions on municipal entry into telecommunications. "Municipal entry can bring significant benefits by making additional facilities available for the provision of competitive services." The Public Utility Comm'n of Texas, *Memorandum Opinion & Order,* 13 FCC Rcd 3460, 3549 (1997), *affirmed sub nom.* City of Abilene v. FCC, D.C. Cir. 97-1633 (Jan. 5, 1999).

[125] *See* Comments of BellSouth at 23-24. See also Joint Comments of MCI Commun. Corp. & WorldCom, Inc., at 16 & n.22.

[126] Comments of Sprint Corp. at 6; Telephony, COMMUN. DAILY, Dec. 8, 1998, *available* at 1998 WL 10697914.

[127] Comments of AT&T Corp. at 21; Comments of Sprint Corp. at 5-6 (ION makes possible "virtually unlimited bandwidth . . . at speeds up to 100 times faster than today's conventional modems.").

[128] Ex Parte presentation by MachOne Commun., Inc., Nov. 4, 1998.

[129] "Wireless cable" is described in Appendix A, ¶ 8.

[130] Comments of AT&T Corp. at 16; Comments of BellSouth Corp., Exhibit E at 2 (Cable Datacom News, Wireless Cable Modem Trials and Commercial launches in North America, http://CableDatacomNews.com/cmic12.htm, *visited* Aug. 26, 1998). For more about wireless cable companies' broadband offerings, *see Fifth Cable Competition Report*, *supra* note 54, at ¶ 85.

some of which were described in paragraph 42 above, are ambitious.[131] According to one estimate, incumbent LECs now provide broadband to approximately 25,000 residential consumers.[132]

59. All of these residence-oriented providers of broadband indicate that they intend to expand their offerings quickly.[133] The providers of Road Runner, for example, state that, by the year 2000, it will be available to all of the 27 million homes passed by Time Warner and MediaOne as well as those homes passed by other affiliated cable companies."[134]

60. In addition, new satellite-based providers -- Loral's CyberStar unit,[135] Hughes' Spaceway, Lockheed Martin's Astrolink, SkyBridge, and Teledesic,[136] among others -- are planning to enter the residential broadband market in the next decade. A growing number of public utilities and wireless cable companies may also enter the residential broadband market. Still more entry for residential consumers is possible via "Third Generation" mobile wireless

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[131] *See* Comments of BellSouth Corp. at 2, 14, 15; Comments of Comcast Corp. at 10; Comments of GTE at 10 n.23 ("GTE plans to deploy ADSL service in portions of 14 states"); Comments of Kielsling Consulting LLC at 7-8 (list of Bell offerings or plans taken from their web sites); Comments of MediaOne Group, Inc., Appendix A, stating that Ameritech now provides DSL service to portions of Chicago and Ann Arbor and will make ADSL available to 70 percent of all in-region homes by the year 2000; Bell Atlantic intends to deploy ADSL to 2 million households in Washington, D.C., Pittsburgh, Philadelphia, and the Hudson River Waterfront in New Jersey by the end of 1998, and expects to deploy ADSL to over 6 million households in 1999; BellSouth will make ADSL service available to 1.7 million customers in 30 markets by the end of 1998, and 23 additional markets in 1999; U S West estimates that it will offer ADSL services to approximately 5 million customers in 40 cities in 14 states this year; and GTE plans to equip approximately 6 million lines with ADSL in 300 central offices in 16 states by the end of 1998. *See also* Joint Comments of MCI Commun. Corp. and WorldCom, Inc., at 16 n.20; Comments of National Cable Television Ass'n at 16-17.

[132] Comments of BellSouth at 32-33 & Exhibit A at 35.

[133] *See, e.g.*, Comments of Bell Atlantic, Attachment A (aggressive roll-out of cable modems in 12 states in Bell Atlantic's region).

[134] *See* Company Profile, http://www.rr.com/rdrun/company/index.html, *visited* Dec. 8, 1998.

[135] Chris O'Malley, *No Waiting on the Web*, TIME MAGAZINE at 76 (Nov. 16, 1998).

[136] *See* Comments of AT&T Corp. at 17; Comments of Bell Atlantic at 7-8; Comments of PanAmSat Corp. *passim*; Comments of SkyBridge L.L.C. at 7. Merrill Lynch estimates that the many U.S. households who do not receive a land-based broadband service will be a prime target for these and other Ka-band satellite carriers. Merrill Lynch, *Global Satellite Marketplace '98* at 132-34, April 22, 1998. *See also* Appendix A, ¶ 9.

broadband service by CMRS providers, AT&T's "Project Angel,"[137] over-the-air broadcasters using digital broadcast spectrum,[138] local multipoint distribution service at 28/31 GHz,[139] providers of service at 24, 38, and 39 GHz,[140] and other high bandwidth wireless companies,[141] providers of wireless communications service,[142] satellite master antenna TV companies,[143] and high-altitude, long-endurance platform (HALE) companies such as Sky Station.[144]

61. The following Chart shows current basic capabilities, typical providers, and economics of some of these technologies (and, for comparison purposes, of current narrowband technologies).

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[137] *See, e.g.*, Comments of BellSouth Corp. at 29. *See generally* Comments of Cellular Telecommun. Indus. Ass'n *passim*; Comments of Personal Commun. Indus. Ass'n at 21-23; Comments of the Rural Telecommun. Group at 18; Comments of SBC Commun. Inc., at 13. AT&T's Project "Angel[] costs have plummeted -- to about $700 per household for two phone lines and high-speed Internet access" according to Peter Elstrom, *AT&T's Wireless Path to Local Service*, BUSINESS WEEK at 53, Dec. 28, 1998.

[138] *See, e.g.*, Comments of BellSouth Corp. at 30. *See also* Jube Shiver, Jr., *The Cutting Edge: Net via TV Airwaves Is Not Clicking, Despite Big Backers, Computers: Price-Conscious Consumers Show Little Interest in WaveTop, a Video Datacasting System*, LOS ANGELES TIMES, Sept. 7, 1998, *available at* 1998 WL 18871751.

[139] Comments of AT&T Corp. at 15; Comments of Bell Atlantic at 7-8; Comments of Bell South Corp. at 28-29; Comments of Kielsling Consulting LLC at 8 ("LMDS may still be a year or more away from sizeable deployment"). Some rural companies may use LMDS. Comments of the Organization for the Promotion and Advancement of Small Telecommun. Cos. (OPASTCO) at 3; Comments of SBC Communications Inc., at 13. LMDS is described in Appendix A, ¶ 7.

[140] *See, e.g., supra* ¶ 43.

[141] Comments of the Rural Telecommun. Group at 13.

[142] *Id.* at 2.

[143] *See generally* Comments of Optel, Inc.

[144] *See Airships to Offer Cheap Broadband Access*, EXCHANGE, June 6, 1997, *available at* 1997 WL 8930053; *FCC Grants Licenses for 73 New Ka-band Satellites*, MOBILE SATELLITE NEWS, May 15, 1997, *available at* 1997 WL 8299075.

CHART 2

TECHNOLOGY DEPLOYMENT TO RESIDENTIAL CONSUMERS

Technology (1)	Service Providers (10)	*Typical Marketed* Downstream Residential Speeds (11)	Current Availability (12)	Cost to Provider (13)
Traditional Analog Phone Wire (2)	ILECs, IXCs, ISPs, CLECs	56 Kbps	Nationwide	N/A
ISDN (2)	ILECs, Utilities	128 Kbps	Most major cities	N/A
Satellite - Current (3)	Satellite Operators (DirecPC)	400 Kbps	Nationwide	$400-$500 (per subscriber)
ADSL (4)	ILECs, IXCs, CLECs, Utilities	1.5 Mbps	Some major cities, suburbs and rural areas	$600-$800 (per subscriber)
ADSL-lite (5)	ILECs, IXCs	1 Mbps	In trials	$400-$600 (per subscriber)
Cable Modems (6)	MSOs, CLECs, Utilities	3 Mbps	Some major cities, suburbs and rural areas	$800-$1000 (per subscriber)
Terrestrial Wireless - LMDS - 24/38 GHz (7)	LMDS Companies 24 GHz Providers 38 GHz Providers	1.5 Mbps	In over 30 major markets	$5000-$15000 (per building)
Terrestrial Wireless - MMDS (8)	MMDS Companies	1 Mbps	Some major cities and suburbs; also in 2-way trials	$600 (per subscriber)
Satellite - Future (9)	Satellite Operators (Geo and Non-Geo)	10-64 Mbps	Under development	N/A

Sources for data in Chart 2 are in Appendix A.

3. Deployment to "All Americans"

62. Thus far, this Report has discussed the deployment of broadband in general terms. In section 706 (a) of the 1996 Act, however, Congress instructed us to "encourage the deployment on a reasonable and timely basis of [broadband] *to all Americans (including, in particular, elementary and secondary schools and classrooms)* . . ."[145] At this early stage, we

[145] Pub.L. 104-104, Title VII, § 706 (a), Feb. 8, 1996, 110 Stat. 153, reproduced in the notes under 47 U.S.C. § 157 (emphasis added).

cannot draw any definitive conclusions about whether, if present trends continue, broadband services will ultimately be deployed to "all Americans." In this section, we discuss deployment of broadband to particular classes of users that may be served least if deployment does not occur in a reasonable and timely manner.

a. Backbone to Rural Areas

63. Some BOCs allege that broadband backbone, whatever its availability in major metropolitan areas, will not extend into all rural areas under current conditions.[146] Thus, they argue, rural consumers will be unable to access broadband by a local call, even if they have a broadband facility serving the last mile. The BOCs' solution to this perceived problem is to allow them to provide broadband service across LATA boundaries.[147]

64. At this time, we do not find that lack of backbone is a pervasive factor in rural areas. Cable television systems are widespread in rural America. According to one study, over ninety per cent of this country's population has access by a local phone call to several Internet service providers.[148] Another five percent have access by a local call to one.[149] Only five percent of Americans now lack access to any Internet service provider by a local call.[150] This proves that Internet backbone is accessible to ninety-five percent of Americans as a technical matter. In addition, there should be alternatives to cable- and wireline-based broadband services for these five percent of Americans. Satellite-based multichannel video programming can reach all rural areas in the contiguous United States and is most popular there.[151] This may foretell a similarly widespread acceptance of satellite-based broadband access from future satellite-based entrants into the consumer market.

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[146] Comments of Bell Atlantic at 16; Comments of U S West Commun., Inc., at 14-18.

[147] LATAs, or Local Access and Transport Areas, are geographic areas across whose borders BOCs are generally prohibited from providing certain in-region telecommunications services until they receive authority pursuant to section 271 of the 1996 Act.

[148] Reply Comments of the Commercial Internet Exchange Ass'n at 2-3 & accompanying footnotes, *citing* Tom Downes & Shane Greenstein at 4, *Universal Access and Local Commercial Internet Markets*, at 21 (June 8, 1998), *available at* http://skew2.kellog.nwu.edu/~ngreenste/research.html.

[149] *Id.*

[150] *Id.*

[151] Annual Assessment of the Status of Competition in Markets for the Delivery of Video Programming, *Fourth Annual Report*, 13 FCC Rcd 1034, 1041 (1998) (direct-to-home satellite-based multichannel video is most popular in Montana, where it accounts for 23.6% of all multichannel video subscribership).

65. Although some rural areas may lack easy access to broadband backbone facilities,[152] the comments in this proceeding show that, at present, there is no widespread shortage of broadband backbone in rural areas compared to other areas. The Rural Telecommunications Group, for example, specifically denies the existence of any such shortage.[153] Further, if the tentative predictions we make elsewhere in this Report about the prospects for competition and significant demand in the consumer market for broadband are correct, we expect there to be sizeable investment in broadband backbone in rural areas.

b. The Last Mile to Rural and Low-Income Consumers

66. Some commenters raise the possibility of slow deployment of facilities serving the last mile to rural customers.[154] They contend that in some rural areas the prices that rural customers would be willing to pay might not induce any company to build broadband facilities, especially to residential consumers outside of small towns.[155] Commenters also express concern for consumers who will not be able to afford broadband service in the home and for entire communities where, due to conditions of poverty, there may not be enough demand to attract deployment.[156] Other commenters focus on consumers who can benefit more than most from broadband and urge special measures to ensure that they can afford it. These consumers include persons with disabilities, schools and classrooms, libraries, rural health care providers.[157] Commenters assert that broadband can greatly increase opportunities

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[152] *See* Comments of Kathryn Clodfelter, President of the Crawford County Community Network; Comments of Jim Warner.

[153] Comments of the Rural Telecommun. Group at 11.

[154] *See, e.g.*, Comments of the Campaign for Telecommun. Access at 9; Comments of the Rural Policy Research Inst. at 1-2; Comments of SBC Telecommun., Inc., at 7. According to these commenters, the low population density in rural areas may create a relatively unattractive cost/revenue ratio for broadband providers.

[155] According to these commenters, the low population density in rural areas may create a relatively unattractive cost/revenue ratio for the provision of broadband services. *See, e.g.*, Comments of the Campaign for Telecommun. Access at 9; Comments of the Rural Policy Research Inst. at 1-2; Comments of SBC Telecommun., Inc., at 7.

[156] Comments of the District of Columbia Public Service Comm'n at 4-5; Comments of Information Renaissance at 5-6; Comments of Phones for All, Inc.; Comments of SBC Commun. Inc., at 7.

[157] For example, two-way video, invented for business conferences, can allow the people with hearing disabilities to use sign language or speech reading and thus carry on conversations with the advantage of facial expressions and other nuances. Text-based Internet, if converted into braille, can enable people with visual disabilities to read and research at their computers. Reply Comments of the Consumer Action Network at 2:

for education, jobs, social and recreational life, and health care for these customers.

67. Some commenters urge relaxation of section 271's prohibition on the BOCs' provision of certain in-region interLATA services.[158] Others propose Commission-mandated schedules for the construction of broadband networks,[159] expansion of the Commission's present universal service programs,[160] or more market-oriented solutions to the potential lack of broadband facilities to particular classes of customers.[161]

68. Other commenters, while not denying the special circumstances and/or needs of these consumers, contend that the marketplace will meet the demand. Indeed, some commenters believe that the importance of communications to rural communities' health care, education, economic life, and recreation, as well as the local and civic-minded ownership of many rural carriers, will lead to more broadband in rural communities than elsewhere.[162] The comments also state that some incumbent LECs, cable operators, and other carriers have begun providing broadband services to schools, libraries, and residential consumers in some rural areas[163] and that three quarters of the members of the National Telephone Cooperative Association either have deployed xDSL technology to some extent or are planning to do so.[164]

69. At this stage in the deployment of advanced services to rural communities, our data is anecdotal and we can in no way conclude that all Americans have, or are about to

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Reply Comments of the Council of Organizations Representatives on National Issues Concerning People Who Are Deaf or Hard of Hearing at 3.

[158] *See, e.g.*, Comments of Campaign for Telecommun. Access at 8-11.

[159] *See, e.g.*, Comments of New Networks Inst. at 15-17 ("The Commission has the authority to simply issue an order directing the ILECs to make xDSL-equipped loops available to end users" "and subject them to penalties if they fail to comply"); Reply Comments of Center for Media Education *et al.* at 5 (suggesting that the Commission list rural and poor urban communities and "develop incentives to encourage deployment to these areas"), Reply Comments of Qwest Commun. Corp. at 9 (advocating specific deployment schedules for incumbent LECs, especially RBOCs).

[160] Comments of Information Renaissance at 17; Opening Comments of Universal Service Alliance at 13-14; Reply Comments of the Education & Library Networks Coalition at 3

[161] *See infra* ¶ 78.

[162] Comments of Moultrie Ind. Tel. Co. at 6; Comments of the Rural Telecommun. Group at 2-8.

[163] *See* Comments of OPASTCO at 3; Comments of the Rural Telecommun. Group at iii, 6. *See also* Reply Comments of Tele-Commun., Inc., at 10.

[164] Comments of the National Tel. Coop. Ass'n at 2-3.

have, access to these services. At the same time, however, it appears to us that companies are building or providing these services in many rural areas and that the rural character of these areas will not present an intractable barrier to deployment. For example, Valley Telephone Cooperative in south Texas, with a line density of less than one subscriber per square mile, as well as other rural carriers, have deployed DSL or are testing it.[165] Incumbent and competitive LECs and Internet service providers are testing ADSL in places such as Harrison, Arkansas (population 9,922), Sergeants Bluff, Iowa (population 2,772), Winthrop, Maine (population 5,968), and Kamas, Utah (population 1,061).[166]

70. In addition, incumbent and competitive LECs are not the only possible providers of broadband in rural areas. The cable television operator MediaOne states that it is now offering broadband to "a diverse base of residential customers, including customers in . . . rural areas," including twenty-one small communities in New Hampshire.[167] We know of other deployments of broadband by cable television companies in parts of rural South Dakota and Kansas[168] and in such small towns as Connelsville, Pennsylvania (population 9,229), Bedford, Virginia (population 6,073), Michigan's sparsely populated Upper Peninsula, Marshall, Minnesota (population 12,023), and Payette, Idaho (population 5,592),[169] and Durant, Oklahoma (population 12,823).[170]

71. Rural electric companies and cooperatives, who are among the utilities we refer to in paragraphs 40 and 55 above, are other possible providers in rural areas. In addition, fixed wireless providers such as Winstar and Teligent are also possible providers of broadband in rural areas, as are users of unlicensed spectrum.[171]

72. We lack information on the deployment and availability of advanced telecommunications capability in disadvantaged urban neighborhoods. Therefore, we are

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[165] Comments of Kiesling Consulting LLC at 6.

[166] Comments of Transwire Commun., Inc., Exhibit B at 1, 5-6.

[167] Comments of MediaOne Group, Inc. at 3, 8.

[168] Comments of National Cable Television Ass'n at 8 & Appendix 1.

[169] Comments of AT&T Corp. at 11 & Exhibit B ("Non-ILEC Deployment of Broadband Services and ILEC Responses"); Comments of National Cable Television Ass'n, Appendix 1 at 2.

[170] Comments of BellSouth Corp., Exhibit D (Cable Datacom News, *Commercial Cable Modem Launches in North America* at 2-4, http://www.CableDatacomNews.com/cmic7.htm, *visited* Aug. 26, 1998).

[171] *See, e.g.*, the web page of Adaptive Broadband, http://www.adaptivebroadband.com/products/products.htm, *visited* Jan. 25, 1999.

unable to determine whether broadband is being deployed to those areas in a reasonable and timely fashion. There are, however, a number of ways that broadband can be brought into disadvantaged urban communities. It may appear initially in convenience stores, cafes and other public accommodations (as did telephones and television), and schools and libraries. Schools, libraries, health care facilities, businesses, and academic and military concentrations can serve as anchor customers,[172] from which additional deployment can be made at relatively low cost. Local government authorities can encourage further deployment of high-capacity facilities by cable companies through the cable television franchising process.[173] Incumbent LECs are also committing to deploy broadband in areas of special need.[174] For example, SBC committed to deploy broadband services in more than 200 communities in California, including such traditionally underserved communities as East Palo Alto, South Central Los Angeles, Watts, Hunters Point, Oakland, Compton, and San Francisco's Mission District.[175] A similar program was adopted by Bell Atlantic for New York State.[176]

73. At this time, we do not broaden our universal service programs. In our *Universal Service Order*, we adopted the recommendation of the Joint Board to support Internet access via facilities with greater than voice grade quality only for schools, libraries, and rural health care providers.[177] Given the apparent potential deployment of broadband in rural and low-income areas, we do not re-examine that decision here.

74. Moreover, we need to be particularly careful about any action we take to promote broadband deployment, given the nascent nature of the residential market for broadband. At this time, the dimensions of broadband and the upper limits of market-based

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[172] Comments of the Rural Policy Research Inst. at 5. *Cf.* Reply Comments of the Education & Library Networks Coalition at 4 n.3 ("expanding infrastructure to meet the needs of rural health care providers may often benefit neighboring schools and libraries.").

[173] *See* Comments of Information Renaissance at 14.

[174] Comments of the District of Columbia Public Service Comm'n at 10-11; Comments of State of New York Dep't of Public Service at 2-3; Opening Comments of Universal Service Alliance at 7.

[175] Opening Comments of Universal Service Alliance at 8.

[176] *Id.* at 10.

[177] *See, e.g.*, Federal-State Joint Board on Universal Service, *Report & Order*, 12 FCC Rcd 8776, 8822-23, 9006-07 (1997), *appeal pending sub nom.* Texas Office of Public Util. Counsel v. FCC, 5th Cir. No. 97-60421 (and consolidated cases) (Universal Service Order).

supply and demand are unclear.[178] Moreover, some actions could contravene the intent of section 706 that our broadband policy be technology-neutral[179] and could skew a potentially competitive marketplace.[180] Nevertheless, we will continue to closely monitor the rollout of advanced services in rural and low-income areas, including in subsequent reports. We are committed to ensuring the reasonable and timely deployment of advanced telecommunications capability to all Americans, including those in rural and low-income areas. In addition, we may examine calls for expansion of our present programs in future proceedings. [181]

75. We also recognize the enormous potential of broadband services to enhance educational and employment opportunities for people with disabilities. Advanced telecommunications capability can dramatically increase communications access and quality of life for this population. People with disabilities are included within section 706's mandate that broadband be deployed to "all Americans." In addition to increasing telecommuting opportunities, and therefore employment opportunities, advanced video and data technologies can allow people with disabilities to obtain information in accessible formats and communicate with others through telecommunications networks in accessible mediums. In essence, advanced telecommunications capabilities can, in some instances, allow people with disabilities to transcend physical barriers posed by traditional telecommunications services.

76. We caution, however, that the promise of advanced telecommunications capability for people with disabilities will not be realized unless inherent barriers in telecommunications products and services are removed, and accessible equipment and services are widely available through mainstream markets. There exists a genuine danger that people with disabilities will be left out of the telecommunications revolution if telecommunications equipment and services are not designed to be accessible to the broadest possible range of

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[178] Comments of TDS Telecommun. Corp. at 2 (counseling against "regulating ahead of the market curve" "before the marketplace defines itself and its limit"). *See also* Comments of the Technology Entrepreneurs Coalition at 3, *quoting* W.W. BARLEY III (ED.), COLLECTED WORKS OF F.A. HAYEK, F.A. HAYEK, THE FATAL CONCEIT: THE ERRORS OF SOCIALISM at 85 (U. of Chicago Press 1988) (". . . what cannot be known, cannot be planned."); Reply Comments of National Rural Telecom, Ass'n at 8 ("it is too early for government intervention that second-guesses the marketplace before marketplace forces have developed sufficiently to evaluate where market-driven deployment is likely to lag or languish.").

[179] Section 706 (c) defines "advanced telecommunications capability," which we refer to as broadband, "without regard to any transmission media or technology."

[180] Comments of Comcast Corp. at 11-12 & n.16; Comments of Sprint Corp. at 10-11.

[181] For example, on or before January 1, 2001, the Commission will convene a Federal-State Joint Board to review the current definition of universal service. Universal Service Order, *supra* note 177, 12 FCC Rcd at 8790, 8807, 8834-35.

users. Congress recognized this principle through its enactment of section 255 of the Act.[182] Section 255 specifically provides, among other things, that manufacturers of telecommunications equipment and customer premises equipment, and providers of telecommunications services shall ensure that their equipment and services are accessible to and usable by individuals with disabilities, if readily achievable.[183]

77. The Commission has not completed its final rules for section 255 at this time. We remind telecommunications service providers and equipment manufacturers, however, that the provisions of section 255 are currently enforceable.[184] Finally, while we do not propose to change any of our present programs in this proceeding, we are committed to taking advantage of any opportunities to encourage the deployment of advanced telecommunications service to people with disabilities. Plans for the deployment of advanced services should also address the needs of persons with disabilities. We encourage the disability community to continue to provide information to the Commission on any barriers to advanced telecommunications capability that may arise as such advanced services are deployed.

78. Finally, we find merit in the "demand pull" concept, which holds that consultations between actual and potential suppliers of broadband and community leaders in traditionally underserved areas can lead suppliers to more rapid deployment of broadband capability.[185] For example, the Center for Media Education asserts that the cable television operators were initially reluctant to wire low income areas for video service. They preferred to wire affluent areas, which they thought would be more profitable. Once they did wire low income areas, however, they discovered that such areas were among their most profitable.[186] The Alliance for Public Technology suggests that community leaders that know the needs of their communities in such areas may be able to coalesce enough demand to pull in profit-

[182] 47 U.S.C. § 255 *et seq.*

[183] 47 U.S.C. § 255 (b), (c).

[184] *See generally* Implementation of Section 255 of the Telecommunications Act of 1996, Access to Telecommunications Services, Telecommunications Equipment, and Customer Premises Equipment by Persons with Disabilities, *Notice of Proposed Rulemaking*, WT Docket No. 96-198, FCC 98-55, released April 20, 1998, *available at* 1998 WL 185139.

[185] Comments of the Alliance for Public Technology at 6-8. *See also* Comments of Information Renaissance at 15.

[186] Reply Comments of Center for Media Education *et al.* at 4 & n.7.

oriented suppliers.[187] We believe that private efforts to stimulate demand pull may speed the deployment of broadband in traditionally underserved areas.

79. We emphasize that these suppliers are not only the incumbent LECs and cable television companies. They also include new and potential providers of broadband. The latter companies, because they lack a mature business, an existing customer base, and sunk investment in narrowband technologies, may find serving small groups of customers, or customers with unique needs, relatively attractive.[188]

80. We repeat that we are finding only that the record evidence is insufficient for us to conclude that broadband is not being deployed to "all Americans" in a reasonable and timely fashion by private activities and our current programs. If, however, in the future, we find that broadband is not being deployed in a reasonable and timely fashion in specific areas or to particular groups of customers, we will not hesitate to act.

c. Elementary and Secondary Schools and Classrooms

81. Section 706(b) of the 1996 Act specifically directs the Commission to assess the availability of advanced telecommunications to elementary and secondary schools and classrooms.[189] In addition to recognizing the importance of providing schools with access to advanced services in section 706, Congress recognized the need for such access in section 254 of the Act, which for the first time provides universal service support for advanced services to schools and classrooms.[190] We note that section 254 of the Act expressly provides for universal service support for advanced services to schools, libraries, and rural health care providers.[191] Although section 706 concerns the availability to advanced telecommunications capability to all Americans, including all of the entities listed in section 254, we limit our

[187] APT's idea is supported by several others. *See* Comments of GTE at 12 n.33; Comments of Information Renaissance at 13-15; Comments of Alpha Telecommun. & Technologies; letter from the Summit Health Institute for Research and Education, Inc. (undated). *Cf.* Reply Comments of the American Public Power Ass'n at 19-20.

[188] For an example of a traditionally underserved area that, by going to a new entrant, received far more (for less money) than an established carrier would give it, see Doug Fine, *Eskimos Warm to Digital Age*, WASH. POST at C-1 (Aug. 9, 1998).

[189] *See supra* note 3.

[190] 47 U.S.C. § 254.

[191] 47 U.S.C. § 254(h)(2)(A).

discussion in this section to elementary and secondary schools and classrooms, because section 706 expressly mentions these institutions.

82. In the Act, Congress directed the Commission and states to take the steps necessary to establish support mechanisms to ensure the delivery of affordable telecommunications service to all Americans, including schools and classrooms.[192] Congress further directed the Commission to define additional services for support for eligible schools and classrooms and directed the Commission to "establish competitively neutral rules . . . to enhance, to the extent technically feasible and economically reasonable, access to advanced telecommunications and information services for all public and non-profit elementary and secondary school classrooms . . . ."[193] On May 8, 1997, the Commission released the *Universal Service Order*, implementing section 254 of the Act, and establishing a universal service support system that became effective on January 1, 1998.[194]

83. In the *Universal Service Order*, the Commission, among other things, established the federal universal service support mechanism for schools and classrooms.[195] Consistent with the recommendations of the Federal-State Joint Board on Universal Service, the Commission concluded that all telecommunications services, Internet access, and internal connections would be provided at discounts ranging from 20 percent to 90 percent to eligible schools and classrooms.[196] The schools and classrooms support mechanism grants schools and classrooms maximum flexibility to purchase the package of services they believe will most effectively meet their communications needs, subject to the requirement that competitive bids are sought for all services eligible for discounts under section 254.[197] The discount rate provided to a particular school or classroom varies based on the percentage of students eligible for participation in the national school lunch program and the classification of the school or classroom as rural or urban.[198] When demand exceeds available funding and a filing window is in effect, funding priority is first given to requests for telecommunications services and Internet access that are received within an established filing window, and then to requests

[192] 47 U.S.C. § 254 (h)(1)-(2).

[193] 47 U.S.C. § 254 (h)(2)(A).

[194] *Universal Service Order*, 12 FCC Rcd at 9002-92.

[195] *Id.*

[196] *Id.* at 9002.

[197] *Universal Service Order*, 12 FCC Rcd at 9007; 47 C.F.R. § 54.504(a).

[198] *Universal Service Order*, 12 FCC Rcd at 9035-9050.

received within a filing window for internal connections beginning at the 90% discount level.[199]

84. The Commission is confident that, consistent with the goals set forth in section 706 of the Act, the support mechanisms for schools and classrooms will help provide support for the deployment of advanced services to schools and classrooms. Applications were received for support from the support mechanism for schools and classrooms during the filing window for the 1998-1999 funding year[200] and on November 21, 1998, the Administrator began notifying schools and classrooms of the results of their requests for discounts.[201] Although the Education and Library Networks Coalition argues that the universal service support mechanisms are not sufficient to implement section 706,[202] we believe that it would be premature at this time to adopt additional measures for deploying advanced services to schools and classrooms.[203] We expect that, as implementation of the universal service support mechanisms continues, deployment of advanced telecommunications capabilities to schools and classrooms will become widespread. Finally, we note that in the *Universal Service Order*, as recommended by the Joint Board, the Commission committed to reviewing the

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[199] Federal-State Joint Board on Universal Service, *Fifth Order on Reconsideration & Fourth Report & Order*, 13 FCC Rcd 14915, 14936-38 (1998). Funding for internal connections below the 90% discount level is provided based on funding availability. *Id.* at 14938.

[200] The first filing window opened on January 30, 1998 and closed on April 15, 1998. *Fifth Order on Reconsideration*, 13 FCC Rcd at 14920. In the *Fifth Order on Reconsideration*, the Commission changed the funding year for the universal service support mechanism for schools and classrooms from a calendar year cycle (January 1 - December 31) to a fiscal year cycle (July 1 - June 30). *Id.* at para. 8. Because the Commission implemented the funding year change immediately, the applications submitted during the first filing window are being funded through June 30, 1999, within the applicable funding limitations. *Id.* The window for filing applications for 1999-2000 opened on December 1, 1998 and will close on March 11, 1999. The Commission received approximately 30,000 applications for support, although these applications included requests from both schools and libraries.

[201] The Administrator has been notifying applicants in waves and will continue to do so until all applicants have been notified. We note that, in an Order released on November 20, 1998, the Commission directed the Schools and Libraries Corporation and the Rural Health Care Corporation to merge into the Universal Service Administrative Company as the single entity responsible for administering all four universal service support mechanisms. Changes to the Board of Directors of the National Exchange Carrier Association, Inc., Federal-State Joint Board on Universal Service, *Third Report & Order in CC Docket No. 97-21, Fourth Order on Reconsideration in CC Docket No. 97-21 & Eighth Order on Reconsideration in CC Docket No. 96-45*, FCC 98-306, released Nov. 20, 1998, *available at* 1998 WL 804687.

[202] Reply Comments of Education & Library Networks Coalition at 3.

[203] No commenter furnished objective data about how many schools and classrooms do, and do not, have access to advanced capabilities.

definition of universal service on or before January 1, 2001.[204] We believe it would be appropriate at that time to assess whether the implementation of the universal service support mechanisms has resulted in the deployment of advanced services to schools and classrooms.

C. The Demand for Broadband Capability

85. We next examine the demand for broadband capability. In order to determine whether broadband capability is being deployed in a reasonable and timely fashion, we must consider whether the consumers' demand for broadband is being met. The speed of future investment and the success of that investment will depend, in part, on consumer demand for high-speed services.

86. At present, the demand for high-speed Internet access is the primary driver of consumers' desire for broadband. One statistical trend that indicates the vast potential of the Internet-via-satellite market comes from Frost & Sullivan. It estimates the market for Internet-specific satellite earth stations will increase from approximately $101 million in 1998 to $1.78 billion by year-end 2002.[205] We expect that the demand for this application of broadband will continue to grow rapidly in future years. In 1998, there were personal computers (PCs) in almost half of American households[206] and there were approximately 30 million home subscribers to narrowband Internet services.[207] Experts project continued growth in the home PC and Internet markets, elements of which are variously described as "increasing," "rapid[]," "staggering," and "exploding."[208] Prices of home-oriented PCs are below $1,000 and high-speed cable modem prices are below $350.[209] Many predict that these

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[204] *Universal Service Order*, *supra* note 177, 12 FCC Rcd at 8790.

[205] Clayton Kunz, *Broadband Satellite Systems: The Rubber Hits the Road*, Feb. 1998, http://www.frost.com/verity/newsletter/telecom/98-02/art05.htm

[206] Robert Lemos, *ZDNet, PCs in Half of U.S. Homes -- Almost*, http://www.zdnet.com/zdnn/stories/news/0,4586,2169244,00.html, *visited* Dec. 30, 1998. *See also* Comments of United Homeowners Ass'n at 14.

[207] Chris O'Malley, *No Waiting on the Web*, TIME MAGAZINE at 76 (Nov. 16, 1998) (27 million); Reply Comments of Comcast Corp. at 21 (35 million). Even if these figures are not precisely comparable because of homes and individuals with several different Internet accounts, they still show a large potential residential market for broadband. That there are approximately 30 million home Internet subscribers is a superlative record for a service that consumers had barely heard of five years ago.

[208] Comments of the Progress & Freedom Foundation at 11-16.

[209] Comments of BellSouth Corp. at 19.

prices will continue to fall significantly, with one commenter predicting that broadband cable modem prices will be below $150 by the end of 1999.[210] These conditions indicate that there is a large pool of potential residential consumers of broadband and that the pool is likely to grow in coming years.[211]

87. As for the retail price of broadband, some offerings are already priced below $50 a month. The following Chart shows the present speeds and prices of several broadband (and, for comparison, current narrowband) technologies. It assumes that the customer already has purchased a PC.

[210] Comments of BellSouth Corp., Exhibit A, *citing* The Forrester Report, *Broadband Hits Home* at 2, http://www.forrester.com/cgi-bin/cgi.pl, *visited* Sept. 14, 1998.

[211] Indeed, if WebTV is capable of supporting broadband speeds, then the 98% of American homes that have television sets need not purchase a PC to receive broadband.

CHART 3

TECHNOLOGY COSTS TO RESIDENTIAL CONSUMERS

Technology (1)	Cost to Consumer - *Installation* (14)	Cost to Consumer - *CPE* (15)	Cost to Consumer - *Monthly Basic Svc* (16)	Cost to Consumer - *Monthly Internet Service* (17)	Cost to Consumer - *Total First-Year Costs* (18)	Monthly "Bits per Buck" Ratio (19)
Traditional Analog Phone Wire (2)	$0	$200	$20	$20	$680	1.4
ISDN (2)	$90 - $160	$300	$30-$50	$30-$50	$1385	1.6
Satellite - Current (3)	$50	$300	$30-$50	$0 (included in access fee)	$830	10.0
ADSL (4)	$100	$200	$50-$60	$0 (included in access fee)	$960	27.3
ADSL-lite (5)	$0	$200	N/A	N/A	N/A	N/A
Cable Modems (6)	$75-$150	$0 (incl. in install fee)	$40	$0 (included in access fee)	$593	75.0
Terrestrial Wireless - LMDS - 24/38 GHz (7)	$200	$1000	$50	$0 (included in access fee)	$1700	30.0
Terrestrial Wireless - MMDS (8)	$100	$400	$50-$70	$0 (included in access fee)	$1220	16.7
Satellite - Future (9)	N/A	$500-$1000	N/A	N/A	N/A	N/A

Sources for data in Chart 3 are in Appendix A.

88. There appears to be a significant initial demand for broadband in the consumer market -- at least 375,000 paying customers.[212] In addition, the first survey of which we are aware shows that customers are highly satisfied with the most popular form of residential

[212] *See infra* ¶¶ 54, 58. There is disagreement about the price-elasticity of demand, which is the measurement of consumer responsiveness to price changes, such as the extent to which a higher price will result in fewer sales. *Compare* Comments of the Progress & Freedom Foundation at 16-17 (demand is price-elastic) *with* Dan Allen, Sr., & Earl Craighill, *Demand for High Bandwidth Access* at A-32 (Feb. 1998) (demand may be price-inelastic), Appendix A to USTA Presentation, *supra* note 36.

broadband service on offer today, cable modem broadband service.[213]

89. Concerning specific services and applications, we expect consumers to demand more than high-speed Internet access. This may include high-speed, high-quality access to video conferencing, [214] electronic commerce,[215] which boomed unexpectedly over the recent holidays,[216] local area networks,[217] hundreds of radio and television channels and individually requested books, movies, and musical recordings.[218] Consumers may also demand broadband not only for more and faster forms of today's products (*e.g.*, movies), but also for new products that are especially tailored to the Internet and/or broadband. These products may include "magazines" that are individually customized to fit the consumer's preferences, and interactive single- or multi-player games including those on popular television shows.[219]

90. We therefore expect that the demand for residential broadband is going to grow in coming years, in all likelihood making it a mass consumer product eventually.[220] It is not clear, however, how quickly residential broadband will reach the point in the "S Curve" when supply and demand rise sharply -- that is, when it begins moving from being a niche product

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[213] Anne M. Hoag, Ph.D., *Cable Modem Market Study: Adoption Patterns & Impact on Internet Usage: Summary of Findings* at B-3-4 (Feb. 1998) (demand may be price-inelastic), Appendix A to USTA Presentation, *supra* note 36.

[214] Comments of the Progress & Freedom Foundation at 19 (among business customers, video conferencing is growing 100% per year).

[215] *See* United States Government Electronic Commerce Policy, *available at* http://www.ecommerce.gov/, *visited* Dec. 29, 1998; Remarks by the President and the Vice President at Electronic Commerce Event, Nov. 30, 1998, *available at* http://www.whitehouse.gov/WH/New/html/19981130-19675.html, *visited* Dec. 2, 1998.

[216] Leslie Walker, *Online Shoppers Triple Holiday Spending*, WASHINGTON POST, Jan. 4, 1999 at A-4; Bob Tedeschi, *Reports Indicate Online Holiday Sales Exceeded Expectations*, CYBERTIMES, www.nytimes.com/library/tech/99/01/cyber/articles/05aol.html, *visited* Jan. 6, 1999.

[217] Comments of Retail Internet Service Providers at 7 n.8.

[218] Reply Comments of Broadcast.com at 2. *See also Fifth Cable Competition Report*, *supra* note 54, at ¶¶ 102-05.

[219] Karen Kaplan, *The Cutting Edge Year-End Technology Special: Buzzword for the New Year Is Bandwidth*, L.A. TIMES at C-1, Dec. 28, 1998, *available at* 1998 WL 18907754.

[220] *See, e.g.*, Comments of Cincinnati Bell Tel. Co. at 11-12.

to being a mass market one.[221] Some of the products for which S Curves have been observed developed in largely unregulated markets, which may have speeded their deployment.

D. Conclusion

91. In this section, we apply the measurements discussed in paragraphs 20-25 and 31-32 above, to the actual deployment of broadband to residential customers to date. At such an early stage of deployment to residential customers, it is difficult to reach any firm judgment. Nevertheless, based on the objective comparison we spelled out in paragraphs 31-32 above, which compares the penetration of other nascent consumer products, the deployment of advanced telecommunications capability to all Americans appears, at present, to be proceeding on a reasonable and timely schedule.[222] Based on the record submitted in this proceeding, it appears that the following numbers of residential customers, at a minimum, are now subscribing to broadband: 350,000 from cable television companies and 25,000 from ADSL. This amounts to 375,000 customers,[223] or a residential penetration of approximately .4%.[224] The 375,000 figure is understated because it attributes no customers to utility, wireless cable, and competitive LEC offerings and because it is several months old in a business that is gaining new subscribers rapidly.[225]

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[221] *See supra* note 44.

[222] Many parties concur with this conclusion, though by different analytical paths. *See* Comments of Comcast Corp. at 1-2; Comments of Kielsling Consulting LLC at 2; Comments of MediaOne Group, Inc., at 12. *Cf.* Comments of the Commercial Internet Exchange Ass'n at 9. *Cf.* Comments of State of New York Department of Public Service at 2 ("Recent reviews . . . reveal no discernible evidence of significant unmet demand for advanced telecommunications capability."); Comments of Telecommun. Resellers Ass'n at iii; Reply Comments of Comcast Corp. at 6.

[223] *See also* Kathleen M.H. Wallman, *Higher Ground: Reconceptualizing the Debate Over Deploying Advanced Telecommunications Capability Under Section 706 of the Telecommunications Act of 1996* at 5 (Dec. 1998) (implying that there are fewer than 500,000 residential subscribers to ADSL and cable-based broadband service).

[224] Industry Analysis Division, Common Carrier Bureau, TRENDS IN TELEPHONE SERVICE, Table 16.1 at 85 (July 1998).

[225] *See* Catherine Yang, *Filling the Need for Speed*, BUSINESS WEEK at 50, 51, Dec. 28, 1998 (@Home is growing 40-50% per quarter and RoadRunner adds 4,000 subscribers a week). Two estimates made at the end of 1998 are that there were 500,00 residential subscribers to some form of "high-speed" Internet service. *See Spencer E. Ante, A Broad Band of Unrealistic Expectations*, http://fnews.yahoo.com/street/99/01/21/valley_990121.html, *visited* Jan. 25, 1999; Stephen Buel, *Bandwidth: Spread of High-Speed Access Expected To Transform Internet Usage*, SAN JOSE MERCURY NEWS, Jan. 20, 1999, *available at* 1999 WL 8293884 and http://www.mercurycenter.com/business/center1/hispeed012099.htm.

92. 375,000 residential customers, or .4% residential penetration, at the end of the second calendar year of deployment is far more than the number of customers for the telephone, color television, and cellular service at the same stage in their deployment, and approximately the same penetration percentage as that of black-and-white television. Even if the customer numbers stated in paragraph 32 above were adjusted upwards to account for the smaller population of the United States in past decades, there would still be fewer than 375,000 residential customers for the similar technologies, except for black-and-white television. We are further encouraged by the fact that companies in virtually all segments of the communications industry are making sizeable investments in broadband technologies. We expect that these investments will lead to more competition in, and greater deployment of, broadband generally, and in particular, to classes of users, including people in rural areas, low-income people, schools, and classrooms.

93. The above, however, is a static snapshot taken at the present moment. Ensuring that deployment is reasonable and timely as the market develops continues to be one of our top priorities. We will, for example, examine barriers to entry to determine whether such barriers inhibit firms' ability to meet customer demand. Where immediate action is warranted, we are taking steps, which we discuss in the next Sections, to ensure that the deployment of broadband is reasonable and timely. We will also continue to monitor closely the deployment of broadband to all Americans, most specifically in future reports of this type.

94. Under most scenarios, competition among several facilities-based providers of residential broadband will occur. We therefore expect facilities-based competition in much of the United States, even in the short term. We also emphasize the importance of resale, major entry into broadband by companies that do not currently offer communications services, such as utilities, and new technologies such as next generation Ka-band satellite systems.[226]

95. We think of broadband facilities as an input product, like microprocessors or memory in the computer world. For such products, a so called "virtuous cycle" can develop. Successive generations of input products provide more performance for the same amount of money. The greater performance enables current applications to perform better and fuels more demand for them, and demand for new applications that were not feasible before. We have seen such a virtuous cycle in bandwidth in the SONET market for optical networking, in the local area network market for desktop data communications, and in the modem market for consumers. Although we conclude that the current deployment of broadband appears reasonable and timely, we anticipate seeing such a virtuous cycle for consumer market bandwidth, especially in facilities serving the last mile. As a result, we expect consumer demand to increase substantially in coming years.

[226] *See supra* ¶ 39 & *infra* Appendix A at ¶ 9.

96. The demand pull concept adds consumers as a stimulus to the virtuous cycle. As the cycle gains momentum and cost decreases and performance increases, we expect that companies will provide new applications and services for broadband consumers. As a result, more consumers will demand broadband, and the virtuous cycle will accelerate. In this way, we will reach our ultimate goal that all Americans have meaningful access to advanced telecommunications capability and the benefits of the Information Age.

97. We expect consumers to demand, and the market to deliver, much more in coming years. We envision successive generations of bandwidth technologies for the last mile, each a leap forward in speed from the current generation.[227]

98. Although we conclude that deployment of broadband appears reasonable and timely today, we will continue to monitor deployment of such capability, including through annual reports. We note that the pace of broadband deployment may need to accelerate in coming years to remain reasonable and timely.[228] We expect to see deployment of broadband capability continue and accelerate in the near future. Moreover we will not hesitate to promote competition and reduce barriers to infrastructure investment so that all companies have market-based incentives to invest, innovate, and meet the needs of all consumers.

IV. ADDITIONAL ISSUES

99. We note that many issues and proposals for action that we raised in the Notice and that parties raised in their filings herein are being addressed in other proceedings, and we urge the parties to participate in those proceedings. Below, we address three issues on which we believe a discussion of our general thinking would be particularly useful: (1) access to broadband systems; (2) access to multiple dwelling units; and (3) Internet peering arrangements.

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[227] *See generally* Kathleen M.H. Wallman, *supra* note 223.

[228] If the market for broadband grows as the market for over-the-air television did, deployment will need to accelerate very sharply in the next two years. In 1948, the year corresponding to 1998 for broadband, there were only 172,000 television sets. In 1949, however, there were 940,000; and in 1950, there were 3.875 million. Bureau of Census, U.S. Department of Commerce, HISTORICAL STATISTICS OF THE UNITED STATES, COLONIAL TIMES TO 1970, Vol. 2 at 796 (Series R 93-105, Households with Television Sets).

A. Access to Broadband Systems

100. In the Notice, we asked generally about the kinds of regulatory structures that would best foster the deployment of broadband and that would best fit the consumer broadband market.[229] Few comments addressed these general questions, but many addressed one specific regulatory issue, whether Internet service providers should be given rights of access to broadband systems operated by cable television companies. Many commenters took strong positions favoring[230] or opposing[231] the placing of such an obligation on cable television operators.

101. We note, as a preliminary matter, that our duty to encourage broadband deployment of advanced services requires us to look broadly at *all* methods of providing additional bandwidth to customers, not just those methods provided by cable companies or other particular types of service providers. We observe further that the record, while sparse, suggests that multiple methods of increasing bandwidth are or soon will be made available to a broad range of customers. On this basis, we see no reason to take action on this issue at this time. We 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.

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[229] Notice, *supra* note 11, 13 FCC Rcd at 15308-11.

[230] *See* Comments of America Online, Inc., at 9-11; Comments of GTE at 17 n.44; Comments of Virtual Hipster at 3; Comments of the Rural Policy Research Inst. at 4; Reply Comments of America Online, Inc., *passim*; Reply Comments of Broadcast.com at 4; Reply Comments of Center for Media Education *et al.* at 9; Reply Comments of the Internet Service Providers' Consortium at 5; Reply Comments of Mindspring Enterprises, Inc., at 14-23. The Rural Policy Research Institute advocates unbundling for "*all* competitors . . . where necessary." [Italics in original.] Two parties call for ISPs to have the same rights *vis a vis* incumbent LECs as competitive LECs. Comments of Verio Inc., at 3-4; Reply Comments of the Coalition of Utah Ind. Internet Service Providers at 6-7.

[231] *See* Comments of AT&T Corp. at 38-42, *citing* B. Esbin, *Internet Over Cable: Defining the Future in Terms of the Past*, Commission Office of Plans & Policy Working Paper #30 (Aug. 1998); Comments of Comcast Corp. at 2, 8, 16-17 & nn.28-29; Comments of National Cable Television Ass'n at ii; Comments of the Progress & Freedom Foundation at 8-9, 27; Reply Comments of AT&T Corp. at 13-16; Reply Comments of At Home Corp. at 14-15; Reply Comments of Comcast Corp. at 17-24 & n.35 at 18; Reply Comments of Cox Commun., Inc., at 5-7.

B. Access to Multiple Dwelling Units

102. Several commenters allege that they have encountered problems in providing broadband to tenants in many apartment and condominium buildings and other multiple dwelling units (collectively, MDUs) because they cannot obtain access on reasonable terms to the "last hundred feet" of facilities to the tenant's unit.[232] In order to provide service to tenants, communications carriers need access to wire within the MDU to carry signals to the individual premises of each tenant that seeks their service.[233] In addition, wireless carriers, in particular, state that they need access to rooftops for placement of their transmission and reception facilities and to riser conduit for transmission of signals between their rooftop facilities and the building's central service node.[234] Commenters allege that their access to these important service facilities has been unreasonably obstructed both by incumbent providers and by building owners.[235]

103. Commenters suggest a variety of Commission actions that could promote the availability of broadband to MDUs. For example, among other things, commenters have suggested that the Commission forbid exclusive access agreements between building owners and providers.[236] Real estate interests, such as The Building Owners and Managers Association, however, counter that a dynamic market for access to buildings is evolving and that building owners have good reason to afford their tenants the services they want.[237]

104. As of 1990, MDUs comprised approximately 28% of all housing units

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[232] The same considerations apply to office buildings.

[233] *See* Comments of Allegiance Telecom, Inc., at 8; Comments of the Wireless Commun. Ass'n Int'l, Inc., at 26-30; Reply Comments of KMC Telecom, Inc., *passim*; Reply Comments of RCN Telecom, Inc., at 14-21.

[234] Reply Comments of WinStar Commun., Inc., at 4.

[235] *See, e.g.,* Comments of Allegiance Telecom, Inc., at 8; Comments of Optel, Inc., at 4-6; Reply Comments of KMC Telecom, Inc., at 4-5.

[236] *See* Comments of Allegiance Telecom, Inc., at 8-9; Comments of Sprint Corp. at 9; Reply Comments of KMC Telecom, Inc., at 10; Reply Comments of WinStar Commun., Inc., at 5-6.

[237] Building Owners & Managers Association, WIRED FOR PROFIT: THE PROPERTY MANAGEMENT PROFESSIONAL'S GUIDE TO CAPTURING OPPORTUNITIES IN THE TELECOMMUNICATIONS MARKET at 2 (1998) ("Property management professionals must be prepared for access demand to grow as telecommunications choice grows. . . . Either way, those providing choice will need access to your tenants, and your tenants will demand access to them".).

nationwide, and that percentage is likely growing.[238] If a significant portion of these units is not accessible to competitive providers of broadband, that fact could seriously detract from local competition in general and the achievement of broadband availability to "all Americans" in particular. We are considering the issue of access to MDUs in several proceedings. For example, WinStar has requested that we apply section 224 of the Communications Act, governing regulation of pole attachments, to require public utilities to make rooftop facilities and related riser conduit owned or controlled by the utility available to competing providers of communications services.[239] In these proceedings, we can address more fully any questions regarding our statutory or constitutional authority to take any particular action and the need for action. If the answers to such questions show that Commission action is permissible and desirable, we will then consider what actions will ensure that the deployment of broadband to all Americans is reasonable and timely.

C. Internet Peering

105. In the Notice, we asked whether the Commission should monitor or exercise authority over peering -- an arrangement in which two Internet backbone providers exchange traffic that originates from an end user connected to one of the providers and terminates with an end user connected to the other provider.[240] Commenters almost unanimously oppose Commission involvement at this time in peering and similar relations among Internet firms.[241] Only one commenter, Bell Atlantic, suggests possible action, and that is only that we "lower barriers for new entrants, in particular currently precluded entrants."[242] We agree with SBC that premature regulation "might impose structural impediments to the natural evolution and

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[238] Telecommunications Services Inside Wiring, *Report & Order & Second Further Notice of Proposed Rulemaking*, 13 FCC Rcd 3659, 3679 (1997) (*Inside Wiring Report & Order & Second Further NPRM*).

[239] Implementation of the Local Competition Provisions in the Telecommunications Act of 1996, CC Docket No. 96-98, *WinStar Communications, Inc., Petition for Clarification or Reconsideration* (filed Sept. 30, 1996). *See also Inside Wiring Report & Order & Second Further NPRM*, 13 FCC Rcd at 3778-82.

[240] Notice, 13 FCC Rcd at 15309. In general, peering is settlements-free, *i.e.*, the providers do not charge each other for terminating traffic. Also, one peer will not allow traffic from another peer to transit its network to a third provider. *See* WorldCom, Inc. & MCI Communications Corp., CC Docket No. 97-211, *Memorandum Opinion & Order* FCC 98-225 at ¶¶ 143-46, released Sept. 14, 1998, *available at* 1998 WL 611053.

[241] Comments of America Online, Inc., at 13-15; Comments of Internet Service Providers' Consortium at 15-17; Comments of Northern Telecom, Inc., at 3; Comments of PSINet Inc., at 7; Comments of SBC Commun. Inc., at 12.

[242] Reply Comments of Bell Atlantic at 10.

growth process which has made the Internet so successful."[243] Accordingly, we will continue to refrain from action involving peering. We bear in mind that "[t]he Internet and other interactive computer services have flourished, to the benefit of all Americans, with a minimum of government regulation" and that it is the policy of the United States "to preserve the vibrant and competitive free market that presently exists for the Internet and other interactive computer services, unfettered by Federal or State regulation; . . . ."[244]

V. FURTHER ACTIONS

106. We will act whenever necessary to ensure that deployment of broadband to all Americans proceeds at a reasonable and timely pace. We will also continue to inquire annually into the deployment of broadband. We will issue another report next year and will, if we find that deployment is not reasonable and timely, immediately take the actions required by section 706 -- remove barriers to infrastructure investment and promote competition in telecommunications markets. As we showed when we created our Bandwidth Task Force, we give the promotion of broadband the highest priority and we are coordinating all our broadband-related efforts to insure the greatest efficiency and effect. We will complete proceedings that promote the deployment of broadband capability, including proceedings concerning deployment of wireline broadband services,[245] commercial availability of navigation devices[246] and access to facilities serving the last hundred feet.

107. In addition, we will pursue wireless initiatives to ensure that wireless services, both fixed and mobile, are true competitors in the consumer market for broadband. We will continue to allocate, auction, and license more spectrum for uses that include broadband, especially facilities that serve the last mile and last hundred feet.[247] We will also move

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[243] Comments of SBC Commun. Inc., at 12.

[244] 47 U.S.C. § 230 (b)(2). See also 47 U.S.C. § 230 (a)(4).

[245] *See* Deployment of Wireline Services Offering Advanced Telecommunications Capability, CC Docket No. 98-147, *Memorandum Opinion & Order & Notice of Proposed Rulemaking* FCC 98-188, released Aug. 7, 1998, *available at* 1998 WL 458500.

[246] *See, e.g.*, Implementation of Section 304 of the Telecommunications Act of 1996, Commercial Availability of Navigation Devices, *Report & Order*, 13 FCC Rcd 14775 (1998).

[247] Comments of Northern Telecom, Inc., at i, 1; Comments of the Wireless Information Networks Forum at 8-9. *See, e.g.*, Amendment of the Commission's Rules with Regard to the 3650-3700 MHz Government Transfer Band, ET Docket No. 98-237, *Notice of Proposed Rulemaking & Order* FCC 98-337 at ¶¶ 1, 6, released Dec. 18, 1998.

forward to implement the next generation of mobile services and the re-examination of our 45 MHz CMRS spectrum cap.[248] We will also work for efficient international harmonization of spectrum allocations, product certifications, and technical standards for interfaces.[249]

108. Moreover, we will promptly grant licenses so that broadband facilities can be built promptly.[250] We will continue authorizing broadband capacity for traditional geostationary C- and Ku-Band frequencies, such as those used by DirecPC. We also expect to license new, innovative systems in the Ka- and millimeter wave Bands.[251] Finally, we will use the tools at our disposal to promote competition and remove barriers to infrastructure investment. Through these efforts, we seek to promote the reasonable and timely deployment of broadband so that all Americans will have meaningful access to advanced telecommunications capability.

VI. ORDERING CLAUSES

109. Accordingly, IT IS ORDERED that, pursuant to section 706 of the Telecommunications Act of 1996, this Report IS ADOPTED.

110. IT IS FURTHER ORDERED that the Motions to Accept Late-Filed Comments or Reply Comments filed by APT, AT&T, Cablevision Systems, and U S West

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[248] *See* 1998 Biennial Regulatory Review -- Spectrum Aggregation Limits for Wireless Telecommunications Carriers, WT Docket 98-205, *Notice of Proposed Rulemaking* FCC 98-308, released Dec. 10, 1998.

[249] Comments of Northern Telecom, Inc., at 9.

[250] *See* Comments of Williams Commun., Inc., at 16. For example, the Commission is now in the second licensing round for Ka-band satellites and will rule on 18 requests for licenses and modifications or amendments to existing Ka-band licenses.

[251] These bands are at 18 and 28 GHz and 36-51 GHz, respectively. *See, e.g.*, Allocation & Designation of Spectrum for Fixed-Satellite Services in the 37.5-38.5 GHz, 40.5-41.5 GHz, & 48.2-50.2 GHz Frequency Bands, IB Docket No. 97-95, *Report & Order* FCC 98-336, released Dec. 23, 1998.

Communications are GRANTED.

Federal Communications Commission

Magalie Roman Salas

Magalie Roman Salas
Secretary

APPENDIX A: SOURCES FOR CHARTS 2 AND 3

1) Technology categorization simply refers to the means by which broadband services are deployed (or expected to be deployed) to the consumer market. We have not included other technologies such as T-1, frame relay, *etc.*, which are primarily offered to business customers.

2) Traditional analog phone wire and ISDN (Integrated Services Digital Network) both represent "narrowband" deployments to the home. They are included for comparison purposes. Regarding the installation cost per customer, the assumption here for traditional analog phone wires is that Internet service is provided over the primary line, which explains why the installation cost associated with an additional line is not incurred. Sources: Kenneth Terrell, *Breaking the Speed Limit*, U.S. NEWS & WORLD RERPORT, Aug. 10, 1998, at 60; Matt Richtel, *Start-Ups' Hopes are Riding on an Internet Route Through the Sky,* N.Y. TIMES, Nov. 30, 1998, at C1.

3) High-speed Internet access services are being offered today via geostationary satellites positioned at approximately 35,800 kilometers above the earth. The sole provider of such services to residential consumers today is Hughes Network System's DirecPC. DirecPC, however, provides these high-speed services in the downstream direction only (a one-way transmission). Upstream traffic, by contrast, is carried via a conventional telephone connection. The downstream/upstream speeds therefore differ dramatically, with current residential downstream speeds ranging up to 400 Kbps and current residential upstream speeds typically occurring at 28.8 Kbps or 56 Kbps. For the downstream transmission, DirecPC charges residential customers between $29.99 and $49.99 (which includes the Internet connection) for either 25 hours per month or 100 hours per month. Additional hours are charged $1.99 per hour. Promotions are not included in these fees. For the upstream path, customers incur no additional charge above and beyond what they pay for local phone service. *See* AT&T Comments at 17; About DirecPC - Pricing, *available at* <http://www.direcpc.com/about/a34f.html>, *visited* Dec. 15, 1998. As a side-note, another provider, Loral's CyberStar, L.P., launched geostationary broadband services in October 1998, but these services currently are offered to business customers only. *See Beam This Up*, TELE.COM, Dec. 1, 1998, *available at* <wysiwg://41/http://www.techweb.com/se/directlink.cgi?TLC19981201S0022>, *visited* Dec. 15, 1998.

4) ADSL stands for asymmetric digital subscriber line data service, which rides on traditional analog copper pairs of phone wire into the customer's premises. ADSL and ADSL-lite are just two of the many varieties of DSL technologies, which differ by speed and the method in which they are deployed. To date, ADSL has been the most popular and certainly the most widely deployed in the consumer market. Maximum downstream speeds for ADSL reach up to 9 to 10 Mbps, while upstream speeds range up to 640 Kbps to 768 Kbps. *See, e.g.*, AT&T

Nov. 18, 1998, *Ex Parte* at 2, and DSL Summary Table, *available at* <http://www.aware.com/technology/telecom/index.html>, *visited* Dec. 13, 1998. Provider cost numbers include the cost of equipment on both ends of the line, ranging up to $800 per link. *See* ADC Telecommunications, Inc., Jan. 11, 1999, *Ex Parte* at 7, 22; David Self & Jim Szeliga, *Running the DSL Numbers*, at 6, *available at* <http://www.americasnetwork.com/issues/98issues/980101/980101_fujitsu.html>, *visited* Sept. 17, 1998. An important caveat to note when evaluating ADSL deployment is the constraint that homes served generally must be within 18,000 feet of a telephone company's central office to qualify for the service. Cost figures related to installation, basic service and Internet service are taken from multiple sources, including: Copper Mountain Dec. 15, 1998, *Ex Parte*, Attachment titled "DSL Overview for FCC," at 8; and Kenneth Terrell, *Breaking the Speed Limit*, U.S. NEWS & WORLD REPORT, Aug. 10, 1998 and various websites of the Bell Operating Companies.

5) Also known as G.lite or "splitterless" ADSL, ADSL-lite differs from ADSL primarily in the customer modem, which is self-installable and does not require a separate voice-data splitter at every user site. ADSL, by contrast, requires a "truck roll" by a service technician to the customer's premises to install the modem and voice-data splitter, and to test the inside wiring. The elimination of the truck roll reduces the provider's deployment costs significantly, by $200 or more, according to Carol Wilson, *Is 'Lite' ADSL The Real Thing?*, INTER@ACTIVE WEEK, Nov. 2, 1998, *available at* <wysiwyg://6/http://www.zdnet.com/i...tarchivestory/0,4356,370856,00.htm>; Aware DSL Lite Presentation at 5, *available at* <http://www.aware.com/dsl-lite/interactive_info.htm>), and is viewed in the industry as the most likely variant of xDSL technologies to succeed in the consumer market. The typical residential downstream speed of 1 Mbps is based on a product recently introduced by Nortel. Maximum downstream and upstream speeds are estimated at 1.5 Mbps and 512 Kbps, respectively, which demonstrates that while G.lite may be easier to deploy than ADSL, its data speeds are not as fast. (*See* Copper Mountain Dec. 15, 1998, *Ex Parte*, Attachment titled "DSL Overview for FCC" at 5; AT&T Nov. 18, 1998, *Ex Parte* at 2; and Telecommunications Technology - DSL Summary Table, *available at* <wysiwig://39/http://www.aware.com/technology/telecom/index.html>, *visited* Dec. 13, 1998). Finally, since ADSL-lite is still in trials at this time, no customers' price points have yet been established.

6) Cable modems require upgraded hybrid fiber coaxial (HFC) cable, capable of two-way digital transmissions. Typical residential downstream speeds of 1.5 - 3 Mbps (on up to 10 Mbps) are currently being advertised by cable providers. *See* AT&T Comments, Exhibit E, "Comparison of Prices In Areas Where Services Compete: Cable v. ILEC Broadband Access Services." Assuming a full 6 MHz channel is allotted, maximum downstream speeds can range up to 27 Mbps, while maximum upstream data rates can reach up to 2 Mbps, assuming that several 1.6 MHz channels are allotted. *See, e.g.*, AT&T Nov. 18, 1998, *Ex Parte* at 2;

AT&T Comments at 11-12. An important distinction between cable modems and ADSL is that the HFC architecture is a shared medium, meaning that cable modem subscribers all compete for bandwidth to the Internet, although ADSL subscribers enjoy a dedicated connection. Cable companies are working to mitigate any traffic interruptions using several techniques, such as splitting nodes into sub-nodes, which effectively reduces the number of subscribers sharing the cable bandwidth.

7) Local Multipoint Distribution Service (LMDS) operates in the 28/31 GHz band, representing 1.3 GHz of spectrum. Currently, residential one-way broadband services are being offered at downstream speeds of approximately 500 Kbps. Upstream service is by standard telephone copper wire. *See* BellSouth Comments, Exhibit E. Additionally, companies with licenses in the 24 and 38 GHz bands are offering two-way broadband services, but primarily to small and medium-sized businesses, as well as to some large business customers. *See, e.g.,* Winstar Comments and Teligent Comments. Regardless of the spectrum band, point-to-point solutions can achieve typical speeds up to 1.5 Mbps both downstream and upstream, and can reach maximum speeds of 155 Mbps in both directions. *See* ADC Telecommunications, Inc., Jan. 11, 1999, *Ex Parte* at 23. New point-to-multipoint systems, which reduce the time and cost of deployment, may reach data rates of 20 Mbps downstream and 3 Mbps upstream. *See* ADC Telecommunications, Inc. Jan. 11, 1999, *Ex Parte* at 23; Bernard Herscovich, *Broadband Wireless Access From Vision to Reality*, X-CHANGE, at 3, *available at* <http://www.vpico.com/xc/articles/822feat7.stm>. With regards to consumer costs for installation, customer premises equipment (CPE) and monthly service, sources are: BellSouth Comments, Exhibit E; The Strategis Group, *LMDS Marketplace:1997 Report* at 231-32.

8) Multichannel Multipoint Distribution Service (MMDS) represents wireless spectrum blocks in the 2.1 to 2.7 GHz band. Typical residential downstream speeds vary greatly. Current offerings range from 256 Kbps (BellSouth Comments, Exhibit E at 1, *see* Wireless One information) to 1 Mbps and higher (American Telecasting Inc. Nov. 9, 1998, *Ex Parte* at 11). Typical upstream speeds are lower, in the 256 Kbps range (American Telecasting Inc. Nov. 9, 1998, *Ex Parte* at 11). Maximum speeds are considerably greater, comparable to HFC cable modem rates of up to 27 Mbps downstream and up to 2 Mbps upstream. *See* AT&T's Nov. 18, 1998, *Ex Parte* at 2. It should be noted that the MMDS spectrum, until recently, supported one-way transmission only (requiring a telephone return path for data services). With the Commission's recent ruling in favor of Multipoint Distribution Service (MDS) and Instructional Television Fixed Service (ITFS) licensees being able to offer two-way digital services, MMDS providers may now offer 2-way high-speed data services. With regards to costs to consumers, retail prices vary from $49.95 up to $69.95 per subscriber per month for unlimited Internet access. *See* AT&T Comments at 16; Wireless Cable Modem Trials and Commercial Launches in North America, *available at* *<http://cabledatacomnews.com/cmic12.htm> visited* on Dec. 14, 1998.

9) Future broadband offerings via satellites will be deployed over geostationary systems (at an altitude of approximately 35,800 kilometers) and non-geostationary systems (at altitudes typically below 2,000 kilometers for low-earth orbit satellites and approximately 10,000 kilometers for medium-earth orbit satellites). Currently, there are no providers offering such services, though there are several who are constructing systems and who plan to start offering 2-way broadband satellite services early in the new millennium. Because of their 2-way capability, these services will not need a standard telephone copper wire return path as DirecPC does today. Typical downstream residential speeds will range anywhere from 500 Kbps to 20 Mbps and, in some instances, possibly as high as 64 Mbps. Maximum speeds are being estimated at up to 155 Mbps. Upstream speeds will generally not exceed approximately 2 Mbps. *See* John Montgomery, *The Orbiting Internet: Fiber in the Sky*, BYTE MAGAZINE, Nov. 1997, at 10, *available at* <http://www.byte.com/art/9711/sec5/art1.htm#117covt1>, *visited* Dec.15, 1998; Alcatel USA Inc. Nov. 18, 1998, *Ex Parte*, Attachment titled "Broadband Wireless Access" at 36; and AT&T Nov. 18, 1998, *Ex Parte* at 2. Cost information for these future deployments generally is not publicly available at this time.

10) Service providers include incumbent local exchange carriers (ILECs), competitive local exchange carriers (CLECs), interexchange carriers (IXCs), internet service providers (ISPs), utility companies, multiple systems operators (MSOs), fixed wireless companies (holding LMDS and MMDS licenses), and satellite providers of broadband services via geostationary satellites (GEOs), via middle-earth orbit satellites (MEOs) and via low-earth orbit satellites (LEOs).

11) Typical downstream residential speeds refers to the rate at which data is usually transmitted from the service provider down to the residential customer. Although many of the technology platforms mentioned above can support faster rates, most residential users either will not be offered these faster services (due to locational and technical limitations) or will not be able to afford such services if they are being offered. Higher speed services tend to attract primarily business customers.

12) Availability of broadband services is as of December 1998 to residential users. Availability of such services is expected to expand over time.

13) Cost to provider refers to those incremental infrastructure costs associated with the provision of broadband services, such as high-speed Internet access, to subscribers. Typically, these "costs per subscriber" will include equipment costs for both the transmission and reception of data streams to and from subscribers. The transmission equipment costs in particular require penetration assumptions in order to amortize those specific costs across actual or expected numbers of subscribers. Reception costs refer to the CPE costs incurred by the provider and then either leased or sold to the subscriber. "Costs per sub" excludes all recurring costs such as the cost of transporting the data streams and the cost to maintain the

system, and one-time costs such as customer acquisition costs and costs related to initial system infrastructure deployment (putting satellites in the sky, upgrading cable fiber to 750 MHz, *etc.*). We would expect one-time costs to decline as providers gain market share and realize certain economies of scale and scope.

14) Installation costs to customers refer to the one-time charge levied for a technician to visit the customer premises to install the relevant customer premise equipment and test/manipulate the inside wiring. Over time, these charges are expected to decrease, if not end altogether (depending on the technology platform), as new technologies and business partnerships with computer makers eliminate portions of this one-time cost. As complexity of services appears to limit sales, companies are beginning to focus on making simpler, easier-to-use and -install products which are more attractive to end users.

15) CPE costs to customers refers to the relevant equipment that a customer must buy or lease to subscribe to advanced services. Such equipment could include modems and splitters, satellite dishes, set-top boxes, fixed wireless antennas, *etc.* These costs, too, are expected to decline as standards are adopted and vendors manufacture subsequent generations of equipment. Retail markets for this equipment, particularly cable modems, are also expected to develop.

16) Monthly basic service costs to customers refers to the monthly fee a customer must pay the service provider for the basic "pipe" into the home for a copper phone line, a cable wire, an antenna, *etc.* These costs will decrease over time if competition between different technology platforms takes hold in markets around the country. For example, we are already seeing DSL services priced to be directly competitive with cable modems, and also some pricing plans which vary based on usage and bandwidth (*e.g.*, more expensive for faster speeds). It should be noted that the monthly basic service costs included here do *not* reflect bundled pricing discounts, *etc.*

17) Monthly Internet service costs to customers refers to the monthly fee a customer must pay to gain access to the Internet. This cost may be separate from, or may be included in, the monthly basic service fee. Typically, service providers give customers a choice of buying a bundled basic service/Internet access option from them or of buying just the basic service. In the latter case, the customer would be responsible for signing up with a separate Internet Service Provider in addition to signing up with the primary basic service provider. Monthly fees for internet access typically average $19.95.

18) Total first-year costs to consumers includes both one-time and recurring monthly costs to the end-user. Where ranges of end-user costs are concerned, an average of the range was taken to determine total costs.

19) The "bits per buck" ratio is a short-handed way to illustrate today's performance/price trade-off that a typical end-user would face. Specifically, "bits per buck" here refers to the kilobits per second of data a user would receive for each dollar spent, based on recurring monthly costs (not including one time costs for, *e.g.*, CPE purchases and for installation). The higher the kilobits per second for each dollar spent, the better the value for the end-user. Clearly, broadband deployments in the lead today (based on subscriber numbers), such as cable modems, benefit from having lower price points and higher data speeds. However, as mentioned above, cable modem service is a shared medium and is susceptible to traffic loads. As traffic mounts, data speeds may fall to the level of ADSL or lower. ADSL and ADSL-lite, while offering lower data speeds, likely will see price declines over the next 12-18 months to levels more in line with cable modem pricing, thus improving their respective "bits per buck" ratios.

SEPARATE STATEMENT OF CHAIRMAN WILLIAM E. KENNARD

In the Matter of Inquiry Concerning the Deployment of Advanced Telecommunications Capability, CC Docket No. 98-146

Promoting the deployment of advanced telecommunications capabilities to all Americans is at the top of my agenda.

As today's Report concludes, we see billions of dollars being invested in broadband and an extraordinary level of infrastructure deployment. Advanced telecommunications capabilities are being rolled out in this country at a rate that outpaces the rollout of previous breakthrough products and services in the communications field. So by this objective measure at least, we are ahead of the curve.

But it is very early in the game. Therefore I want to make it very clear that this issue remains at the top of my agenda. Regardless of the objective measures we use to measure deployment, on a subjective level I am impatient. I want the Internet to go faster and farther, for all Americans -- the young and the old, those in our inner cities and in our rural hamlets, those with every advantage and those with special needs.

Those cut off from these high-speed networks today will find themselves cut off from the economic opportunities of tomorrow. And more importantly, they will be cut off from the most important network that there is -- the network of our national community.

In Section 706, Congress said that if we find that deployment is **not** reasonable and timely, we must take immediate action to remove barriers to investment and to promote competition. Don't think for a minute that our Report today lets us off the hook. We must always be looking for ways to remove barriers to investment and to promote competition.

I am particularly concerned about deployment in rural areas and in inner cities. Given the early stage of deployment of advanced telecommunications generally, it may seem difficult to discern the extent of the disparity between rural and urban areas. But today's Report suggests that in the very short term, demand for high bandwidth will really start to take off. My concern in that a geometric increase in demand may be mirrored by a geometric increase in the urban-rural disparity.

Our challenge is to ensure that deployment is as ubiquitous as possible, in rural areas as well as urban areas. The Common Carrier Bureau already issues regular reports on fiber deployment, and I am directing them to re-double their efforts when it comes to scrutinizing the needs of rural America and whether those needs are being met.

Later today Commissioner Tristani and I will be leaving for New Mexico to hold hearings on the need to increase the reach of modern telecommunications among Native Americans. And when I meet with the membership of the National Telephone Cooperative Association in a couple weeks, I look forward to learning more from them about how the FCC can help in the deployment of advanced telecommunications in rural America.

It may well be that the answer, particularly in rural markets, lies in wireless and satellite technologies. It is therefore imperative that we continue to maximize the amount of spectrum available for broadband uses. In short, we must use all the tools we have to accelerate deployment of advanced telecommunications throughout America.

We had intended to take actions in that regard today, in one of the rulemaking items that we had to re-tool a bit in the wake of the Supreme Court decision. In that item we would have considered ways to give both incumbents and new entrants incentives to deploy DSL technology quickly. Staff is moving promptly to get that item back before the commissioners for a vote.

That item will be a continuation of a number of recent initiatives by which we have been bringing more bandwidth to the home. We recently authorized two-way MDS service that is permitting licensees in that wireless service to upgrade their offerings. We also provided for the relocation and expansion of spectrum in the 24 Ghz band. Already we are seeing wireless operators moving to take advantage of that increase in spectrum availability for the provision of broadband.

We also need to consider our universal service proceedings. Among other things, we need to make sure that wireless operators have the same ability as their wireline competitors to obtain certification to receive universal service support.

As I said before I am impatient. Because every day counts. For incumbents and new competitors, for investors, and, most importantly, for the American consumer.

Finally, we must continue to monitor the extent to which broadband pipes are used to expand, not restrict, consumer choice. The Internet has grown enormously in recent years, in large part due to the openness of the networks that make up the Internet and the interconnection of all of them. Many consumers are used to being able to dial-up access to the Internet provider of their choice. As new providers emerge, we must evaluate whether openness and connectivity are the best means to achieve our goal, and that of Congress, to increase the useful deployment of broadband.

So while I am pleased to adopt this Report and its findings, our work is far from over.

Separate Statement
of
Commissioner Susan Ness

Re: *Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion Pursuant to Section 706 of the Telecommunications Act of 1996, CC Docket No. 98-146*

In Section 706 of the Telecommunications Act, Congress directed us to report periodically on the progress of broadband deployment to all Americans. Although the future is nearly impossible to predict, I am optimistic about the level of investment in infrastructure and the early signs of competition across technologies and among service providers. Business customers, for example, already have access to a plethora of broadband services. As the use of the Internet expands both at work and at home, consumer appetite for bandwidth will continue to grow.

While I support the report and its findings, I write separately to elaborate on four points:

First, because consumer demand for bandwidth is increasing, how we define "advanced" technologies will evolve over time. Already consumers are becoming increasingly sophisticated as are the applications they use. More and more of these applications are interactive and make creative use of color, graphics, and streaming video -- all of which require fast bitstreams. The gestation period for upgrading infrastructure to support new services, however, is not instantaneous. Thus, infrastructure providers must remain ahead of the curve, so that by the time consumers demand advanced services, those services have been deployed and are available. For example, from the planning stages to a satellite launch can take five years or longer. The cost of high speeds, new features and capacity, however, ultimately is borne by consumers. There is a tradeoff between abundant two-way broadband capability and the cost involved to deploy such capability to all Americans. The marketplace is sensitive to these issues. It does not make sense for government to mandate excessive capacity well beyond consumer needs.

Second, we must ensure that advanced services reach "all Americans." Broadband must be available not only in our great cities, but across rural America. Different broadband access technologies work better in different locations and circumstances. Terrestrial wireless and satellite technologies, for example, are particularly well-suited to reach hard-to-serve areas. Thus, we have focused on allocating spectrum for wireless local loops. In addition, several broadband satellite systems are under development which, if deployed, could provide ubiquitous broadband capability in the five-to-ten year timeframe.

Third, section 706 also specifically directs the Commission to assess the availability of advanced telecommunications capability to elementary and secondary schools and classrooms. We do not want to fall behind our global competitors which are expending significant resources to equip their students to compete in the global marketplace. Our current universal service programs should help to facilitate deployment of advanced services to schools and classrooms, although the demand for funds to date has outstripped supply.

Finally, as our report makes clear, in no respect are we are contemplating regulation of the Internet. In fact, the Internet is a medium of communication that has grown enormously in recent years with minimal government regulation. Two characteristics of the Internet that have contributed to its growth are its connectivity and openness. By connectivity, I mean the ability of backbone, last mile service, and content providers to become part of, or have access to, the Internet. By openness, I refer to the open, non-proprietary, technical standards by which the Internet operates. These principles are worth preserving. I am optimistic that, as multiple paths to the home and to businesses emerge, the competitive marketplace will safeguard consumers' interests in access, choice, and interoperability. Because we are still in the early stages of deployment, we should keep a watchful eye but practice regulatory restraint and give the broadband marketplace a chance to work.

One thing is clear: over the next few years, the broadband marketplace will be very dynamic. For now, the tools appear to be in place for deployment of advanced telecommunications capability to all Americans in a reasonable and timely fashion. We will continue to monitor deployment to ensure that no barriers to competition or infrastructure investment arise.

SEPARATE STATEMENT OF COMMISSIONER HAROLD FURCHTGOTT-ROTH

Re: In the Matter of 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).

I support today's report that tentatively concludes that advanced services are being deployed in a reasonable and timely manner. While I recognize that not all Americans currently have access to such services, the actual deployment of this emerging market is growing dramatically. Moreover, I am encouraged by the substantial investments in broadband technology that numerous companies are making. This is one example of the success of the Telecommunications Act of 1996. The 1996 Act, and its technology neutral approach, anticipated that consumers would be able to receive such advanced services from a wide range of competitors -- including incumbents and new entrants. Indeed many of the companies offering such services to consumers were created by the 1996 Act's emphasis on local competition. This report is concrete evidence that the 1996 Act is working.

SEPARATE STATEMENT OF COMMISSIONER MICHAEL K. POWELL

Re: In the Matter of Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion (CC Docket No. 98-146).

In this statement, I write separately to explain the bases upon which I support this Report.

The deployment of advanced services, particularly broadband services, will radically transform American life, our society and our economy. The greatest danger for regulators, however, is our inability to keep pace with the speed of developments and innovations that the new networks will unleash. We must recognize that these new technologies, combined with the pro-competitive provisions of the 1996 Act,[252] are shattering the traditional telecommunications paradigm. As aspects of this Report suggest, competition and the free market, as opposed to burdensome regulation, will ultimately prove to be the best means for achieving the widespread deployment that Congress envisioned.

Section 706 of the Act commands that the Commission "encourage the deployment on a reasonable and timely basis of advanced telecommunications capability to all Americans."[253] It is beyond doubt that such capability is not currently available to even a majority of Americans. Indeed, the market for broadband services is still in its infancy, notwithstanding evidence that its future growth will be strong. Thus, what we do today should assuredly not be interpreted as some finding that the lofty goal of Section 706 has been forever met and that our work is done. The remaining, I believe separate, question is whether deployment of advanced services, which is now underway, is proceeding in a reasonable and timely way toward this lofty goal. Based on what we know at this early stage, I think it is, and thus I am pleased to support this Report.

Although I fully recognize that all Americans do not yet have access to advanced services, I agree with the Report's assessment that advanced services are being deployed in a "reasonable and timely" manner. Reasonable and timely achievement of the goal of deployment to "all Americans" must contemplate that such widespread deployment will take some time. But there is not yet a solid consensus as to all aspects of what constitutes reasonable and timely deployment. I believe this Report takes important steps toward developing such a consensus. In order to further that process in future proceedings, I offer

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

[253] Pub. L. 104-104, Title VII, § 706(a), Feb. 8, 1996, 110 Stat. 153, reproduced in the notes under 47 U.S.C. § 157.

some principles here that should guide our efforts to assess and encourage advanced services deployment. In sum, I believe these efforts must take into consideration such factors as the tools that Section 706 prescribes for encouraging deployment of advanced services, consumer demand and willingness to pay, economic cost, and technological limitations. I begin to touch briefly on some of these factors in this statement.

I also support the Report for what it does not do. In particular, I applaud the Report for declining, as a general matter, to propose solutions in search of problems. The Report correctly notes it is likely that multiple methods of broadband access to customers will develop over the next few years. To support this statement, the Report points to the massive levels of capital investment by the industry that in turn will cause extensive broadband deployment to all areas of America. The current market participants have a vested interest in providing advanced services as rapidly as possible to all Americans who are willing to pay the economic cost of these services. Regulators must resist the temptation to play parent to these infant services and prospective customers, dictating what products and services consumers will see, regardless of what they value and are willing to pay. Rather, regulators must strive to ensure the freedom of both consumers and suppliers to determine the economically optimal set of services, prices and availability in the open market.

Notwithstanding the positive aspects of this Report, my participation in its development persuades me that the Commission should keep several critical considerations in mind as it undertakes future proceedings of this type:

First, I believe that our assessment of what constitutes "reasonable and timely" deployment and that any actions resulting from that assessment should take into consideration the specific methods that Congress has prescribed for encouraging more rapid deployment. Through Section 706, Congress has evidenced its intent that the Commission refrain from enacting restrictive regulation in encouraging deployment. Congress has prescribed methods by which the market itself can facilitate growth. Congress commands that the Commission, in the event of unsatisfactory deployment of advanced services, "shall take immediate action to accelerate deployment of such capability by removing barriers to infrastructure investment and by promoting competition in the telecommunications market."[254] Notably, Congress has not, under Section 706, created a program to mandate and fund deployment, but has instead instructed the Commission to let the influx of market participants and investment capital accelerate deployment and thus benefit all consumers. Thus, Congress mandates that we encourage deployment by removing barriers to investment and through other deregulatory market-based methods. We should, therefore, refrain from enacting cumbersome standards and from requiring "rollout" deadlines that may cause hesitation from the capital markets,

[254] Pub. L. 104-104, Title VII, § 706(b), Feb. 8, 1996, 110 Stat. 153, reproduced in the notes under 47 U.S.C. § 157.

thereby delaying, rather than accelerating achievement of the goals of Section 706.

Second, and relatedly, I believe we should acknowledge that competition and innovation are the results of self-interested market participants struggling to present the marketplace with newer and more useful products at competitive prices. We must keep in mind that regulators do not drive competition, market participants do. Our policies must reflect this understanding if we are to achieve our ultimate goal of making advanced services available to all Americans according to the methods Congress has presented.

Third, we should be mindful of the important distinctions between the advanced services provisions of Section 706 and Section 254. While there does appear to be a connection between the universal service provisions of Section 254 and Section 706's concerns about the availability of advanced services to school children, there are distinct differences between the provisions' methods for achieving their respective objectives. The placement of advanced services provisions in Section 254(b) appears to contemplate the use of discounts or subsidies to support services that the Joint Board and the Commission decide should be supported (presumably in an explicit and competitively neutral fashion). Section 706, on the other hand, instructs the Commission to encourage reasonable and timely deployment to all Americans "by utilizing . . . price cap regulation, regulatory forbearance, measures that promote competition in the local telecommunications market, or other regulating methods that remove barriers to infrastructure investment."[255] Again, in my view, the tools suggested for encouraging advanced services deployment under Section 706 appear to be fundamentally more market-based and deregulatory in nature than those suggested under Section 254.

Fourth, we should strive to develop a more realistic and, as such, complex understanding of how we should measure the pace of advanced services deployment. Such measurement must, in my view, be sensitive to factors such as consumer demand, willingness to pay, and economic cost. It must decidedly not degenerate into some arbitrary, subjective or political measure, based on what "goodies" we wish to give to consumers, however well-deserved or well-intentioned. The Report's analysis demonstrates that no two services can be deployed in precisely the same manner, and as such, any comparisons must be flexibly drawn. As the 1996 Act ushers in new levels of competition for all telecommunications market participants, we must take care to recognize that past experiences with a non-competitive market will have limited usefulness. I appeal rigorously to commenters in future proceedings of this type to help us develop a richer understanding of how we should measure advanced services deployment consistent with the procompetitive, deregulatory framework Congress has erected.

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[255] Pub. L. 104-104, Title VII, § 706(a), Feb. 8, 1996, 110 Stat. 153, reproduced in the notes under 47 U.S.C. § 157.

Finally, as I said in my statement on the Notice initiating this proceeding, I believe we should be aware that requiring certain firms to provide access to their facilities or services to other firms or even to end users may have some unfavorable consequences. In particular, I think we should search for alternative solutions to encourage innovation and competition in the provision of "last mile" transmission to homes and businesses. While mandating access can bring about short-term improvements in retail competition, it also may undermine incentives for developing new methods to circumvent the influence of incumbents over distribution.

In conclusion, I would like to emphasize my appreciation of the commendable effort put forth by the Bureau, as well as that of my colleagues, on this critical and demanding issue. Additionally, I look forward to working with everyone at the Commission, in the States and in Congress to help make our effort to encourage the deployment of advanced communications a success.

SEPARATE STATEMENT OF COMMISSIONER GLORIA TRISTANI

In the Matter of Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, Etc., CC Docket 98-146

Section 706 of the Telecommunications Act of 1996 vests tremendous responsibility in the Commission. Beginning with today's Report, we must regularly assess whether advanced telecommunications capability is being made available to "all Americans on a reasonable and timely basis." If we find at any time that it is not, we must "take immediate action to accelerate deployment of such capability."

In order to fulfill our obligation under Section 706, we need a full and accurate picture of the state of deployment of advanced telecommunications services. We need to know what advanced services are being offered and specifically where they are being deployed. As the Report acknowledges, for the most part we simply do not have that information. Instead, the Report largely relies on other types of evidence -- *e.g.*, analogies, anecdotes and evidence of investment -- in order to conclude that deployment of advanced services appears reasonable and timely. While I appreciate the effort in the Report to compensate for the lack of direct evidence in the record, I write separately to underscore my belief that the lack of such evidence makes drawing any conclusions about the state of deployment a tentative and inexact undertaking.

I am especially concerned about the lack of hard evidence when it comes to our obligation to determine that advanced telecommunications services are being deployed, and are available, to "all Americans." Being from a rural state, I know the importance and the challenges of ensuring that all areas of our country have access to the kind of services covered by Section 706. Congress determined -- and I believe that it chose its words carefully -- that *all* Americans should have access to the advanced telecommunications services that will permit them to compete in today's information economy.

I make these comments not to denigrate today's Report in any way. But I hope that we can build on this experience and improve our data and analysis for next year's Report. To the extent the record compiled in this proceeding is inadequate, I hope that we can ask more pointed questions in the next Notice of Inquiry and, where necessary, be proactive in gathering information ourselves. Congress directed us to report on the state of deployment of advanced services, not on the state of the comments submitted by outside parties.