conclusions are supported by the pro-competitive purposes of the 1996 Act and are consistent with the Commission's overarching policy of eliminating barriers to facilities-based competition.

The plain language of Section 224 requires that utilities provide non-discriminatory access to any pole, duct, conduit, or right-of-way that they own or control and contains no limiting language to suggest anything less.[54] If the congressional mandate and the Commission's competition policies are to succeed, this access right cannot exclude rights-of-way (including rooftop easements), conduits, risers, end-user premises in MTEs, and utility property used as part of a utility's distribution system. Non-discriminatory access to these rights-of-way is essential if wireless providers are to compete in MTEs. Any practical administrative issues associated with providing such access have already been addressed by the Commission in other contexts and therefore can be resolved by applying that precedent.[55]

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[54] Section 224(f)(1) states that "[a] utility shall provide a cable television system or any telecommunications carrier with non-discriminatory access to any pole, duct, conduit, or right-of-way owned or controlled by it." 47 U.S.C. § 224(f)(1).

[55] *See, e.g., Deployment of Wireline Services Offering Advanced Telecommunications Capability*, First Report and Order and Further Notice of Proposed Rulemaking, FCC 99-48 (rel. Mar. 31, 1999); *Implementation of Section 207 of the Telecommunications Act of 1996*, Second Report and Order, 13 FCC Rcd 23874 (1998) ("*Second OTARD Order*"), *recon. pending, appeal pending sub nom. Building Owners and Managers Assoc. Int'l v. FCC*, No. 98-1610 (D.C. Cir. docketed Dec. 23, 1998); *Telecommunications Services Inside Wiring, Customer Premises Equipment; Implementation of the Cable Television Consumer Protection and Competition Act of 1992: Cable Home Wiring*, Report and Order and Second Further Notice of Proposed Rulemaking, 13 FCC Rcd 3659 (1996); *Implementation of Section 703(e) of the Telecommunications Act of 1996, Amendment of the Commission's Rules and Policies Governing Pole Attachments*, Report and Order, 13 FCC Rcd 6777 (1998) ("*1998 Pole Attachment Order*").

The "pole attachment" provisions of Section 224[56] are one aspect of Congress's stated policy to ensure that the bottleneck control by utilities, including ILECs, over their facilities and rights-of-way will not be used to deflect or obstruct potential competitors from offering service and thereby deprive the public of the benefits of competition.[57] Even prior to the 1996 Communications Act amendments, the Commission recognized that "[t]he purpose of Section 224 of the Communications Act is to ensure that the deployment of communications networks and the development of competition are not impeded by private ownership and control of the scarce infrastructure and rights-of-way that many communications providers must use in order to reach customers."[58]

Originally enacted in 1978, Section 224 was designed to ensure that utilities' bottleneck control over poles and rights-of-way would not stifle the growth of cable television. In 1996, Congress expressly extended to telecommunications carriers the same mandatory right of access previously provided only for cable television systems. As the Commission has already determined, the right of access provided by Section 224 includes access for facilities used to provide wireless telecommunications

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[56] Under Section 224(a), "pole attachment" means any attachment . . . to a pole, conduit, or right-of-way owned or controlled by a utility. 47 U.S.C. § 224(a).

[57] *See, e.g.*, 47 U.S.C. § 251(c)(2)-(4) (imposing interconnection, unbundled access, and resale obligations on ILECs); 47 U.S.C. § 251(b) (imposing resale, number portability, dialing parity, access to rights-of-way, and reciprocal compensation obligations on all LECs).

[58] *1998 Pole Attachment Order*, 13 FCC Rcd at 6780 (footnotes omitted) (citing Pub. L. No. 95-234 ("1978 Pole Attachment Act") and S. REP. NO. 580, 95th Cong., 1st Sess. 19, 20 (1977) ("*1977 Senate Report*"), *reprinted in* 1978 U.S.C.C.A.N. 109, 121).

services.[59] The statute limits neither the type of equipment that may be attached to utility facilities,[60] nor the rights-of-way that are subject to the non-discriminatory access requirement. In fact, Section 224(f)(1) expressly requires that utilities provide non-discriminatory access "to *any* . . . right-of-way owned or controlled"[61] by them, which necessarily includes rooftops, risers, ducts, and conduits located in MTEs, as well as both publicly and privately granted rights-of-way.

The *NPRM* correctly observes that in an MTE, competing telecommunications carriers *must* have access "either to the existing riser cable and inside wiring, or to riser conduit and other building space in which to place their own facilities, or both[,]" and that wireless providers may also "need access to rooftops on which to place their antennas, and to conduit for laying cable to carry signals from the antenna either to the NID [network interface device] or directly to individual units."[62] The *NPRM* also concludes correctly that where a rooftop or other location constitutes a right-of-way owned or controlled by a utility—*i.e.*, where the utility has the right to place its antennas or other facilities there and exercises this right of ownership or control—Section 224 requires it to permit telecommunications service providers non-discriminatory access to

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59 *1998 Pole Attachment Order*, 13 FCC Rcd at 6798-99.

60 *See Implementation of the Local Competition Provisions in the Telecommunications Act of 1996, Interconnection between Local Exchange Carriers and Commercial Mobile Radio Service Providers*, First Report and Order, 11 FCC Rcd 15499, 16085(1996) (subsequent history omitted) ("*First Local Competition Order*").

61 47 U.S.C. § 224(f)(1) (emphasis added).

62 *NPRM* ¶ 34 (footnote omitted).

such rights-of-way.[63] In that regard, the Commission correctly interprets the spirit and intent of Section 224 in tentatively concluding that once a utility uses any pole, duct, conduit or right-of-way for wire communications, all rights-of-way that it owns or controls are subject to Section 224 regardless of the purpose for which they are used and regardless of whether they are publicly or privately granted.[64] This naturally encompasses any facilities or rights-of-way located in MTEs, including rooftops, ducts, and conduits. As the *NPRM* also found, Section 224 extends to locations on the utilities' own property that are used "in the manner of a right-of-way in connection with the utility's distribution network."[65]

The Commission's approach reflects reality. For wireless telecommunications providers, access rights to rooftops and riser conduits are the *sine qua non* of competing for customers located in an MTE. Without the ability to co-locate antennas and cables in utility-owned or controlled areas and facilities located in MTEs, the service areas of wireless competitors will have gaps that cannot be plugged and head-to-head facilities-based competition will be curtailed. Consumers in these MTEs simply will not have a wireless option. Moreover, if the Commission were to permit monopoly ILECs to exclude competitors and favor their own services merely because their distribution facilities are located in rights-of-way obtained from private parties, the

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63 *Id.* ¶ 41.

64 *Id.*

65 *Id.* ¶ 39; *see also id.* ¶ 43.

nondiscrimination provisions of Section 224 would be rendered meaningless. In either case, the undisputed public benefits of competition would be needlessly forestalled.

As demonstrated above and as the Commission concluded in the *NPRM*, rooftops, conduits, and other locations constitute a "right-of-way" within the meaning of Section 224 so long as they are "owned" or "controlled by" the utility. PCIA suggests that to implement the pro-competitive purposes of the 1996 Act, the broad definition of these terms inherent in Section 224 itself should be incorporated in the Commission's rules. Thus, all rooftops, risers, conduits, ducts, easements, and property used by a utility in the distribution of its services must constitute "rights-of-way" for Section 224 purposes.

Similarly, the scope of "ownership and control" of such rights-of-way under Section 224 must include both public and private grants, whether acquired by contract, eminent domain, easement, prescription, lease, adverse possession, or fee simple absolute. As suggested in the *NPRM*, this should include all the utility's property that is used for the distribution of its services in a manner equivalent to that for which it might obtain a right-of-way.[66] The test for making this determination should be a simple one: whether the property is used for the distribution of the utilities' service. Under this test, property owned by the utility and used exclusively for business offices, customer service representatives and similar functions would *not* be subject to Section 224. On the other hand, substations, distribution plants, pedestals, switching offices, poles, ducts, conduits, rights-of-way, and other property used for the distribution of the utilities'

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[66] *NPRM* ¶ 43.

service would be encompassed by Section 224 and the Commission's rules mandating non-discriminatory access to competitive telecommunications carriers at reasonable rates.[67]

As the Commission tentatively concluded in the *NPRM* and as it has previously held in the *Local Competition* proceeding, a utility's use of any pole, duct, conduit, or right-of-way for wire communications triggers non-discriminatory access under Section 224 to *all* such facilities owned or controlled by the utility, regardless of the purpose for which they are used.[68] The obligation to provide non-discriminatory access under Section 224(f) only applies to any utility "who owns or controls poles, ducts, conduits, or other rights-of-way *used, in whole or in part for any* wire communications."[69] Therefore, non-discriminatory access does not apply under the statute where a utility has neither used nor permitted others to use any of its facilities for wire communications.

Once *any* part of the utility's facilities are used for wire communications, however, the plain language of the statute dictates, *a priori*, that *all* poles, ducts, conduits, or other rights-of-way owned or controlled by the utility are subject to non-discriminatory access, regardless of whether such facilities are currently being used for wire communications. This conclusion is confirmed by Congress's use of the phrase "used, in whole or in part for any wire communications" to describe when a utility's facilities would become subject to the non-discriminatory access requirement of Section

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67 *See* 47 C.F.R. § 1.1403(a).

68 *NPRM* ¶ 41; *First Local Competition Order*, 11 FCC Rcd at 16079-80.

69 47 U.S.C. § 224(a)(1) (emphasis added).

224(f). The Commission consequently has correctly held that "use of any utility pole, duct, conduit, or right-of-way for wire communications triggers access to all poles, ducts, conduits, and rights-of-way owned or controlled by the utility, including those not currently used for wire communications."[70] No legal or policy justification exists to construe Section 224 any differently here. Indeed, a contrary determination would be inexplicable.

There is no reason to believe that management of a non-discriminatory access regime will prove difficult to carry out. Any practical administrative issues arising from this requirement of non-discriminatory access can be addressed and resolved by reference to the Commission's existing rules and procedures for the sharing of space or facilities by competitors. Indeed, as the precedent reveals, the Commission has in place a range of regulatory models that can be adapted to the existing "pole attachment" regulations.[71]

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[70] *First Local Competition Order*, 11 FCC Rcd at 16080.

[71] *See, e.g., Expanded Interconnection with Local Telephone Company Facilities*, Report and Order and Notice of Proposed Rulemaking, 7 FCC Rcd 7369, 7407 (1992), *recon.*, 8 FCC Rcd 127 (1992), *further recon.*, 8 FCC Rcd 7341 (1993), *vacated in part and remanded sub nom. Bell Atl. v. FCC*, 24 F.3d 1441; *First Local Competition Order*, 11 FCC Rcd 15499 (1996); *Deployment of Wireline Services Offering Advanced Telecommunications Capability*, Memorandum Opinion and Order and Notice of Proposed Rulemaking, 13 FCC Rcd 24011, 24028 (1998); *Deployment of Wireline Services Offering Advanced Telecommunications Capability*, First Report and Order and Further Notice of Proposed Rulemaking, FCC 99-48, ¶ 8 (rel. Mar. 31, 1999).

VI. THE COMMISSION SHOULD TAILOR ITS RULES GOVERNING THE DEMARCATION POINT AND UNBUNDLED NETWORK ELEMENTS TO ENSURE THAT ALL TELECOMMUNICATIONS CARRIERS HAVE ACCESS TO NECESSARY WIRING TO DEPLOY ADVANCED TELECOMMUNICATIONS SERVICES.

The *NPRM* requests comment on whether, and to what extent, the agency should modify its rules under Part 68 governing determination of the demarcation point in MTEs to promote access. PCIA urges the Commission to revise its rules as is necessary to ensure that fixed wireless providers have access to the wiring required to deploy their advanced telecommunications services. For PCIA's members, the biggest issue is access, not ownership. Regardless of whether the inside wiring, equipment, or other facilities are owned or controlled by a carrier or premises owner, fixed wireless providers must have access to these facilities to make their services available. Therefore, any new rules governing demarcation points should take into account the need of these operators to have access to certain facilities in MTEs to provide their advanced telecommunications services. The Commission should ensure that incumbent carriers are not able to set arbitrary demarcation points, which could hinder competition by making it difficult for providers to access the facilities necessary to provide their services.

With the foregoing in mind, PCIA believes that the Commission should amend its rules to specify that the inside wire demarcation point for all commercial and residential MTEs is the minimum point of entry ("MPOE"). Under that scenario, intra-MTE wiring access can be obtained from the customers themselves (if they desire the service) or the premises owner (subject to the non-discriminatory access principles outlined herein). Here, PCIA points out that under the Commission's current rules, ILECs are

not required to provide a single demarcation point at the MPOE for MTE buildings wired before August 13, 1990, unless it is specifically requested by the building owner.[72] This can pose a significant obstacle with respect to a wireless carrier's ability to provide competitive services in a timely and responsive manner.

In the event that the demarcation point for all MTEs is not moved to the MPOE, the Commission must ensure that wireless carriers have access, as needed, to intra-MTE wiring not controlled by customers and building owners. Because of the broadband nature of many of the service offerings contemplated by wireless operators, in many cases they will want to install their own wiring. Where such fresh installation is not possible, however, the wireless service providers may need access to the pre-existing intra-MTE wiring controlled by the ILEC. This goal can be achieved by making available the ILEC-controlled intra-MTE wiring between the building entry and the demarcation point as an unbundled network element.

VII. SECTION 1.4000 OF THE COMMISSION'S RULES SHOULD BE AMENDED TO EXTEND PREEMPTION PROTECTION TO ALL FIXED WIRELESS ANTENNAS USED IN THE PROVISION OF *ANY* TELECOMMUNICATIONS SERVICE.

PCIA fully supports the petition for rulemaking recently filed by the Wireless Communications Association International, Inc. ("WCA"), which calls on the Commission to amend Section 1.4000 of the Commission's Rules to preempt any non-

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[72] *See* 47 C.F.R. § 68.3(b)(2); *Review of Sections 68.104 and 68.213 of the Commission's Rules Concerning Connection of Simple Inside Wiring to the Telephone Network and Petition For Modification of Section 68.213 of the Commission's Rules Filed by the Electronic Industries Association*, Second Report and Order and Second Further Notice of Proposed Rulemaking, 12 FCC Rcd 11897, 11915 n.104 (1997).

federal restriction that impairs the installation, maintenance, or use of any subscriber premises reception or transmission antenna used to provide any type of fixed wireless service. Amending the "antenna preemption rule" will promote competition and the deployment of advanced telecommunications services by allowing certain consumers who rent apartments or lease space in multi-tenant buildings to gain access to fixed wireless services. Although extension of the scope of the rule will not solve the larger building access concerns being addressed in the instant proceeding, it is a good step in the right direction in that it represents a logical step with respect to the convergence of technologies and communications services.

A. Extending The Antenna Exemption Rule To Include All Fixed Wireless Antennas Is Essential To The Commission Meeting Its Obligations Under Section 706(a) Of the 1996 Act.

The current antenna preemption rule reflects the Commission's effort to address the requirement in Section 207 of the 1996 Act that the Commission promulgate rules that prohibit restrictions on viewers' installation of devices that receive over-the-air video programming. The Commission responded by extending its antenna preemption rule to allow consumers who rent or occupy multi-tenant buildings and have an exclusive-use area, such as a balcony or patio, to install video programming reception devices.[73]

Indeed, as the rule stands now, a fixed wireless service provider is permitted to seek protection from non-federal restrictions *only* if the provider's package of services

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[73] *In re Implementation of Section 207 of the Telecommunications Act of 1996*, Second Report and Order, 11 FCC Rcd 19276, 19307 (1996) (Memorandum Opinion and Order, and Further Notice of Proposed Rulemaking).

specifically includes multichannel video programming. Thus, the rule provides no protection whatsoever for those fixed wireless operators who, while they may be offering an array of other attractive services, are not providing multichannel video services.

The result of the limited scope of the antenna exemption rule has been the creation of an arbitrary line between those wireless operators that provide multichannel video services and those that don't, *even though* the antennas they use can literally be identical in form and technology. This inconsistent treatment among fixed wireless service providers under the rule has resulted in and, if left unchanged, will continue to skew the marketplace and significantly inhibit the deployment of advanced telecommunications services as was contemplated when Congress adopted Section 706 of the 1996 Act.

Clearly, the Commission could greatly encourage the deployment of advanced services by eliminating the disparate treatment among fixed wireless providers that now exists under the antenna preemption rule. By extending preemption protection to all fixed wireless antennas, regardless of the communications services being received or transmitted by them, the Commission would create a regulatory environment under which a whole host of fixed wireless operators can deliver to consumers the very types of competitive services contemplated by Congress when it passed the 1996 Act.

B. Notwithstanding The Obvious Benefits That Would Flow From The Adoption of WCA's Proposal, The Commission Must Still Reconcile Its Antenna Preemption Rule With the Mandates of Section 207 Of The 1996 Act.

In supporting WCA's petition, PCIA points out that, although amending Section 1.4000 as proposed by WCA is a needed change, it unfortunately will not resolve the core building access issue being addressed in this proceeding. Specifically, expansion of the antenna preemption rule to include protection for all fixed wireless service providers still leaves unaddressed the fact that consumers in MTEs who do not have exclusive-use areas (*e.g.*, patios, balconies, etc.) where antennas can be installed are prevented from accessing available fixed wireless telecommunications and video services.

As PCIA noted in its petition for reconsideration filed in CS Docket No. 96-83,[74] in adopting the current antenna preemption rule, the Commission failed to extend Section 207's protection to tenants of MTEs that do not have property under their exclusive use suitable for the installation of Section 207 devices. Unfortunately and notwithstanding what PCIA believes to have been Congress' intent in adopting Section 207, the practical effect of the Commission's action is that building owners, landlords and condominium associations—*not* the consumer—will be the ones choosing which services will be made available in the building they own or control. Such a result runs contrary to one of the principle purposes of the 1996 Act—to open telecommunications markets for all Americans so that *consumers* would have the largest possible range of

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[74] Personal Communications Industry Association, et al., Petition for Reconsideration, CS Docket No. 96-83 (filed Jan. 22, 1999).

choices for telecommunications services. As it stands now, an entire class of consumers, consisting of millions of MTE tenants, are excluded from the protections of Section 207.

In view of the foregoing, PCIA renews its request that the Commission reconsider its Order in CS Docket No. 96-83 and adopt amended rules that prohibit all restrictions on installation of Section 207 devices in MTEs, except those necessary for public safety purposes.

VIII. CONCLUSION

The Commission must act decisively to ensure that all Americans have the opportunity to avail themselves of the many benefits that flow from advanced communications services and technologies. Accordingly, PCIA respectfully urges the Commission to take immediate action and adopt a non-discriminatory building access requirement premised on the mutually beneficial principles outlined in these comments.

Respectfully submitted,

PERSONAL COMMUNICATIONS INDUSTRY ASSOCIATION

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August 27, 1999

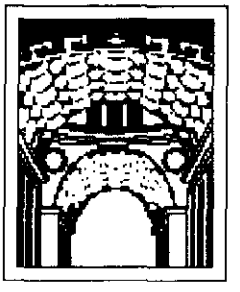
APPENDIX A

"WIRELESS BROADBAND ACCESS MARKET ANALYSIS"

WIRELESS BROADBAND ACCESS (WBA)

MARKET ANALYSIS

PCIA White Paper
August 1999



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WIRELESS BROADBAND ACCESS (WBA)

MARKET ANALYSIS

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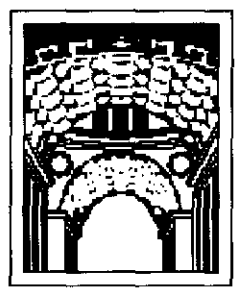

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TABLE OF CONTENTS

TABLE OF FIGURES

TABLE OF TABLES

WIRELESS BROADBAND ACCESS (WBA) MARKET ANALYSIS

1.0 Overview

With the widespread penetration of the Internet in the United States, and the continued development of the Internet's services and capabilities, a major market for broadband capabilities (i.e., accessing these services at high speeds) is developing. A variety of solutions have been proposed, and several competitors have begun to address this market offering different solutions. The purpose of this white paper is to examine the role of fixed wireless architecture to provide broadband services as compared with several wireline alternatives, including fiber, hybrid fiber coax, and copper infrastructures.

2.0 Broadband Telecommunications Services

Broadband telecommunications services are about data; about moving data from one place to another - across the street, across the country or around the world — and about doing it at speeds of more than 200 kilobits per second (Kbit/s).

2.1 Drivers of Demand

2.1.1 Business Customers

Until recently, data communications has been the province of the business customer. Businesses needed to transfer large batches of data from one place to another. As the benefits of rapid data transfer became apparent, the demand grew for these services, and data communications networks adapted to meet these needs.

Access to broadband telecommunications services has never been a serious issue for large corporate entities and major institutions. These groups have a sufficient volume of data communications traffic and the deep pockets to warrant the dedicated high-speed leased lines that have

dominated these services. Small and medium-sized business entities (SMEs), without the resources of larger businesses, have not been as fortunate. As a recent study by Ferris, Baker, Watts indicated, two-thirds of all business users still access the Internet at 56 Kbit/s or less. For these SME users, the broadband services now emerging represent a significant improvement in the utility of the Internet and in their own efficiency.

2.1.2 Residential Customers

Residential demand for high-speed services has lagged behind business demand, but it is becoming a major factor. In 1983, only 8% of American adults had access to a personal computer (PC) at home. By 1997, 43% of American adults lived in a household with access to a PC. In addition, 68% of all U.S. adults with a college degree and 74% of all adults with a graduate degree had access to a personal computer. We also note that in 1997, 11% of Americans adults reported having more than one working computer in their home[1]. NTIA and the Census Bureau recently reported that 36.6% of the households in the U.S. in 1997 had PCs[2].

INSIGHT expects that the trend in residential penetration will continue. In its recently released research study, *Consumer Demand for Broadband Services*, INSIGHT projected that 68 million U.S. households would own PCs by the year 2003. This means that residential penetration will grow from 47.3% of U.S. households in 1998 to 63.9% of all households in 2003.

Projected Households with Personal Computers, 1998-2003

	1998	1999	2000	2001	2002	2003
US Households (Mil.)	101	102.1	103.2	104.3	105.4	106.5
Households with PCs (Mil)	47.8	51.9	55.1	59	63	68
Penetration Rate	47.3%	50.8%	53.4%	56.6%	59.8%	63.9%

[1] Sources: The National Science Foundation, Science and Engineering Indicators – 1998 Chapter 7
J.D. Miller and L. Kimmel, Public Attitudes Toward Science and Technology, 1979 – 1997, Integrated Codebook

[2] Falling Through the Net II: New Data on the Digital Divide

Approximately 28% of adult Americans had e-mail addresses in 1997. An estimated 55% of adults with a college degree and an estimated 62% of adults with graduate or professional degrees had e-mail addresses in 1997[3]. The NTIA estimated 18.6% of U.S. households had online access in 1997 and that online access had grown at a rate of 397% since 1994. INSIGHT estimates that the number of households using online services will grow to 64.3 million in 2003.

Projected Households Online, 1998-2003

	1998	1999	2000	2001	2002	2003
U.S. Households (Mil)	101	102.1	103.2	104.3	105.4	106.5
Households Online (Mil)	27.3	38	45.7	50.3	57.3	64.3
Penetration Rate	27.0%	37.2%	44.3%	48.2%	54.4%	60.4%

Penetration rates for households using online services are expected to double by 2002 and are expected to continue to post robust growth through 2003 and into the future. Households using online services are expected to grow at twice the rate of households acquiring PCs over the same period. Almost 95% of the households with PCs are projected to be online by 2003.

Projected Online Households as a Percent of Households with PCs, 1998-2003

	1998	1999	2000	2001	2002	2003
Households with PCs (Mil)	47.8	51.9	55.1	59	63	68
Households Online (Mil)	27.3	38	45.7	50.3	57.3	64.3
% of Total	57.1%	73.2%	82.9%	85.3%	91.0%	94.6%

2.2 Internet Growth

The growth in traffic for the public switched telephone network (PSTN) is increasingly data traffic, and this increase in data traffic reflects the overwhelming growth of the Internet. The number of Internet host computers has grown at an astonishing rate. (An Internet host is any computer that

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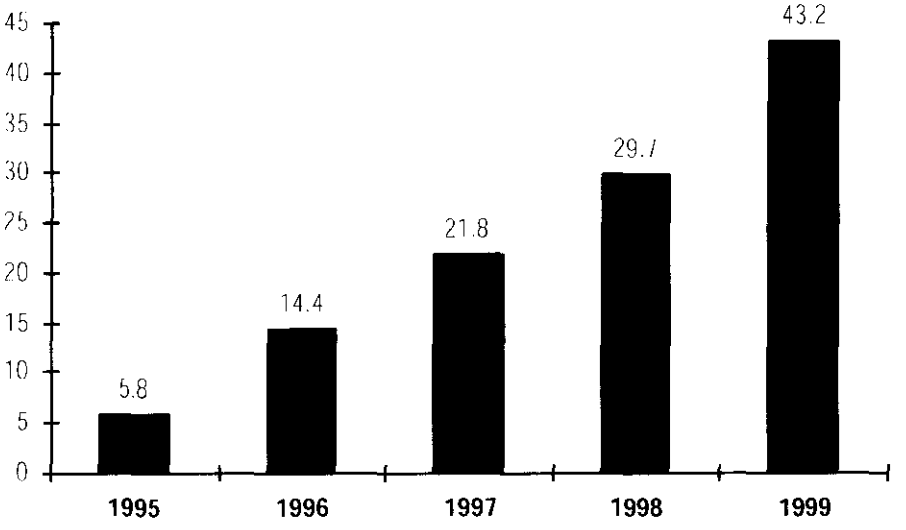
[3] Op. cit. The National Science Foundation, Science and Engineering Indicators – 1998 Chapter 7
J.D. Miller and L. Kimmel, Public Attitudes Toward Science and Technology, 1979 – 1997, Integrated Codebook

has full two-way access to other computers on the Internet.) According to the Internet Software Consortium, traffic on the Internet has been doubling every 100 days.

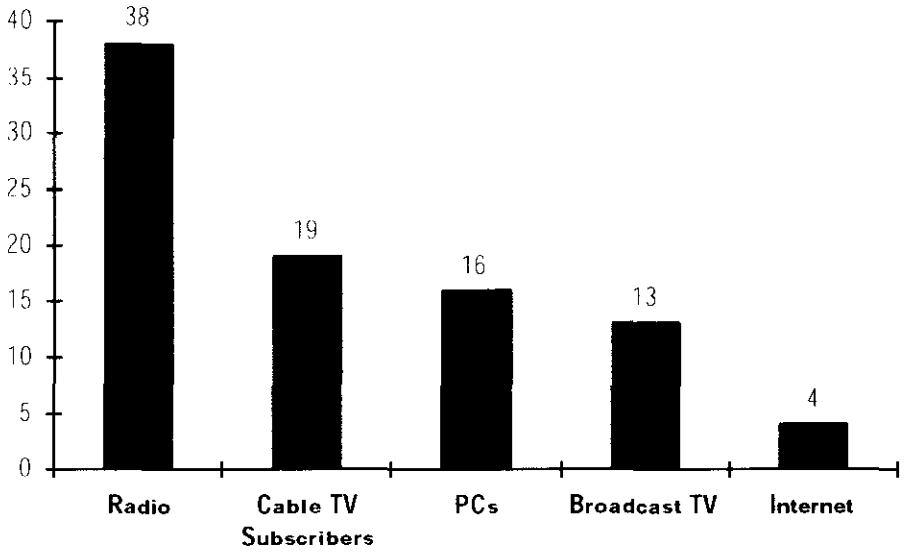
Total Number of Internet Hosts, January 1995 to January 1999 (Millions)



Source: Internet Software Consortium

A study by the U.S. Department of Commerce indicated that 100 million people used the Internet in 1997. More than 50 million of these users were Americans. As shown by the following figure, the Internet has achieved widespread consumer acceptance, reaching 50 million users in a much shorter time than other mass market media/products.

Years to Achieve 50 Million User Penetration Among Various Mass Media/Products



The World Wide Web, composed of a variety of business and personal Web sites, accounts for most of the interest in the Internet. As with most mass media, a "virtuous circle" has been established. As users grow more familiar with the Web, their usage tends to increase. As usage increases, larger numbers of service providers and product vendors are drawn to the medium. As new and existing companies provide new or expanded services, current users increase their usage and new users enter and stimulate additional growth.

As a part of its study of consumer requirements for broadband telecommunications services, INSIGHT developed a profile of Internet subscribers. Respondents to the survey indicated the following about their age:

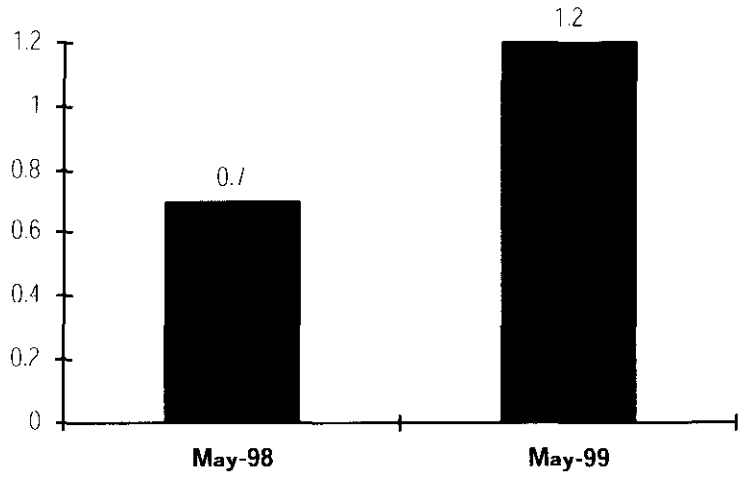
Age Distribution of Internet Users

Age Groups	1998 Survey	1990 Census
18 - 34 Years	43.9%	53.7%
35 - 54 Years	44.0%	25.3%
55 - 64 Years	7.9%	8.5%
65 Years and Over	4.2%	12.5%

The penetration of the 18 to 34 year old group and the 35 to 54 year old group were about equal. Users in these age groups make up the bulk of the total Internet users. We've attributed the modest under-representation of the 18 to 34 year group to the fact that they tend to have lower incomes than older users. (Several studies, including our own, have found that access to the Internet is directly related to income and educational levels.) As the population continues to age, we expect that the proportion of Internet users aged 65 and older will increase as well.

Media Metrix, a market research firm specializing in Internet and digital media measurement, tracks the average time that users spend online. Media Metrix' information report for May 1999 indicates that the average user spent 7.6 hours per month on the Web. This compares to 5.3 hours per month for May 1998. During the same twelve month period, the total Internet hours of use grew at an annual rate of 69.2%—from 700 million to 1.2 billion. This growth was a combination of new visitors, an increase in the number of days that the average user accessed the Web and an increase in the amount of time the average user spent online.

Total Internet Hours of Use, Month of May 1998 vs. May 1999 (Billions of Hours)



Source: Media Metrix, Inc.

2.3 Accessing the Internet

Online access is predominantly accomplished by analog modems today. The typical analog modem in service with a personal computer operates at 28.8 Kbit/s (28,800 bits per second). Newer modems operate at data rates of 56 Kbit/s. With overhead and a noisy dial-up environment, peak effective modem speeds are actually below the rated speed.

As a practical matter, downloading a large multimedia or data file using a 28.8 Kbit/s modem can take a significant amount of time. A personal computer using a 28.8 Kbit/s modem will take 46 minutes to download a 12 Mbyte file. A file this size might represent a three and a half minute video clip. Accessing even relatively small multimedia files represents a major commitment in time and resources for most users. A 56 Kbit/s modem would probably take half as long to accomplish the same task. Since analog modems have reached their limit at 56 Kbit/s, achieving faster download times means using digital equipment and a higher speed access technology.

The public is looking to the Internet for solutions to many basic needs. As Internet usage continues to grow, we expect that consumers and businesses will rely on this medium for a larger share of basic requirements as well as entertainment, information and communications capabilities. The limited bandwidth provided by even the fastest analog modems cannot meet this developing need.

INSIGHT believes that as the public makes increasing use of the Internet, users will require higher speed access to the medium. To meet this demand, service providers will deploy a combination of high-speed wireline and wireless telecommunications capabilities. Based on recent comments and actions from leading service providers, we expect broadband services to be delivered using a combination of wireline and wireless approaches, "...a patchwork of overlapping networks, including Digital Subscriber Line (DSL), fiber, wireless, cable or other means"[4]. These wireless and wireline infrastructures are discussed in the following sections.

[4] Comments of Mr. Robert Finch, Vice President of Strategic Development at MCI Worldcom

3.0 Wireless Broadband Access

Wireless broadband service providers utilize radio spectrum as a medium for transporting telecommunications and data traffic. Wireless infrastructures are generally divided into two types: mobile (e.g., cellular and PCS networks) and fixed (e.g., LMDS and MMDS networks). At the current time, mobile networks are unable to provide broadband services, and INSIGHT will focus its attention on the fixed wireless network types.

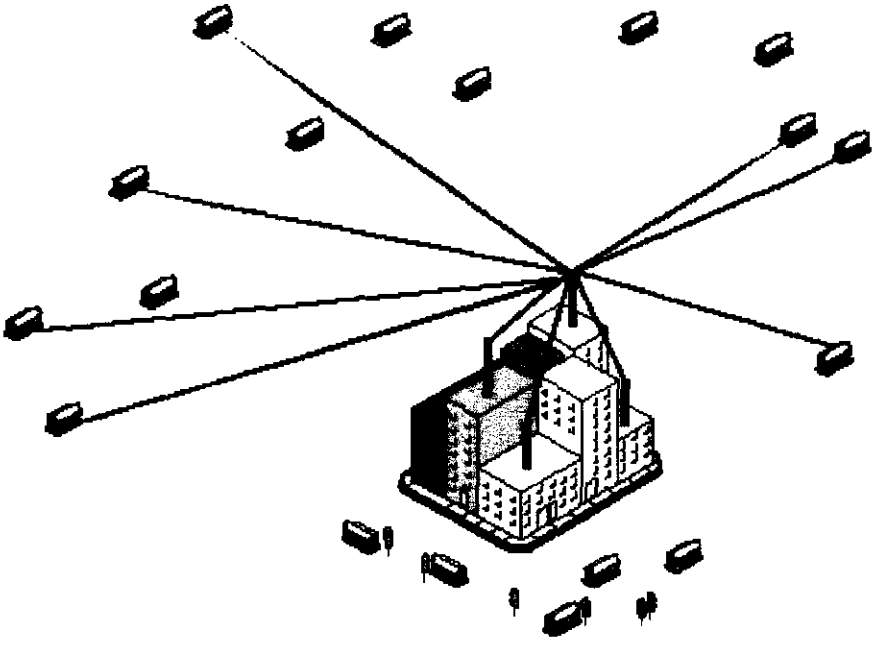
Wireless broadband access (WBA) can deliver a full menu of telecommunications services including fixed voice, high speed data communications, Internet access, high-quality multichannel television, video conferencing, virtual private network (VPN) services, distance learning and can be used to provide backhaul services for other carriers. One of the significant attractions of WBA is the potential for bundling telecommunications services. WBA can accommodate those customer requirements.

3.1 Overview

3.1.1 Network Architecture

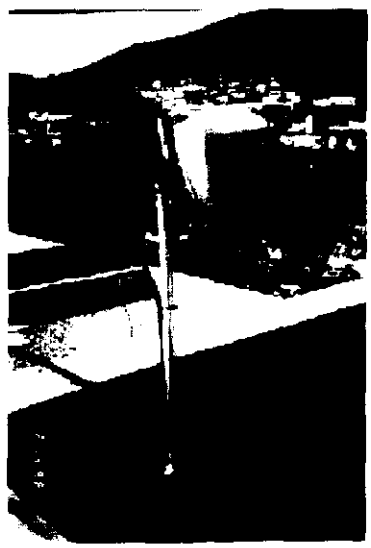
Fixed wireless systems can be thought of as either Point-to-Point (PTP) or Point-to-Multipoint (PTM). PTP systems provide very large data capacities and are dedicated to a single consumer or company. A PTP link is very similar to deploying a fiber optic line to a building, except that it can be done much more quickly and cheaply. On the other hand, PTM systems share much of the expense of the central node or "base station" among as many as several thousand customers. Each customer has the ability to access the network "backbone" with high-speed connections, though at lower cost than a dedicated PTP link.

Point-to-Multipoint Fixed Wireless Configuration



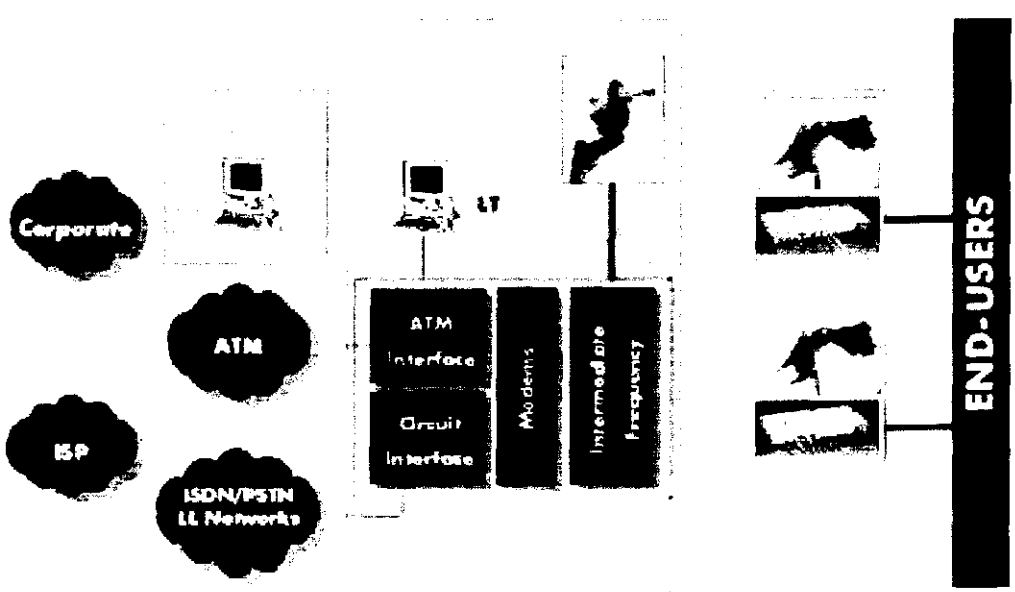
When a fixed wireless broadband subscriber picks up a handset to place a voice call, the signal travels from the handset through a network interface via inside wiring to the service provider's electronics cabinet located somewhere in the building. An up/down converter converts the call to a high frequency radio signal. The signal is sent to a transceiver paired with a small wireless rooftop antenna – which is about the same size and weight as a satellite TV mini-dish (see photo) - where it is relayed on a line-of-sight basis to the service provider's base station.

Example of a Fixed Wireless Transceiver/Antenna



The base station gathers the traffic, aggregates the signals and routes them to the carrier's broadband switching center. Depending on the traffic's destination, the center delivers it to the PSTN, an ISP, or a private network.

Broadband Wireless Architecture



Source: Alcatel USA

Over this kind of infrastructure, WBA carriers can launch higher capacity, higher speed services than those that would be available over a circuit-switched network. Wireless broadband access (WBA) can provide fiber-like services in terms of speed and service quality. The nature of the radio link is to extend fiber-like service across a broader geographical area. WBA systems are expected to deliver availability of up to 99.999% with bit error rates (BER) comparable to fiber optic cable performance. Systems will support access speeds up to 155 Mbit/s (OC-3).

WBA carriers have adopted a building-centric approach to building out their systems. Companies focus their efforts on multi-tenant buildings and MDUs that are not served by fiber optic facilities. Although early arrangements were negotiated on a building-by-building basis, WBA companies have sought to step up the pace of deployment via negotiations with REITs and multi-building owners.

3.1.2 Rollout Challenges

In general, WBA carriers have secured only a small fraction of the access rights they will need to offer their services to a large part of the multi-tenant building and MDU community. The U.S. Census Bureau reported 22.7 million MDUs in the U.S.[5] The Census Bureau also recently reported that there are 4.6 million commercial buildings in the U.S.[6] Of these, approximately 1.1 million buildings are described as office, lodging, health care and public buildings. We estimate the number of WBA access rights in-hand at 10,000 to 12,000 at this time.

WBA also faces some technical challenges:

- The WBA requirement for line-of-sight transmission may pose problems for wireless access. An antenna must be able to support a radio line-of-sight connection with the base station to obtain service.

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[5] U.S. Bureau of Census, 1998 Current Population Survey

[6] U.S. Census Bureau, Statistical Abstract of the United States : 1998

- Some portions of the radio spectrum allocated to WBA services are susceptible to weather-related signal loss. Network designs must consider rain regions in setting link budgets since rain adversely affects performance for these frequencies.

Improvements in serving architecture and smaller cell sizes will make these issues less significant as time goes on.

3.2 Fixed Wireless Spectrum

The Federal Communications Commission (FCC) has licensed wireless broadband services at four locations in the radio spectrum.

Frequency Allocations of Fixed Wireless Services

Name of Service	Frequency Band
Multichannel Multipoint Distribution Service (MMDS)	2 GHz
Digital Electronic Messaging Service (DEMS)	24 GHz
Local Multipoint Distribution Service (LMDS)	28-31 GHz
Microwave Service	38 GHz

3.2.1 MMDS

Multichannel Multipoint Distribution Service (MMDS) was originally licensed as a radio-based television programming distribution platform. It was configured as a one-way service and licensed to operate in approximately 200 MHz of spectrum in the 2 GHz band.

Until recently, MMDS was used exclusively to provide analog and digital video services to residential and SME customers. The technology's attractiveness was limited by its one-way nature. Telecommunications applications have been limited to data communications and one-way Internet access; for instance, a carrier would use its spectrum to deliver downstream traffic to customers and use landline telephony for the return channel. Downstream services (from the service provider to the customer) range from 128 Kbit/s to 1.544 Mbit/s. The return leg utilizes POTS, ISDN or T-1 telephone lines, depending on the customer's speed requirements.