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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	)	CC Docket No. 98-146
Timely Fashion, and Possible Steps to	)	
Accelerate Such Deployment Pursuant to	)	
Section 706 of the Telecommunications	)	
Act of 1996	)	

COMMENTS OF AT&T CORP.

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SUMMARY

AT&T welcomes the opportunity to participate in the instant Notice of Inquiry to examine the status and broadband capabilities of existing and planned networks, which will bring advanced telecommunications services to homes and businesses across America. These Comments directly respond to the Commission's request for information about the actual and planned provision of broadband services not only by telecommunications carriers making improvements on traditional telecommunications networks, but also by many other industries, including cable, fixed wireless and satellite systems. Unlike the incumbent local exchange carriers ("ILECs") (who have been slow to deploy any new generation service for fear of cannibalizing their existing businesses), the new telecom entrants and the non-traditional service providers are poised to meet consumer demand for high-speed services with no embedded customer base, no inherent market advantage, and with considerable expenditure of capital and assumption of marketplace risk. AT&T's own actions in the marketplace and investment plans demonstrate its resolve to invest in new capabilities that will benefit consumers by offering them an expanded range of high-value services and a choice of local access providers, in most cases for the first time.

These Comments describe the major methods employed and being planned for the delivery of advanced telecommunications services, demonstrating the variety of vehicles that are emerging to meet the demand for broadband services. It is clear that the non-traditional technologies being developed for two-way broadband access will take time to emerge, and that competitive alternatives via traditional telecommunications networks (i.e., provided by competitive local exchange carriers) are also slow in coming. While

seeking to extend their stranglehold on basic telecommunications services to the expanded realm of broadband access through the regulatory process, ILECs have been reluctant to invest in actual deployment of broadband services -- except when prompted by a tangible threat of deployment by a CLEC or cable company in certain local areas. At the same time, they have stubbornly resisted complying with their legal obligation to make their critical local network facilities available to competitors, erecting overt and subtle barriers for deployment by competitors.

The fact that the ILECs have the financial resources to do far more in the area of broadband access deployment than they have undertaken to date is evidenced by their major investments in other ILECs to horizontally extend their basic service monopolies, and by their investments in foreign carriers -- instead of in their own networks. Thus, deployment of advanced telecommunications capability is not occurring as quickly as it might. This stands in stark contrast to the robust and innovative long-haul backbone networks currently being constructed by interexchange carriers and other data backbone entrants, using IP and other new technologies, operating in an open, competitive market.

Despite the major impediments facing new entrants, CLECs and new entrants from other industries are aggressively rolling out broadband services to consumers and small businesses, and are beginning to achieve limited marketplace success. Many more are in the planning stage. As these new entrants emerge, they will exert increasing pressure on the ILECs to deliver their own broadband services, at prices closer to those services' economic cost. Given these promising signs, the Commission should adhere to the pro-competitive blueprint of the Telecom Act and do all that it can to facilitate the entry by competitive providers in the market for

advanced telecommunications services. In particular, the Commission should enforce the pro-competitive provisions of the Telecom Act where ILECs fail to meet their obligations, and should refrain from imposing traditional common carrier regulation on new players who do not possess significant market power.

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COMMENTS OF AT&T CORP.

Pursuant to the Revised Public Notice released on August 12, 1998, AT&T Corp. ("AT&T") respectfully submits these Comments in the Notice of Inquiry ("NOI") mandated under Section 706 of the Telecom Act to review the status of the actual and planned deployment of advanced telecommunications capability to serve all Americans.

I. INTRODUCTION

AT&T welcomes the opportunity to address the important issues raised in the NOI and engage in the public discussion of whether advanced telecommunications capability is being deployed in a reasonable and timely fashion as contemplated by Congress in Section 706 of the Telecom Act. In response to the Commission's call for detailed information about the variety of technologies and service providers that are providing or planning to provide advanced services to consumers and small businesses, AT&T offers in Section II of these Comments a detailed discussion of the types of capabilities that the Commission should consider in its inquiry and the state of deployment

of those capabilities in both the local and long-haul markets. What is clear from this analysis is that where the market is open to competitive entry -- that is, in the long-haul "backbone" market -- there is an abundance of entry and innovation. In contrast, in the local market, where the incumbent local exchange carriers ("ILECs") control competitors' access to the monopoly local loop and other network elements essential to deliver broadband services to consumers and small businesses, competitive local exchange carriers ("CLECs") are seriously thwarted in their efforts to provide competitive services. On the basis of this evidence, as well as compelling evidence that the ILECs are investing far more in horizontal mergers and foreign acquisitions than in modernizing their networks, as discussed in Section III, AT&T concludes that advanced telecommunications capabilities are not being deployed as quickly as they might.

In Section IV, AT&T addresses whether the Commission should adopt specific regulatory changes to remove barriers to infrastructure investment, or otherwise promote competition so as to speed the deployment of advanced telecommunications capability. AT&T recommends that the Commission not go beyond Congress' manifest intention to retain different regulatory models for different industries. To impose on new entrants regulatory requirements designed to curb monopoly power would simply dampen the efforts of competitive industries or firms that are not currently regulated under Title II to provide competitive broadband access services. Hence such action plainly would not promote and accelerate deployment of alternatives to the existing LEC monopolies. Instead, the Commission should redouble its efforts to enforce the market-opening provisions of the Telecom Act, because access to the bottleneck network elements of the ILECs remains critical not only to traditional CLEC-type entry, but also to entry by non-

traditional service providers as well. In Section IV, AT&T also urges the Commission to focus on nondiscriminatory access to inside wire, and to rely on existing Universal Service support mechanisms to facilitate deployment of advanced telecommunications capability to schools, libraries and those areas of the country that are not the early beneficiaries of advanced services.

II. ANALYSIS OF CURRENT AND FUTURE DEPLOYMENT OF ADVANCED TELECOMMUNICATIONS CAPABILITY.

A. The Commission Should Define "Advanced Telecommunications Capability" In A Flexible Fashion, Consistent with the Telecom Act.

As a threshold matter, the NOI requests comments on the appropriate definition of "advanced telecommunications capability."[1] Section 706(c)(1) defines that term as follows:

> 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.[2]

At the outset, the Commission should recognize that Congress sought in Section 706(c)(1) to encourage the deployment of telecommunications capability -- that is, of underlying basic network infrastructure that makes possible the transmission of information.[3] Section 706 does not address the deployment of information services

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1 See NOI, ¶¶ 13-17.

2 47 U.S.C. § 157 nt.

3 See 47 U.S.C. § 153(43) (defining "telecommunications" as " transmission, between or among points specified by the user, of information of the user's choosing, without change in the form or content of the information as sent and

(footnote continued on following page)

themselves, and the Commission should observe this statutory distinction between information services and telecommunications. For example, while advanced telecommunications capability may permit enhanced access to content, subscriber relationships such as "push" technologies that permit different forms of delivery of content are software driven in the information provider's network and are not part of the basic telecommunications network.[4] Thus they should appropriately be excluded from any analysis of the deployment of advanced telecommunications capability. Moreover, the Commission also should not divide telecommunications services into segments based on the applications for which they are used or the technologies they employ, such as "voice" versus "data," or "packet-switched" versus "circuit-switched." The Commission has just correctly ruled that such distinctions find no support in the Telecommunications Act and do not provide a basis for disparate regulation of telecommunications services.[5]

The Act's unequivocal statement that advanced telecommunications capability may exist "without regard to any transmission media or technology" makes clear that Congress did not intend to refer merely to technologies that existed in 1996. Given

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(footnote continued from previous page)

received."); In the Matters of Deployment of Wireline Services Offering Advanced Telecommunications Capability et al., CC Docket Nos. 98-147 et al., Memorandum Opinion and Order, and Notice of Proposed Rulemaking, FCC 98-188, rel. August 7, 1998 ("Section 706 Order"), ¶ 35 (advanced services such as xDSL and packet switching are "simply transmission technologies," and therefore are "telecommunications" as that term is used in the 1996 Act).

4 See NOI, ¶ 16.

5 See Section 706 Order, ¶ 41.

the rapid evolution of telecommunications technologies, and the 1996 Act's intent to encourage that evolution, AT&T agrees that the meaning of "advanced telecommunications capability" will "change over time, including new technologies as they are developed and excluding ones that were once cutting-edge but have since become conventional."[6]

Because of the evolving nature of "advanced telecommunications capability," AT&T recommends that the Commission not attempt to delineate specific technologies that it deems "advanced," but instead rely on specific performance standards; e.g., upstream and downstream bandwidth, guaranteed and permissive throughput, latency specifications, and availability of open interfaces. Reliance on standards instead of particular services allows the Commission the flexibility to encourage (and the industry to pursue) the development of multiple capabilities to meet varied market demand And the Commission should be prepared to revise those standards as they become outmoded.

AT&T proposes that given the current state of technology, "advanced telecommunications capability" should include telecommunications facilities that can support information transfer at speeds greater than 128 kilobits per second ("Kbps") between a user and a network, the speed provided by ISDN basic rate. This is the minimum speed required today to enable users efficiently to originate and receive voice, data, graphics, and limited video telecommunications.

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6 NOI, ¶ 15.

Section 706(c)(1)'s reference to a "capability that enables users to originate and receive" telecommunications plainly requires that advanced telecommunications capability be bi-directional; however information transfer rates in the both directions need not be equal. Indeed, many broadband technologies that will be widely available to consumers in the near future support greater downstream bandwidth than upstream.[7] It is not necessary, however, that the same facility be used in both directions. For example, current technologies that permit satellite access to the Internet utilize telephone lines for upstream communications.

B. Current And Future Deployment Of Advanced Telecommunications Capability In The "Last Mile."

At present, virtually 100% of American consumers and small business customers can access high-speed, long-haul data networks, including the Internet, only via twisted pair copper wires controlled by incumbent LEC monopolists. As AT&T discussed at length in its Comments on Bell Atlantic's Section 706 petition, for example, average speeds over the Internet backbone are well above the 56 Kbps maximum available over standard analog phone lines, but most residential and small business customers are limited to that speed by virtue of their inability to reach the Internet via any means except ILEC-controlled POTS lines.[8] There can be no serious dispute that "last mile" connections are

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7 See Section II.B, infra.

8 Comments of AT&T Corp., In the Matter of Petition of Bell Atlantic Corporation for Relief from Barriers to Deployment of Advanced Telecommunications Services, CC Docket No. 98-11, filed April 6, 1998, pp. 21-28.

the most significant bottleneck restricting widespread access to advanced telecommunications capabilities.

Four broadband access technologies have emerged as the most likely candidates to provide, on a significant commercial scale, last mile connectivity to advanced data services for consumers and small businesses: (i) digital subscriber line ("xDSL") services; (ii) hybrid fiber/coax ("HFC") cable networks constructed by upgrading existing cable television facilities for two-way communication; (iii) fixed wireless; and (iv) satellite-based services. AT&T will discuss each of these technologies below.[9]

1. xDSL Services

As the Commission recognized in its recent Section 706 Order, the term "xDSL" refers to several varieties of Digital Subscriber Line services.[10] These services utilize existing ILEC copper loops to carry data traffic at much higher speeds than is possible via either POTS or ISDN, and thus permit the same copper loop to be used for simultaneous transmission of voice and advanced data services. xDSL services are not a substitute for existing, bottleneck "last mile" facilities, but simply upgrade the capacity of the local loops that ILECs today control. In fact, xDSL technology is merely the latest in

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9 Although the Commission has invited, and AT&T has conducted, a review of industries that are beginning to develop advanced telecommunications capabilities (see NOI, ¶ 18), this does not compel the application of common carrier regulation to non-traditional service providers. See Section IV.A, infra.

10 See Section 706 Order, ¶ 1, n.2.

advancements to increase capacity over the copper loop -- ISDN being the prior phase of such development. The most prevalent xDSL technology being deployed for consumers and small businesses is asymmetric DSL ("ADSL"), which transmits between 1.5 and 9 Megabits per second ("Mbps") downstream, and 16 Kbps to 640 Kbps upstream.

ADSL is provisioned by attaching DSL modems to each end of a telephone customer's loop. Traffic is then routed through a digital subscriber line access multiplexer ("DSLAM") at the central office or remote terminal to which the loop is connected. The DSLAM splits the traffic coming into the central office or remote terminal, directing data to a packet-switched network, and voice traffic to the public switched telephone network ("PSTN"). Exhibit A graphically depicts ADSL architecture as provided by incumbent LECs.

Most ILEC loops can be upgraded to support ADSL.[11] Bellcore estimates that close to 80% of all residences are within 18,000 feet of the central office, and close to 50% are within 12,000 feet.[12] Even assuming that only "home run" configured loops (i.e., copper running directly from residence to central office) are capable of being equipped with ADSL, the percentage of all RBOC lines which are qualified is typically within the

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11 Under current standards, twisted-pair copper loops can accommodate xDSL if they are less than 18,000 feet in length, are free of obstructions such as loading coils and most bridged taps, and have been tested so as not to cause or incur spectral interference with other services.

12 Bellcore presentation, "Role of RDTs in Supporting xDSL," July 30, 1998 ("Bellcore"), p 7.

40-60% range.[13] However, ADSL services can be deployed in association with digital loop carrier ("DLC") systems simply by placing a DSLAM of smaller size in the remote terminal. In fact, by remotely deploying DLC systems closer to residences and small businesses, ILECs are able to provide even higher access speed over those shorter copper loops. Bellcore estimates that 27 million loops (19% of all loops) are being served by DLC, and that 50-70-% of new loops are served by DLC.[14] With DLC lines included, an estimated 60-80% of RBOC access lines are ADSL qualified.[15]

ADSL is deployed on a case-by-case basis, per individual subscriber request, thus minimizing investment risk. Further, ILECs can readily integrate ADSL services into their embedded plant and equipment by simply installing DSLAM equipment as adjuncts to their central office switches or their remote terminals. In the future, much of this functionality may actually be directly embedded as electronic "plug-ins" to either central office switches or DLC equipment.

Because ILECs control the local loops that are virtually the only means for most consumer and small business customers to obtain broadband access, they have little incentive to introduce ADSL services except in areas in which they face competition for

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13 Prudential Securities Telecommunications Services Industry Report, August 27, 1998 ("Prudential"), p.20.

14 Bellcore, p. 6.

15 Prudential, p. 20.

the "last mile" of data services.[16] Such competition is beginning to emerge, however, and ILECs are responding by rolling out ADSL services in their regions when they perceive a competitive threat. Exhibit B to these comments lists announcements by cable television providers and CLECs that have begun to offer advanced telecommunications capability in a particular area, juxtaposed with contemporaneous ILEC announcements of ADSL services made in response to those offerings. These data reveal a clear and persistent pattern: ILECs plainly can and will deploy ADSL when a competitor emerges to challenge their bottleneck control over last mile facilities. For example, SBC's Pacific Bell unit entered the market with broadband services in the San Francisco Bay area in May 1998, only after CLECs, including Covad, Epoch, Rhythms and Northpoint, began to provide competitive local data services. Similarly, US West announced plans to introduce ADSL service in the Phoenix area and in Colorado Springs in June 1998, on the heels of announcements made earlier by Cox Cable in the Phoenix area, and by Century Communications (another cable operator) in Colorado Springs.

Contrary to ILECs' recent claims that they cannot (or will not) deploy advanced telecommunications capability unless they receive regulatory relief such as

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16 See "Telco & Cable Internet Strategies: The Dawn of Carrier-class Access," 1997 Jupiter Strategic Planning Services/IT47, p. 31 ("Currently, the RBOCs have a stranglehold on high-speed Internet access via leased lines by virtue of their ownership of the local loop. The RBOCs will have little reason to invest in ADSL for business use until businesses have options for high-speed access besides leasing T1 and ISDN lines. . . . Moreover, high demand for second phone lines in the residential market -- fueled in part by Internet access -- provides a strong disincentive for RBOCs to offer ADSL to consumers, because ADSL offers simultaneous voice and data traffic").

exemption from the unbundling and resale requirements Congress imposed in § 251(c), the RBOCs and GTE have now made broad announcements of rollout plans for ADSL services. However, the RBOCs in particular have not embarked on a "mass market" deployment, focusing instead on larger, urban areas and avoiding rural areas. In contrast, many cable companies -- including small cable service providers -- have announced plans to address the demand for high speed Internet connectivity in markets forsaken by the ILECs. As shown in Exhibit B, such cable offerings include Armstrong Cable Services in Connellsville, PA; Bedford Cable in Bedford, VA; Bresnan Communications in Michigan's Upper Peninsula and Marshall, MN; and Cox Cable in Las Vegas. SBC apparently has shunned the entire state of Texas, leaving high speed Internet access to be provided by cable companies such as Marcus, TCA and Time Warner.

2. Cable Access Networks

Coaxial cable networks traditionally have been capable of distributing only one-way, analog television and audio programming. Today, however, many cable providers are upgrading their networks by installing fiber optics from the cable "head end" to a fiber node further into their networks. Each fiber node serves roughly 500 to 5,000 customers, with individual customers receiving service via coaxial cable that runs from the fiber node to their premises. By bringing fiber closer to subscribers' premises and by implementing upgrades to their remaining coaxial plant, cable providers can offer bi-directional services and thus offer a high-value suite of services to consumers, including high speed Internet access, voice telephony, video on demand, interactive video, and video conferencing services. To deliver such services over an HFC network, a cable provider usually allocates spectrum equivalent to one 6 MHz television channel for downstream

traffic to homes, and several (6 to 8) 1.6 MHz channels for upstream signals. (These upstream channels generally vary in number as well as in frequency location throughout the day.) A single downstream television channel can support data speeds of up to 27 Mbps, while each upstream channel can deliver up to 2 Mbps. Exhibit C is a schematic illustration of two-way cable services over an upgraded HFC network.

A crucial difference between HFC networks and telephone-based technologies such as xDSL is in their basic architecture. Telephone networks utilize dedicated connections in which each user has a circuit dedicated for its use that connects to a central office switch. This structure is analogous to a highway in which many roads converge, each with its own dedicated lane.[17] In contrast to telephone networks, HFC networks utilize a "tree and branch" architecture in which many users' signals are merged and carried along the same path. Thus, both upstream and downstream bandwidth is shared by the active data subscribers connected to a given cable network segment, typically 500 to 5,000 homes on a modern HFC system. Exhibit D schematically depicts the difference between the dedicated architecture of the traditional telephony network and the shared architecture of the modern HFC network.

The most important factor in the deployment of two-way cable data services at present is the need to upgrade existing cable systems through installation of

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[17] In a telephone-based network, once traffic reaches a central office it may be transmitted over a packet-switched, rather than circuit-switched network. However, the path from the customer's premise to the central office (or to a remote terminal) is over a dedicated circuit.

two-way HFC facilities. While xDSL merely increases the capacity of a network that has long provided bi-directional telecommunications, cable systems were built to serve as one-way channels, and require more significant modifications to provide advanced capabilities. Accordingly, upgrading cable networks to provide broadband data services requires a greater per-subscriber investment than that necessary for ILEC xDSL services. ILECs need only add relatively inexpensive electronics to their existing loops and central office equipment in order to upgrade their systems for xDSL; cable providers must reconfigure their networks by building out fiber and upgrading the coaxial cable in their existing cable plant. Moreover, unlike ILECs' xDSL upgrades, which essentially can be implemented on a per-customer basis as the market for those services grows, the nature of high-speed data access via cable is such that cable providers must invest capital up-front to upgrade entire neighborhoods. If customer "take" rates for cable telecommunications services are low, a cable provider's investment simply will be stranded.[18]

There currently are approximately 300,000 cable modem subscribers in North America.[19] Over 85 percent of current subscribers are receiving service via two-way cable modems, with the remainder using services in which a telephone line serves as

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18 See IDC Flash, "DSL Market Gains Direction," January 1998, p. 5 ("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 access network. In addition, most of the costs to deploy DSL are variable rather than fixed - the service provider can deploy equipment as new subscribers come on line").

19 Cable Datacomm News, September 1998.

the upstream channel.[20] Cable operators typically charge between $40 and $60 per month for this service, which typically includes cable modem rental and unlimited Internet access.[21] In contrast, ILEC xDSL offerings in areas where competitors offer high-speed services range from $35 to $190, with an additional fee for Internet access -- considerably higher than the cable companies. Exhibit E displays comparative ILEC and cable provider pricing for broadband access.

Through its recently announced planned acquisition of TCI, AT&T intends to transform TCI's cable network not only into a meaningful alternative to incumbent LEC networks, but into a platform for the delivery of high-value services, including high speed content-enriched Internet access, voice telephony, video on demand, interactive video, and video conferencing services, available to millions of residential customers whose homes TCI passes. TCI already has committed to spend $1.8 billion to upgrade its infrastructure to provide customers in its serving area with additional services, including added channel capacity, high speed data services, and on-demand pay-per-view video; but that upgrade does not include voice telephony. AT&T anticipates that these cable upgrades will be 60% completed by year end 1999, and 90% accomplished by the end of the year 2000. AT&T will have to add significant additional capabilities in order to provide voice telephony over TCI's facilities.

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20 Id.

21 Commercial Cable Modem Launches in North America, Kinetic Strategies, Inc., August 1998.

3. Fixed Wireless Services

There is significant development of fixed wireless access technologies targeted at different spectrum bands. For example, AT&T has on-going field trials of its "Angel" technology, which is designed to offer high-speed, high-quality secure wireless access to homes over CMRS spectrum. Angel will include two phone lines and the capability for 512 Kbps data access, carried over existing wiring in the home.

Wireless cable operators are beginning to allocate channel capacity to deliver high-speed Internet services in addition to traditional video fare. As in the case of wired cable, a 6 MHz wireless television channel can support 27 Mbps of downstream data. However, a telephone-return path must be used for upstream communication until regulatory and technical hurdles can be cleared to allow two-way wireless data delivery.

There are several wireless spectrum blocks in the 2.1 to 2.7 GHz band that can be used for cable television and Internet services, including multipoint distribution service ("MDS"), multichannel multipoint distribution service ("MMDS") and instructional television fixed service ("ITFS"). Wireless cable system operators have aggregated available MDS, MMDS and ITFS spectrum in some markets, giving them up to 200 MHz of bandwidth. The local multipoint distribution service ("LMDS") band presents another potential opportunity for broadband wireless access, with a total bandwidth of 1.3 GHz in the 28 GHz band.

The architecture of fixed wireless cable networks is similar to those of HFC networks. As in the case of wired cable data services, a cable modem router and related networking gear are installed in the wireless operator's head end. Digital data signals are then modulated onto radio frequency ("RF") channels for broadcast transmission to roof-

top antennas at subscriber locations. Coaxial cable runs from the subscriber's antenna to a downconverter (which shifts the microwave signal frequency into the cable television band), and then into a cable modem on the customer's premises. A telephone modem connection is used for upstream connectivity back to the wireless head end, either at POTS or ISDN speeds. Exhibit F displays a typical fixed wireless cable network configuration.

A number of MDS/MMDS/ITFS operators have deployed commercial high-speed data services to date, including American Telecasting Inc. in Denver and Colorado Springs; CAI Wireless Inc. in Rochester and New York City; CS Wireless Inc. in Dallas; People's Choice TV in Phoenix; and DirectNET in Ft. Lauderdale. These wireless operators typically price unlimited high-speed Internet access at $50 to $80 per month for consumers. Subscribers also must purchase a cable modem for $300 to $600.[22]

A key issue facing wireless cable modem technology is its lack of two-way wireless capability. Upgrading wireless cable systems to support two-way transmission would require providers to convert what are now broadcast television systems into networks that more closely resemble a cellular telecommunications platform. Wireless operators also face regulatory constraints, as MDS, MMDS and ITFS spectrum currently may only be used for downstream broadcasts. However, CAI Wireless has received FCC approval to conduct two-way wireless cable trials in Boston and Pittsburgh, and there is

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[22] Wireless Cable Modem Service Availability, Kinetic Strategies, Inc., July 1998.

an NPRM currently pending before the Commission that would permit two-way MMDS services.[23]

4. Satellite Networks

There are various proposed broadband access satellite systems scheduled for introduction in the year 2002 and after. Most of these systems are based on still-evolving proprietary technologies, the cost, capacity, and reliability of which remains to be proven. The only currently available broadband data service in the consumer market via satellite is Hughes DirectPC offering. DirectPC offers downstream Internet access at up to 400 Kbps, with upstream traffic carried via a POTS dial-up connection. Residential subscribers are charged $30 to $50 per month for 25 to 100 hours per month of limited access. Additional time costs $1.99 per hour.[24] Exhibit G depicts the typical satellite network configuration for two-way communications.

C. Current And Future Deployment Of Advanced Telecommunications Capability In The "Backbone."

Contrary to the self-serving claims of some ILECs, Americans' ability to take advantage of advanced telecommunications capability is not constrained by a shortage of "backbone" facilities. As the investor community recognizes, backbone

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23 Amendment of Parts 1, 21, and 74 to Enable Multipoint Distribution Service and Instructional Television Fixed Service Licensees to Engage in Fixed Two-Way Transmissions, Notice of Proposed Rulemaking, 12 FCC Rcd. 2217 (rel. October 10, 1997) (on agenda for September 17th FCC open meeting).

24 URL: www.directpc.com..

investment for advanced services is significant and accelerating, but the "last mile" remains a bottleneck:

> While the aforementioned growth statistics are impressive, we believe they would be significantly higher if it weren't for one main factor: the bandwidth bottleneck in the local loop. . . . [T]oday practically all consumers and many small to mid-sized businesses do not have affordable high-bandwidth connectivity, and this is preventing the delivery of high-bandwidth services.[25]

The open and highly competitive market for interLATA services has proven extremely responsive to Americans' needs. Established IXCs have greatly increased the capacity of their networks in recent years, and continue to make significant investments in high-capacity private line, frame relay, ATM, and IP services. At the same time, new entrants to this market have constructed powerful networks of their own in recent years, and are attracting enormous quantities of new capital with which to increase their capacity.

1. AT&T's Backbone Deployment

AT&T's network currently handles over twelve terabytes of switched, IP, ATM and frame rely traffic on a daily basis, and the capacity of its network is growing rapidly. In early 1998, AT&T announced dramatic plans to "future proof" its long haul network for voice, data, image and Internet calling. Under its new network architecture, AT&T will be able to handle any type of traffic a customer wishes, in unlimited amounts, well into the next millennium. AT&T is greatly boosting the capacity of its 40,000 route

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[25] Prudential, pp. 4-6.

miles of fiber installed in the U. S. through a new SONET (Synchronous Optical Network) photonics technology and will provide its various voice, data and Internet networks over a common fiber transport system. AT&T soon will be the first carrier to test and deploy a system that will support 200 Gigabits per second ("Gbps") (eventually capable of expanding to 400 Gbps) carrying more than three million simultaneous calls on a single SONET fiber -- Lucent Technologies' new WaveStarT OLS 400G, the industry's first 80-wavelength Dense Wave Division Multiplexing ("DWDM") system. DWDM technology -- which uses light to magnify transmission -- will make it possible for AT&T to increase the transport capacity of its existing network by a factor of ten without having to lay any additional fiber-optic cable.

AT&T is currently the industry leader in DWDM deployment, with more wavelength systems in service than any other long-distance carrier. In February of this year, AT&T marked a major milestone when its one thousandth DWDM system became operational. And AT&T is continuing to improve its network architecture, having invested some $7 billion in its network last year alone on its SONET build-out and other improvements. The company currently has coast-to-coast connectivity with 32 large fiber rings. This year, AT&T will add another 26 rings, for a total of 58, completing a three-year project and delivering transmission in any form and with sub-second emergency restoration capabilities.

AT&T also will enjoy synergies between its long distance SONET rings and the smaller, local SONET rings that it now has in 66 markets across the country by virtue of its TCG acquisition. As AT&T completes its flexible, cost-effective build of long-haul SONET rings connected to its metropolitan SONET rings, this network will