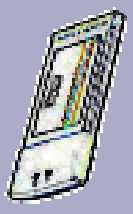


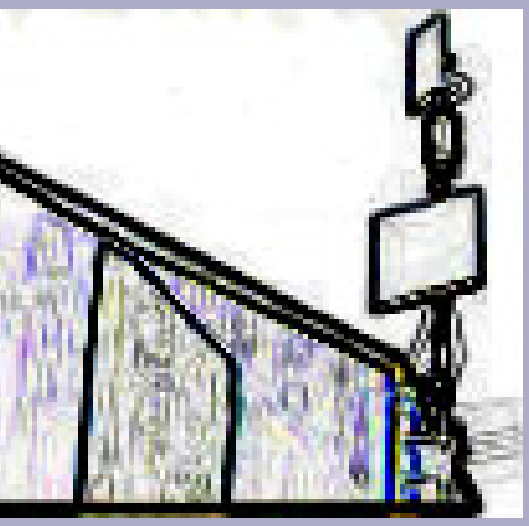
Connected & On the Go

Broadband Goes Wireless

Report by the
Wireless Broadband Access
Task Force

Federal Communications
Commission

February 2005



Wireless Broadband Access Task Force

REPORT

GN Docket No. 04-163

February 2005

Federal Communications Commission

Wireless Broadband Access Task Force

John Branscome, Co-Director
Lauren Van Wazer, Co-Director
Paul Murray, Special Counsel

Erin Boone, Office of Strategic Planning and Policy Analysis
Peter Corea, Wireless Telecommunications Bureau
Chelsea Fallon, Wireless Telecommunications Bureau
Leon Jackler, Consumer and Governmental Affairs Bureau
Meribeth McCarrick, Office of Media Relations
Paul Nagle, Office of Legislative Affairs

Table of Contents

I. Introduction & Executive Summary

The Wireless Broadband Access Task Force (Task Force) was established in May 2004 to assist the Commission in identifying and recommending possible changes in Commission policies that could facilitate the more rapid deployment of wireless broadband services for the benefit of all Americans.[1] The Task Force is pleased to report to the Commission its findings and recommendations with regard to the Commission's wireless broadband policies.

Chairman Powell asked the Task Force to study existing terrestrial wireless broadband policies involving both licensed and unlicensed wireless broadband services ("wireless broadband"),[2] and to make recommendations for possible improvements that would promote the growth of these services.[3] As Chairman Powell noted when forming the Task Force, the Commission is strongly committed to facilitating broadband investment and deployment through different technological choices – including wireless broadband – and has placed a high priority on making sure Americans have access to broadband services through multiple facilities-based platforms.[4]

A. Wireless Broadband is Part of the Digital Communications Revolution

We are at the dawn of a digital communications revolution. Ideas that once resided in the realm of science fiction are now being transformed into the reality of everyday experience. Wireless technologies are one of the major drivers of this revolution. These networks are largely invisible to consumers, yet powerful enough to transform their lives.

Wireless broadband offers consumers a new freedom – the ability to communicate and connect with the world anytime, anywhere:

- Consumers using wireless broadband technologies have the freedom to access the Internet from coffee shops, on moving trains, and in their own backyards.

- Consumers can access the Internet using a single device – to make phone calls, pay bills electronically, and access entertainment and data – all with a seamless high-speed wireless connection. One device now opens up the world.

---

[1] *See FCC Chairman Michael K. Powell Announces Formation of Wireless Broadband Access Task Force*, Press Release, Federal Communications Commission (May 5, 2004) (*WBATF Press Release*).

[2] In this report, the term "wireless broadband" references terrestrial wireless broadband services, and thus does not include satellite broadband services. The study of broadband satellite services are beyond the scope of this report.

[3] *See WBATF Press Release.*

[4] *See id.*

- Using off-the-shelf equipment bought at their local electronics store, Americans now have the power to build their own, in-home wireless broadband networks, operating at speeds that, until recently, were far beyond reach.

- Technological advances in wireless are occurring at a rapid pace. While these technologies are powerful and often complex, they also bring a refreshing simplicity to our lives: laptops with built-in wireless capabilities can automatically locate all of the nearby hotspots, e-mail can be automatically forwarded to a handheld device, and we can now watch streaming video on a mobile phone.

- Communities large and small across the U.S. are getting connected to broadband – gaining access to a wealth of resources and opportunities not previously available.

Wireless broadband technologies also are helping to fuel the engines of our economy. Indeed, the impact of wireless technologies is magnified by their ability to be coupled with other communications technologies – including wireline, cable, broadband over power line, and satellite technologies – in ways that enable endless combinations of mixing and matching of technologies to suit the needs of different applications.

B. Current Deployment of Wireless Broadband, and Related Findings

In order to assist the Commission in exploring policy options relating to wireless broadband, the Task Force surveyed the current state of its deployment. We make several findings, and hope that the Commission may find these useful as it considers additional steps to facilitate the rapid deployment of wireless broadband.

Wireless broadband constitutes a critical component of our nation's goal of ensuring that reliable and ubiquitous broadband becomes available for all Americans. Improving every American's access to wireless broadband is a critical component of the Commission's broader, ongoing efforts to facilitate the timely deployment of reliable and ubiquitous broadband services to all Americans. One unique characteristic that distinguishes wireless broadband from other broadband technologies is its ability to provide both portability and mobility. These attributes enable the kinds of seamless connectivity – at both short and long distances – that Americans seek. In addition, wireless broadband plays a critical role in ensuring that broadband reaches rural and underserved areas, where it often is the most efficient means of delivering these services.

Technological advances in wireless broadband lay the foundation for significantly improved delivery of these services. Enhancements to current wireless broadband technologies, as well as the burgeoning development of new technologies, are continuing to improve and expand the deployment of wireless broadband. From wireless broadband networks ranging short, medium, or long distances – *e.g.*, those that span from a few feet or yards, to 300 feet, to several miles, or even nationwide – we are witnessing

significant technological advances, growth in users, and expansion of portable fixed and mobile applications.

- *Advances in short-range wireless communications networks.* Wireless broadband networks that use unlicensed devices for connecting short distances (*e.g.*, a few feet or yards) among mobile devices (including laptops, PDAs, pagers, televisions, and mobile telephones) and desktop devices are often described as Personal Area Networks (WPANs). These wireless networks increasingly serve as a desirable replacement for wires and cables, and provide seamless interconnectivity among a wide range of devices and the data they can access. We expect significant advances in the coming years in these broadband technologies (*e.g.*, Bluetooth, ultra-wide band) – both in terms of data rates and range of coverage – under the evolving Institute of Electrical and Electronics Engineers (IEEE) 802.15 family of standards and related standards.

- *Advances in medium-range wireless communications networks.* Wireless broadband networks that use unlicensed devices for point-to-multipoint transmissions of distances of fewer than 300 feet, or for point-to-point Internet connectivity using networks that span greater distances (*e.g.*, distances that can reach a few miles) can be described as Wireless Local Area Networks (WLANs). These networks generally involve equipment manufactured in accordance with the IEEE 802.11 family of standards for unlicensed wireless devices, commonly known as "Wi-Fi" (an abbreviation for Wireless Fidelity). These networks have met with tremendous success, and increasingly have been used by Wireless Internet Service Providers (WISPs) – which may number as many as 8,000 providers – to provide a facilities-based alternative to wireline (*e.g.*, DSL) and cable services to millions of Americans over networks that may range in size from small communities, to multiple counties, to multi-regional geographic areas or even larger. Over the last several years, the number of wireless "hot spots" using Wi-Fi technologies have grown exponentially and may number as many as 150,000 by the end of 2005. In addition, several mobile service providers recently have begun using Wi-Fi hot spots to complement their licensed mobile cellular services. Significant advances are expected in the IEEE 802.11 family of standards, thus enabling further improvements in the broadband data rates, coverage, and performance.

- *Advances in longer-range wireless networks.* Wireless broadband networks that involve point-to-point or point-to-multipoint networks with individual network links that can provide last mile connectivity in metropolitan environments or can span distances of up to 30 miles are often referenced as Wireless Metropolitan Area Networks (WMANs). Devices deployed in these networks are manufactured in accordance with vendor-specific proprietary equipment (*e.g.*, Canopy, BreezeMAX) or with the IEEE 802.16 family of standards. The IEEE 802.16 standard, first developed in 2001 for fixed wireless systems (*e.g.*, backhaul) operating in the 11-16 GHz frequency range

of licensed "upper" bands, continues to evolve. In 2003, IEEE 802.16a – commonly referred to as Wi-Max – was developed for operations in lower frequencies in the 2-11 GHz range, including licensed bands as well as bands that permit use of unlicensed wireless devices. More recently, the IEEE 802.16a standard has been extended to include 802.16d, which is also for fixed wireless broadband applications. In addition, the IEEE currently is working to finalize the 802.16e standard, a mobile wireless extension. In sum, the evolving 802.16 standard holds great promise for future developments in wireless broadband because it can be used for applications in both licensed and unlicensed spectrum, allows communications without the need for line-of-site connections, enables interoperability with different equipment using the same standard, and, in the near future, will encompass both fixed and mobile wireless applications.

- *Advances in mobile technologies.* Over the past sixteen months, wireless carriers have begun to deploy broadband technologies on their mobile cellular networks operating on licensed spectrum, and many have announced plans to launch or expand these technologies in the near future. Using new technologies – such as CDMA 1x EV-DO (EV-DO), Wideband CDMA (WCDMA) (also known as UMTS), UMTS/HSDPA (High Speed Downlink Packet Access), and Flash-OFDM (Orthogonal Frequency Division Multiplexing) – carriers are now, or later this year will be, providing wireless broadband services to millions of Americans at speeds ranging from 300 kbps to close to one Mbps. It is expected, for instance, that networks using EV-DO technologies will cover as many as 150 million Americans by the end of 2005.

- *Advances in the development of mesh networks.* Additional technological advances, such as those associated with mesh networks, may also enable further expansion in the delivery of wireless broadband services. Mesh networks are a relatively new and evolving type of network that will have wireless broadband applications. Unlike more traditional wireless networks, in which each node in the network communicates only with a central antenna or base station, each node in a mesh network can function as an access point and transmit data to nodes in close proximity.

New wireless broadband applications proliferate, and improve the quality of our lives. Along with the advances in these various wireless broadband technologies come a host of new and exciting applications. These applications continue to proliferate and empower people. They provide people with more ways to be "more connected" and simplify their communications with work, home, and friends. The applications include: Wi-Fi hot spots (*e.g.*, stores, airports); community networks; en route, mobile applications (*e.g.*, on trains and ferries); public safety applications (*e.g.*, integrating police in the field with their departments, enabling quicker communications of emergency information); surveillance applications (*e.g.*, ensuring building security, securing military bases, improving transportation monitoring, preventing theft in shopping centers); personalized mobile access to music and video entertainment; and educational

applications (*e.g.*, creating a "wireless campus" that connects students with school networks). These examples are but a few of the wireless broadband applications that exist today. Tomorrow promises even greater growth and innovation.

Recent trends reveal the tremendous potential of wireless broadband in the delivery of broadband services to Americans. While wireless broadband currently represents only a small share of the total market for broadband services (which at this time is dominated by cable and DSL), substantial growth is anticipated. Growing numbers of Americans use wireless devices – such as cell phones and Wi-Fi enabled laptops – to connect to the Internet. According to one recent analysis, forty-one (41) percent of all Internet users – or 56 million Americans (28 percent of all Americans) – use devices that are capable of accessing the Internet wirelessly. The percentage of younger Americans that use such wireless devices is significantly higher, and their demand for portable and mobile communications, as well as their comfort and familiarity with these technologies, will serve to further enhance demand. Future developments – such as technological advances, new and enhanced device features, new applications such as video and VoIP, lower equipment costs, enhanced battery life, improved pricing plans, and the increasing convergence and integration of wireless broadband with other broadband delivery mechanisms – will also stimulate significant growth in wireless broadband over both the near and longer term.

C. Recommendations

In several different initiatives during the last few years, the Commission has taken a number of steps to promote the development of wireless broadband services. Through adoption of new policies and rules, it has laid the foundation for significant further progress in achieving the goal of universal, affordable broadband access delivered by wireless and other broadband technologies. Building upon the foundation that the Commission has already established for wireless broadband, the Task Force recommends additional steps the Commission could take to facilitate the deployment of wireless broadband.

Recommendations for continuing and enhancing the success of wireless broadband employing unlicensed devices. In the last few years, the Commission has made significant amounts of new spectrum available in the 5 GHz band for use by unlicensed wireless devices. It also recently revised the antenna rules applicable to advanced technologies used by unlicensed wireless networks. The Commission also has instituted proceedings seeking comment on providing additional spectrum for unlicensed wireless devices. During this same period of time, the use of wireless broadband employing Wi-Fi technologies has skyrocketed. To build on these successes, and to promote the tremendous possibilities of unlicensed wireless broadband in the future, the Task Force recommends that the Commission take the following additional steps –

- Promote voluntary frequency coordination efforts by private industry – such as those already successfully deployed in some of the more congested parts of the country – to mitigate potential interference among unlicensed spectrum users.

- Promote voluntary industry "best practices" (*e.g.*, network planning and design, rule compliance) among unlicensed users.

- Consider increasing the power limits in certain bands available for use by unlicensed devices in order to improve their utility for license-exempt WISPs.

- Work closely with license-exempt WISPs to address, on a proactive basis, their needs relating to Commission policies and regulations.

- Consider hosting a WISP forum on an annual or periodic basis to provide additional opportunities for WISPs and consumers to share their views on issues before the Commission.

- Work closely with the wireless broadband industry to ensure that, where necessary, the Commission addresses unlawful intentional violations (*e.g.*, jamming, power boosting) of the technical rules applicable to unlicensed wireless broadband devices.

Recommendations for improving wireless broadband deployed in licensed spectrum. Also in these last few years, the Commission has made significant amounts of existing and new licensed spectrum in different bands available for use by advanced wireless technologies, including wireless broadband. As with the recent advances in wireless broadband technologies and applications associated with unlicensed devices, so too there have been significant advances in technologies and applications associated with devices employing licensed spectrum. To build on these successes, and to promote the tremendous possibilities associated with wireless broadband deployed using licensed spectrum, the Task Force recommends that the Commission take the following additional steps –

- Improve access to licensed spectrum –

    - Move even more aggressively to put valuable spectrum on the market through further improvements and streamlining of the Commission's spectrum allocation and assignment process;
    - Expedite the transition of the Digital Television (DTV) spectrum to advanced wireless services, including wireless broadband, given that the propagation features in this spectrum are particularly useful for wireless broadband applications, including mobile applications; and
    - When adopting spectrum band plans, consider new configurations – such as asymmetric pairing – that may be particularly conducive to wireless broadband applications.

- Increase the technical and regulatory flexibility of Commission rules applicable to the use of licensed spectrum –

    - Adopt more "flexible use" policies that remove impediments to the use of new and advanced wireless broadband technologies and applications;
    - Consider providing incumbent licensees in restrictive bands with additional flexibility, either by granting significant new flexibility to existing licensees or using creative market-based auction mechanisms; and
    - Further facilitate secondary market arrangements that provide wireless broadband service providers with easy access to licensed spectrum, in places and amounts that they need, and enhance opportunities for more efficient and "dynamic" sharing of the same spectrum among different users and uses made increasingly possible by current and future technologies.

- Apply a pro-competitive, deregulatory framework – one that imposes the fewest regulatory barriers at both the federal and state level – to wireless broadband services to maximize innovation and consumer benefits –

    - Consider classifying wireless broadband as an "information service" – consistent with the Commission's determination regarding broadband services offered over cable networks and its tentative conclusion regarding broadband offered over wireline – in order to minimize potential regulatory hurdles at both the federal and state level;
    - Consider examining whether wireless broadband constitutes an "interstate service" so as to minimize potential regulatory hurdles;
    - Alternatively, consider applying the deregulatory principles applicable to Commercial Mobile Radio Services (CMRS) under Section 332(c) of the Communications Act – which laid the foundation for rapid deployment of mobile voice and data services over the past decade – to wireless broadband; and
    - Similarly, consider clarifying the scope of state authority, under Section 332(c), in setting "other terms and conditions" relating to wireless broadband services so as to ensure that there are consistent and minimal state regulatory barriers to nationwide wireless broadband deployment.

Ensuring that the Commission takes a pro-active, visionary approach as wireless broadband networks converge with other broadband service networks. Increasingly, broadband services are being offered using a combination of more than one type of facilities-based platform, including networks that combine licensed wireless broadband with unlicensed wireless technologies, wireless and wireline broadband technologies, terrestrial wireless with satellite broadband technologies, and wireless broadband with broadband over power lines. In addition, even where the actual

underlying broadband networks are not composed of multiple technologies, some service providers bundle together service offerings for different types of broadband networks. Accordingly, the Task Force recommends that the Commission –

- Pro-actively consider, in ongoing and upcoming proceedings, the impact of the nascent, yet increasingly rapid, convergence of wireless broadband with other broadband technologies and services.

- Evaluate, on an ongoing basis, whether it is time to eliminate many of the disparate regulatory paradigms that apply to different broadband access technologies and services.

- Look for opportunities to remove outdated rules, and accord an increasingly flexible regulatory environment for service providers, to facilitate the convergence of wireless broadband and other broadband services and technologies.

Building upon, and improving, the Commission's outreach efforts to ensure the rapid deployment of wireless broadband. During the last several years, the Commission has expanded and improved its outreach concerning wireless broadband to various governmental agencies, consumers, institutional users, and the industry, including service providers and equipment manufacturers. The Task Force recommends that the Commission continue to build upon these important efforts by taking the following actions –

- Continue, and build upon, effective collaboration with other federal agencies – including the Rural Utilities Services (RUS), the Appalachian Regional Commission and Delta Regional Authority, and the Department of Homeland Security – to facilitate the more rapid development of wireless broadband.

- Continue and build upon effective collaboration with State and Local governmental organizations – including the Commission's Intergovernmental Advisory Committee – to promote wireless broadband deployment.

- Build upon and improve the Commission's current outreach efforts with consumers, institutional users, and the industry (including both service providers and equipment providers) –

    - Use outreach efforts to gain insights about developments in wireless broadband and the needs of service providers, equipment providers, and users;
    - Improve the Commission's analysis of the wireless broadband industry to inform the development of pro-active Commission policies that eliminate outdated regulatory barriers to the deployment of wireless broadband; and

- Improve outreach to the public and the wireless broadband industry to provide helpful information relating to wireless broadband – including the maintenance of a robust Commission webpage dedicated to wireless broadband issues that provide useful assistance to consumers, institutional users, and service providers as they seek to take advantage of the promise of wireless broadband.

II. The Task Force

The Task Force is comprised of a team of multi-disciplinary Commission staff, from across several Bureaus and Offices that work on matters relating to both licensed and unlicensed wireless broadband services. Its mission was to identify and recommend changes in Commission policies that would facilitate the more rapid deployment of wireless broadband services for the benefit of all Americans. In looking at ways the Commission could help in making wireless broadband technologies available, the Task Force actively sought the experience, expertise, and advice of consumers, state and local governments, industry (such as equipment manufacturers and service providers), and other stakeholders across the nation.

On May 5, 2004, the Task Force released a Public Notice seeking comment on several issues that would help it to develop recommendations to the Commission.[5] The issues on which the Task Force sought comment included: the extent and nature of deployment of wireless broadband services, including the types of applications currently associated with wireless broadband; additional steps the Commission might take to improve access to spectrum capable of allowing wireless broadband; and possible regulatory changes that would facilitate the deployment of wireless broadband services in both rural and urban areas throughout the country.[6]

Since its formation, the Task Force has conducted several outreach efforts. On May 19, 2004, the Commission's Wireless Telecommunications Bureau and Office of Engineering & Technology held a forum on wireless broadband (Wireless Broadband Forum). The forum examined the technological, economic, and regulatory factors that influence the availability and deployment of wireless broadband services. The event provided an opportunity for business, technology, and regulatory experts to share their knowledge, experiences, and views on the future of the wireless broadband industry. Twenty-two speakers participated, including representatives of both fixed and mobile service providers and of manufacturers developing new technologies used in both licensed and unlicensed bands. Four panels examined, respectively, issues relating to wireless broadband technologies, business strategies, barriers to entry in the market, and the future of wireless broadband.[7]

---

[5] *See* "Wireless Broadband Access Task Force Seeks Public Comment on Issues Related to Commission's Wireless Broadband Policies," GN Docket No. 04-163, *Public Notice*, 19 FCC Rcd 8166 (DA 04-1266) (2004) (*WBATF Public Notice*).

[6] *See WBATF Public Notice* at 2-4.

[7] *See* Appendix B (list of speakers at the Wireless Broadband Forum); Transcript of Wireless Broadband Forum, <http://wireless.fcc.gov/outreach/2004broadbandforum/comments/transcript_051904.pdf>; *see also*

In addition, the Task Force conducted several field studies during the spring and summer of 2004 to examine various wireless broadband deployment efforts underway around the country. These field studies – in the San Francisco Bay Area, CA, Rapid City, SD, New York, NY, Jacksonville, FL, and Raleigh, NC – allowed Task Force members to meet with representatives from companies and organizations involved in innovative wireless broadband deployments. Members witnessed live demonstrations of new technologies, learned about issues being addressed and problems being solved by these technologies, and gained insight on how regulatory issues may affect current or future service rollouts in both urban and rural areas.[8] Through these efforts, the Task Force learned about innovative wireless broadband technologies being used and developed, examined the level of availability of wireless broadband services, and heard the concerns of those involved in the front lines of these developments.

The Task Force also established a webpage and e-mail box dedicated to providing useful information to the public regarding both licensed and unlicensed wireless broadband services.[9] Launched in May 2004, the website serves as a single location for information on issues relating to wireless broadband, and the e-mail box facilitates communication between WISPs and Commission staff involved with wireless broadband issues and provides WISPs with an additional contact and information resource to address issues relating to deployment of wireless broadband services.[10]

The Task Force received comments from over thirty parties in response to the Public Notice. These comments were submitted by numerous interested parties, including: manufacturers of both licensed and unlicensed wireless broadband technologies; organizations that develop network standards employed in providing wireless broadband; representatives and associations of service providers using both licensed spectrum and unlicensed devices; associations representing rural telecommunications providers; representatives of public safety organizations; representatives of public television; representatives of airports; educational institutions; academics; and economists.[11] The Task Force also conducted its own research – through review of articles, journals, reports, news releases, and websites, among other sources – to develop a clearer picture of the current state and future potential of wireless broadband.

"FCC Announces Wireless Broadband Forum to be Held on May 19, 2004," *Public Notice*, 19 FCC Rcd 8091 (DA 04-1239) (2004). More information on the forum is posted on the Commission's Wireless Telecommunications Bureau webpage at <http://wireless.fcc.gov/outreach/2004broadbandforum>.

[8] The Field Studies are gathered and presented in Appendix C.

[9] The webpage can be found at <http://www.fcc.gov/wbatf>; the e-mail address is "wbatf@fcc.gov."

[10] *See generally* <http://www.fcc.gov/wbatf>. For instance, the web site includes links to relevant Commission proceedings, speeches and presentations, and public workshops and conferences, and it provides detailed information on how interested parties can participate in Commission proceedings. The mailbox is checked on a regular basis and questions and/or comments are directed to appropriate Commission staff for a timely response.

[11] *See* Appendix A (list of commenting parties).

III. Background and Overview of Wireless Broadband

This section provides an overview of broadband services in general, and the variety of means by which such services are delivered to the American people. We also touch on some of the special attributes of wireless broadband which underscore the importance of finding ways for the Commission to further facilitate deployment of wireless broadband. Finally, we note that convergence has already begun to take place between and among wireless networks and other networks that can be used in the delivery of broadband services.

A. Broadband Services in General

Definition of broadband. The term broadband commonly is used to refer to data services that are fast, always available, and capable of supporting advanced applications requiring substantial bandwidth. The Telecommunications Act does not define "broadband" as such, although the Telecommunications Act of 1996 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."[12] We also note that in the September 2004 *Fourth Section 706 Broadband Deployment Report,* the Commission defined an "advanced telecommunications service" as having the capability of supporting, in both the provider-to-consumer (downstream) and the consumer-to-provider (upstream) directions, a transmission speed in excess of 200 kilobits per second (kbps).[13]

Because definitions of broadband have changed over time as technologies continue to evolve, the Task Force chooses to adopt a flexible definition of broadband instead of one that focuses entirely on a specific transmission speed (*e.g.*, 200 kbps in both directions). For purposes of this report, we use the term broadband to describe a general set of transmission capabilities and characteristics, such as always-on, high-speed Internet access with a sufficiently robust functionality suitable for evolving, bandwidth-hungry applications. Although we do not adhere to a strict definition of broadband, we nonetheless often refer to data transmission speeds – including many that exceed 200 or 300 kbps, or more, in one or both directions – as one of these important characteristics.

Types of broadband services. In its recent *Fourth Section 706 Broadband Deployment Report*, the Commission noted that broadband services are provided using a

[12] 47 U.S.C. § 157 nt (c)(1).

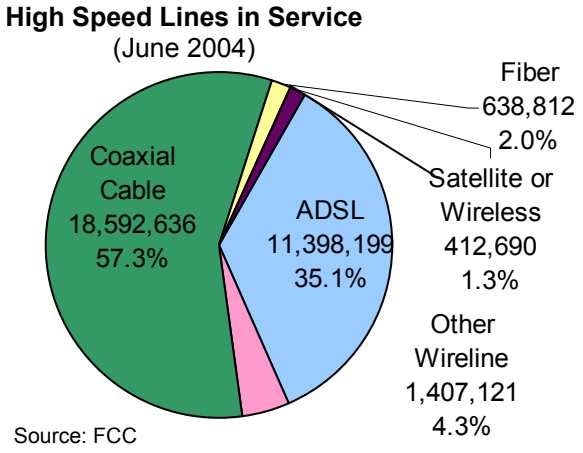
[13] *See* Availability of Advanced Telecommunications Capability in the United States, GN Docket No. 04-54, *Fourth Report to Congress* (rel. Sept. 9, 2004) (*Fourth Section 706 Broadband Deployment Report*) at 12. However, broadband services have other attributes beyond maintaining certain transmission speeds. For instance, Chairman Powell has also described broadband service as having the following attributes: (1) a digital architecture; (2) the ability to carry Internet Protocol (IP) or other multi-layered protocols; (3) an "always on" functionality; and (4) the ability to scale to greater capacity and functionality as uses evolve and bandwidth-hungry applications emerge. *See* Michael K. Powell, speech at the National Summit on Broadband Deployment, Washington, DC, October 25, 2001, available at <http://www.fcc.gov/Speeches/Powell/2001/spmkp110.html>.

variety of different technologies, network architectures, and transmission paths. At the present time, these broadband platforms can be broken down into six general types:

- copper (*i.e.*, wireline) technologies (*e.g.*, DSL);
- cable technologies;
- fiber technologies;
- wireless terrestrial technologies – both unlicensed and licensed;
- broadband over power lines (BPL) technologies; and
- satellite technologies.[14]

General discussion of broadband services other than wireless broadband can be found in the 2004 *Fourth Section 706 Broadband Deployment Report*,[15] and will not be addressed here.

Figure 1. Broadband Is Available Using Many Types of Technologies



Wireless is one of many technologies currently used by consumers to access the Internet at high speeds. High speed lines are over 200 kbps in at least one direction.

Benefits of broadband. Broadband, in all of its forms, provides numerous benefits to American consumers. Because broadband networks offer fast access to the multitude of information available on the Internet, they can increase productivity and drive economic growth, improve education, and allow consumers to make more informed purchasing decisions. Broadband networks transport large amounts of data over long distances in seconds, enabling applications such as distance learning, telecommuting, and telemedicine. And broadband networks offer the ability to entertain by providing access to interactive games, music downloads, and streaming audio and video applications.[16]

The Commission's goals relating to broadband deployment. The Commission has identified several goals related to the deployment of broadband services. First, it is committed to adopting policies that will facilitate the timely deployment of reliable and ubiquitous broadband services. The Commission is also focused on bringing the benefits of broadband service to all Americans, including those in rural and underserved areas, those with low incomes, and those with disabilities, as well as to schools and libraries.[17] Furthermore, the Commission believes in promoting competition among multiple

[14] *See Fourth Section 706 Broadband Deployment Report* at 14-23.

[15] *Id.* at 14-18, 22-23.

[16] *See generally id.*

[17] *Id.* at 8, 10.

broadband providers in order to lower prices and improve service quality,[18] and has stated that multiple broadband networks can also complement one another in deploying broadband service to all consumers.[19] In order to achieve these goals, the Commission has generally advocated market-based mechanisms that will promote competition, provide flexibility to broadband providers, and stimulate investment in broadband networks.[20] At the same time, the Commission remains committed to ensuring that certain, essential services, such as access to emergency services, are maintained across platforms.

B. Wireless Broadband Services

1. Special Attributes of Wireless Broadband

Wireless is a unique broadband solution for several reasons. These include providing both mobility and portability, efficiently connecting devices within short distances, and bridging longer distances more efficiently than wireline and cable technologies. This combination of mobility and portability can make broadband access both seamless and ubiquitous. Just as wireless voice technologies have enabled consumers to move through their daily lives without having to worry about how and where to make a call, wireless broadband technologies can free consumers from having to think through when or where or how they will get access to information and entertainment. Wireless technologies also can be more efficient for communicating between short hops (*e.g.*, Wi-Fi, home wireless networks). In addition, wireless technologies have the ability to reach geographic areas, particularly rural areas, that often cannot be efficiently served by other technologies. Because the deployment of wireless technologies does not require running copper, cable, or fiber lines to individual homes, the costs of deployment often are lower than those associated with these technologies. Further, wireless technologies frequently are a more cost-effective solution for serving areas of the country with less dense populations, and provide rural and remote regions new ways to connect to critical health, safety, and educational services.

Wireless broadband technologies play a unique role in bringing broadband to everyone, everywhere, at any time.

Unlike other broadband technologies, wireless broadband gives you "broadband on the go." Its uniqueness lies in its combined mobility and portability. Either on a free-standing basis, or when combined with other broadband networks, wireless broadband imparts new freedom to users, providing the kinds of seamless interconnectivity that Americans increasingly seek.

In addition, wireless broadband plays a critical role in bringing the benefits of broadband to rural and underserved areas in the country, where it often is the most efficient means of delivering these services.

In addition to offering mobility and connectivity, wireless broadband also will play an important role in the broadband industry by providing competition to existing

[18] *Id.* at 9, 44.

[19] *Id.* at 9.

[20] *Id.* at 46.

broadband services delivered through the currently more prevalent wireline and cable technologies. Wireless broadband, as well as other alternative broadband platforms such as satellite and broadband over power lines, can create a competitive broadband marketplace and bring the benefits of lower prices, better quality, and greater innovation to consumers.

2. Overview of Wireless Broadband Services

Wireless broadband services use wireless radio spectrum in the provision of broadband services. These services are delivered through use of unlicensed Part 15 devices (license-exempt devices) or through devices utilizing licensed spectrum, or both (with the different delivery mechanisms playing a complementary role). A general overview of the spectrum bands, applicable rules, and equipment standards follows.

a) Wireless broadband using unlicensed devices

Spectrum bands available for unlicensed wireless broadband. Several spectrum bands are currently used for the provision of wireless broadband services using unlicensed devices. These bands include the 902-928 MHz band, the 2.4 GHz band, the 5 GHz band, and the upper-millimeter wave bands (which includes, *inter alia*, spectrum bands at 60 GHz and 90 GHz). In addition, ultra-wideband technologies, which provide short range communications, are permitted to operate in bands between the 3-10 GHz range. None of these spectrum bands, however, is used exclusively by unlicensed devices providing broadband services. Depending on the particular band, license-exempt wireless broadband devices access spectrum in bands that are used by other types of unlicensed devices as well as licensed services.

General rules that apply. In accordance with Part 15 of the Commission's rules, use of low power devices that emit radio frequency energy without a license is permissible, provided that the devices comply with certain technical requirements. All Part 15 unlicensed devices must obtain an FCC equipment authorization. This authorization ensures appropriate radio frequency emissions limits for the relevant bands of operation. The principal operating requirement for unlicensed devices is that their operation cannot cause harmful interference to any authorized service and they must accept all interference received from other devices, including other unlicensed devices.

Standards that apply. The Commission's Part 15 rules provide manufacturers with the flexibility to manufacture unlicensed devices using any technology as long as the devices comply with certain technical parameters that vary according to the particular bands of operation. In practice, unlicensed devices operate pursuant to both proprietary standards and industry-established standards. Many manufacturers manufacture proprietary equipment, which does not comport with any particular voluntary standard. Differentiating particular product features or functionality and tailoring equipment to particular applications are two reasons some manufacturers opt not to manufacture according to industry standards. Alternatively, many manufacturers develop equipment that operates pursuant to voluntary standards established by industry standards groups. These latter standards ensure interoperability between equipment manufactured by a variety of vendors. Some typical industry-developed standards used for unlicensed

devices include Wi-Fi (IEEE 802.11), Bluetooth, and WiMax (IEEE 802.16).[21] Recent developments in some of the standards used by unlicensed devices are discussed more fully in Section IV.A, below.

b) Wireless broadband services using licensed spectrum

Spectrum bands available for licensed wireless broadband. Wireless broadband services may be provided in numerous different licensed spectrum bands, including bands regulated pursuant to:

- Part 22 (Cellular Service in the 824-849 and 869-894 MHz bands);
- Part 24 (Broadband Personal Communications Service in the 1850-1990 MHz bands);
- Part 27 (Lower 700 MHz Service in the 698-746 MHz bands, Advanced Wireless Service in the 1710-1755 and 2110-2155 MHz bands, Broadband Radio Service/ Educational Broadband Service in the 2495-2690 MHz bands, Wireless Communications Service in the 1390-1395, 1432-1435, 1670-1675, 2305-2320, and 2345-2360 MHz bands);
- Part 90 (Public Safety in the 4.9GHz band); and,
- Part 101 (Point-to-point Microwave in various bands; Multichannel Video Distribution and Data Service in the 12.2-12.7 GHz band, the 24 GHz Service in the 24 GHz band, Local Multipoint Distribution Service in the 27-29 and 31 GHz bands, the 39 GHz Service in the 39 GHz band, and the 70/80/90 GHz bands).[22]

General rules that apply. The regulations in these bands generally provide exclusive use rights to licensees under a variety of different licensing regimes, as set forth under the applicable rule parts. Depending on the particular band at issue, the provision of mobile[23] or fixed services,[24] or both,[25] is permitted.

Standards that apply. Manufacturers have developed several different technology standards for wireless broadband equipment that operates in the licensed wireless bands. Many of these technologies, including EDGE, WCDMA, and CDMA EV-DO, employ standards that have been developed by industry standards groups, while others use proprietary standards. WiMax is an "open" wireless broadband technology standard

[21] As noted below, the WiMax standard applies to equipment manufactured for licensed spectrum bands as well as unlicensed devices.

[22] Note that this list of bands and services is intended to be illustrative, not all-inclusive.

[23] Because of the certain propagation features of lower bandwidths, mobile services generally are found in the lower bands of spectrum.

[24] Because of propagation features of upper bandwidths, fixed services generally are found in the upper bands of spectrum.

[25] *See, e.g.*, 47 C.F.R. § 24.3 and Part 24 subpart E (broadband PCS); 47 C.F.R. § 27.2 and Part 27 (WCS and AWS). In recent years, the Commission has generally been adopting "flexible use" policies for newly licensed spectrum.

currently being developed by the IEEE for use in both the licensed and unlicensed spectrum bands. These standards are discussed more fully in Section IV.A, below.

C. Convergence of Various Broadband Networks

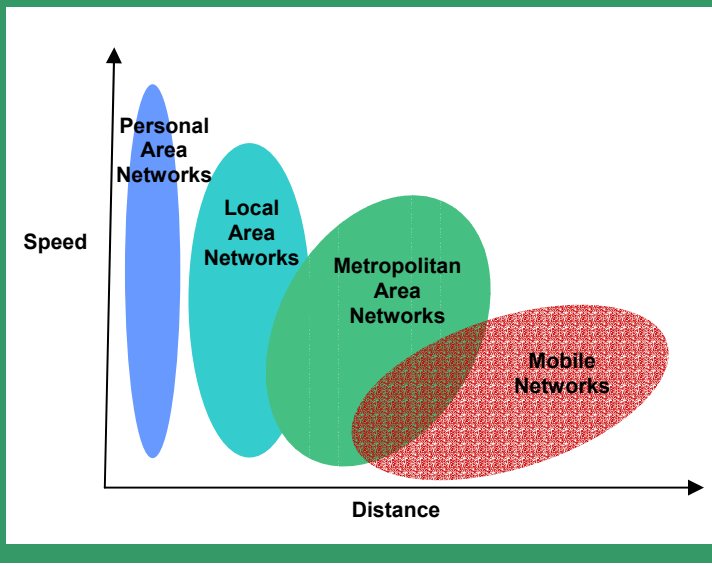
As noted above, there are several platforms other than wireless that can be used in the delivery of broadband services. We have, however, already begun to see the convergence of these various networks in the provision of broadband services.[26] For example, satellite services are often used as backhaul for terrestrial wireless broadband Wi-Fi networks. We discuss this convergence in more detail in Section VII, below.

IV. Current Deployment of Wireless Broadband

A. Technological Developments in Wireless Broadband

There are a wide variety of technologies used in the provision of wireless broadband services. Enhancements to current technologies, as well as developments of entirely new kinds of technologies, are continually increasing the number of available options. Whereas, historically, wireless broadband technologies have tended to be characterized as either exclusively fixed or mobile platforms, the introduction of new standards and technologies providing both types of services is blurring these distinctions. For instance, recent advances in cellular technologies have increased the associated data transmission rates for these technologies; even though cellular technologies may use purely mobile platforms from a technical standpoint, they are increasingly becoming a substitute for certain fixed wireless broadband services.

Figure 2. Wireless Broadband Technologies



Wireless broadband networks can span the length of a room, a building, reach several miles, or even cover the nation. This section will provide a general overview of current and emerging wireless broadband access technologies.

[26] *See generally Fourth Section 706 Broadband Deployment Report* at 45-46.

1. Fixed or Portable Technologies

Fixed or portable wireless broadband access technologies fall within three principal categories of networks, defined principally by the short, medium, or longer-range of coverage capabilities for which they are optimized. As general matter, there are three basic types of such wireless networks: (1) wireless personal area networks (WPANs), with network links typically shorter than 10 meters; (2) wireless local area networks (WLANs), with individual network links that can span up to three miles, and (3) wireless metropolitan area networks (WMANs), with individual network links that can span distances of up to 30 miles.

With the continuing developments in wireless broadband technologies, just as the distinctions between fixed and mobile wireless technologies are beginning to become less well-defined, so too are the differences between technologies used for WPANs, WLANs, and WMANs. For example, while WiMax – a developing wireless networking technology – is generally held out to be suitable for longer distance, outdoor networking, some industry observers note that, longer term, its technical properties may make it well-suited for shorter range WLAN or even WPAN networks. Nonetheless, to understand the general characteristics and applications of different fixed and portable wireless networking technologies and to provide an overall contextual framework for such technologies, it is useful to discuss and categorize them according to their current and most prevalent deployments.

Short-range wireless networks – Wireless Personal Area Networks (WPANs). Wireless broadband networks and associated technologies that operate in short ranges are commonly referred to as Wireless Personal Area Networks (WPANs).[27] These networks often span only a few feet, and usually do not extend beyond 10 meters; they have been characterized as networks that "create a virtual bubble around the user."[28] Generally, WPAN technologies provide interconnectivity among mobile devices (including laptops, PDAs, pagers, televisions, and mobile phones) and desktop devices, serving as a replacement for wires and cables that connect different electronic devices together.

Bluetooth, currently the most common WPAN technology, is a product of the Bluetooth Special Interest Group (SIG), which was founded by Ericsson, IBM, Intel, Nokia, and Toshiba in 1998.[29] The relevant IEEE standards for Bluetooth are 802.15.1 and 802.15.2. Data rates for Bluetooth are currently up to 720 Kbps. Bluetooth equipment operates in the 2.4 GHz band on an unlicensed basis. In November 2004, the Bluetooth SIG announced a timeline for technical enhancements to the technology that

---

[27] The IEEE family of standards for WPANs is 802.15.x.

[28] *Wi-Fi A to Z – Everything You Wanted to Know About Going Wireless*, PC UPGRADE, Dec. 31, 2003, at 138.

[29] The name "Bluetooth" is derived from the 10th century Danish King Harald Blatand – or Bluetooth. His efforts united warring factions in what are now the countries of Norway, Sweden, and Denmark. The Bluetooth SIG wishes that the Bluetooth wireless technology be used analogously "to allow collaboration between industries such as the computing, mobile phone and automotive markets." *See* <http://www.bluetooth.org>.

would increase data rates to between 1-3 Mbps, extend transmission distances, improve interoperability, quality of service, and security.[30] The Bluetooth SIG believes that these enhancements will enable Bluetooth WPANs to be used as part of sensor systems (*e.g.*, home security systems), for streaming audio applications, multi-player gaming, and *ad-hoc* file sharing.[31]

Ultra-wideband is another short-range wireless broadband technology. Ultra-wideband technology uses low-powered, pulse modulation. Extremely narrow, or short, bursts of energy are modulated over a bandwidth that is quite large, often exceeding one gigahertz.[32] With networks spanning fewer than 10 meters and data rates of up to 100 Mbps, ultra-wideband offers a potential WPAN alternative to Bluetooth.[33] Indeed, because its data rates are so much higher than those possible with Bluetooth, ultra-wideband may have more diverse applications. For example, while ultra-wideband communications can be used for in-home computer and peripheral networking, the high potential data rates also make it useful for distribution of audio and video transmissions and, as a result, it may be used for linking cable boxes and associated televisions sets or transferring images from a digital camera to a laptop or television.[34] Ultra-wideband communications operations are permitted indoors and on an unlicensed basis from 3 GHz to 10 GHz.[35] In August 2004, the Commission authorized the first ultra-wideband chip set. The IEEE 802.15 committee is in the process of developing a standard for ultra-wideband networking devices. Currently, there are two different proposed technological approaches, one which uses direct sequence spread spectrum modulation and the other which uses multi-band Orthogonal Frequency Division Multiplexing (OFDM) modulation.

ZigBee is another type of WPAN technology. ZigBee networks operate in the 902-928 MHz and 2.4 GHz bands, and have a range of up to 70-100 meters with data rates of 250 kbps.[36] ZigBee technology is most likely to be deployed in sensory mesh networks and included in commercial and household products, such as thermostats, smoke detectors, medical devices, lighting, and keyless entries.[37] As one industry

---

[30] *Bluetooth SIG Lays Out Roadmap For Bluetooth Wireless Technology*, Press Release, Bluetooth SIG, available at <http://www.bluetooth.com/news/sigreleases.asp>.

[31] *See id.*

[32] *See generally* Revision of Part 15 of Commission's Rules Regarding Ultra-Wideband Transmission Systems, *First Report and Order*, 17 FCC Rcd. 7435 (2002), and *Second Report and Order*, 34 Communications Reg. (P&F) 749 (2004).

[33] Martin Reynolds, *Ultrawideband Opens Wireless Networks to New Possibilities*, GARTNER, Feb. 20, 2002.

[34] *Suppliers Push Ultrawideband as Wireless Alternative*, <http://www.computerweekly.com>, Mar. 13, 2003.

[35] *See* Martin Reynolds, *Ultrawideband Opens Wireless Networks to New Possibilities*, GARTNER, Feb. 20, 2002.

[36] Robert Jaques, *Zigbee is Buzzing*, THE REGISTER, Oct. 17, 2004.

[37] Eric Griffith, *Zigbee (Almost) Arrives*, <http://www.wi-fiplanet.com/news/article>, Dec. 16, 2004.

observer posited, ZigBee's principal application is to replace line-of-sight infrared technology used for remote controls.[38] Currently, up to 255 different devices can be linked per ZigBee network.[39] Although its functionality overlaps with Bluetooth in many respects, ZigBee's relatively lower data rates may limit its applications. For instance, it may be used to provide information links between various objects as part of the management and control of sensory networks rather than as a data communications technology; or, one could use ZigBee with a computer local area network as a means to control all of the lighting within a home.

In December 2004, the ZigBee Alliance, a consortium of more than 100 companies supporting the development of ZigBee products, finalized the Zigbee 1.0 standard.[40] This standard will ensure interoperability between different Zigbee products. The relevant IEEE standard is 802.15.4, although ZigBee 1.0 is not completely coextensive with IEEE 802.15.4.[41] Now that the ZigBee 1.0 has been finalized, analysts have projected that between 5 to 100 million ZigBee chips could be shipped within the next few years.[42]

While Bluetooth, ultra-wideband, and ZigBee are all classified as WPAN technologies and are all included in the IEEE 802.15 family of standards, each technology is targeted for slightly different applications, although to some extent they may overlap. Bluetooth is focused on communications and computing applications, ultra-wideband is targeted at short distance, relatively higher data rate applications, and ZigBee addresses industrial and utility applications – requiring long battery life and relatively lower data rates.[43]

Medium-range wireless network – Wireless Local Area Networks (WLANs). Wireless Local Area Networks (WLANs) are often used for point-to-multipoint transmissions for distances of fewer than 300 feet. WLAN technologies, however, also can be used for Internet connectivity for longer distances, using a point-to-point network configuration; indeed, many WISPs currently use these technologies for networks that span long distances. Generally, WLANs have individual links that span fewer than three miles.

The most prevalent WLAN technology is equipment manufactured in accordance with the IEEE 802.11 family of standards, commonly known as "Wi-Fi," short for Wireless Fidelity. There are three primary types of Wi-Fi. Earliest to market, and hence most ubiquitous, is IEEE 802.11b, which operates on an unlicensed basis in the 2.4 GHz band with data rates of up to 11 Mbps. IEEE 802.11g, the technological successor to

---

[38] *See id.* (quoting Bob Heile, chairman of the ZigBee Alliance).

[39] *See* Robert Jaques, *Zigbee is Buzzing*, THE REGISTER, Oct. 17, 2004.

[40] *See* Eric Griffith, *Zigbee (Almost) Arrives*, <http://www.wi-fiplanet.com/news/article>, Dec. 16, 2004.

[41] *See id.*

[42] *See id.*

[43] Stan Bruederle, *Ultrawideband: A Total PAN Perspective*, GARTNER DATAQUEST, Dec. 18, 2003.

IEEE 802.11b, uses OFDM modulation and has data rates of up to 54 Mbps. It also is backward-compatible with IEEE 802.11b, such that WLANs can be configured using equipment manufactured according to either standard (although using both types of equipment together can reduce expected data rates). Finally, the IEEE 802.11a standard is used by WLAN equipment operating on an unlicensed basis using OFDM modulation in the 5 GHz band.

Equipment manufactured according to the different Wi-Fi standards has various advantages and disadvantages. For example, equipment employing the IEEE 802.11b/g standard, which operates in the 2.4 GHz band, generally is lower in cost and includes a wider selection than equipment under other standards. Also, when compared with equipment operating in the 5 GHz band, signals propagate farther using the same transmit powers. However, because this equipment is deployed in the 2.4 GHz band, it effectively shares this band with many other types of unlicensed wireless devices operate, and it must do so with a smaller amount of bandwidth than is available in the 5 GHz band.

Finally, spectrum in the 70, 80, and 90 GHz " upper millimeter wave" bands is also used for WLAN applications. The Commission recently allowed these bands to be used for wireless, high-speed, point-to-point communications using an automated link registration and coordination system.[44] Two companies, Gigabeam and Loea, have filed for licenses to use this spectrum, though have not yet deployed service. Gigabeam plans to develop and sell line-of-sight, high-speed, point-to-point communications equipment for this band, and is targeting customers in commercial buildings seeking high capacity data links to other buildings not reached by fiber networks. Users of GigaBeam's equipment would install transceiver units, pointed at each other, on the rooftops or windows of two buildings; transceivers would establish a line-of-sight wireless connection to carry data traffic between the two buildings at transmission speeds ranging from 1.25 to 2.5 gigabits per second.[45]

Longer-range wireless networks – Wireless Metropolitan Area Networks (WMANs). Wireless Metropolitan Area Networks (WMANs) are point-to-point or point-to-multipoint networks with individual links that not only can span distances of up to 30 miles, which is important for backhaul applications, but also can provide last-mile connectivity in metropolitan environments. WMANs can employ vendor-specific proprietary equipment and associated technologies or they can be manufactured according to IEEE standards.

When initially adopted, the WMAN IEEE 802.16 standard addressed only licensed networks in the 11-66 GHz range using standardized equipment, including the Local Multipoint Distribution Service (LMDS) at 24 GHz and 39 GHz. Data rates for these systems are high, with up to 155 Mbps within a 2-mile range, but transmission requires line-of-sight between network access points. This technology is well-suited for

[44] *See* Section V.A, *infra.*

[45] Gigabeam Corp., SEC Form 424B4/Propectus, filed Oct. 15, 2004, at 2.

"business districts where rooftop mounting of subscriber dishes is permissible."[46] This standard, however, is not suitable for lower frequencies due to its line-of-sight and large bandwidth requirements.

Although the IEEE 802.16 standard was not finalized until 2001, wireless broadband systems were already operating in the 11-66 GHz range of frequencies. Before the standard was developed, the technologies used in these frequencies were technically similar to the ones specified in the IEEE 802.16 standard and, indeed, one of the goals of the IEEE 802.16 standard was to standardize the equipment for these bands, thereby enabling better interoperability and reducing equipment costs.

A number of licensed carriers currently operate in the 11-66 GHz range, specifically in the 24 GHz, 39 GHz, and LMDS bands, often referred to as the "upper bands," offering fixed wireless broadband services. The major carriers in these bands, including First Avenue Networks and XO Communications, have begun to focus on providing backhaul transport and private line telecommunications services to other carriers and large business customers.[47] Many providers using these upper bands have also begun leasing spectrum on a point-to-point or geographic area basis to other fixed and mobile carriers. For example, in May 2004, IDT announced the reorganization of its fixed wireless division to focus on providing private line, wholesale, and backhaul services, as well as leased spectrum, to other telecommunications companies, including mobile and fixed wireless carriers.[48] XO Communications is offering a range of wireless broadband services, including VoIP, high-speed Internet access, and other data services, at speeds ranging from one to 20 Mbps, to small and medium sized businesses in conjunction with its metropolitan fiber networks.[49]

Manufacturers are continuing to develop new types of WMANs and associated technologies under the 802.16 family of standards. In January of 2003, the IEEE adopted the 802.16a standard – commonly referred to as WiMax – as an extension of the previously existing 802.16 standard. IEEE 802.16a addresses operations in the 2-11 GHz bands, which spans both licensed bands and those available for unlicensed devices. WiMax networks have shared data rates of up to 75 Mbps.[50] Importantly, the new standard employs OFDM. OFDM allows signals to pass through buildings and trees. This development increases spectral efficiency and robustness from interference and reduces multipath distortion; that is, radio signals that are generated from the original, desired signal but that are distorted because they are reflected from objects in the environment. Subsequently, the IEEE 802.16a standard has been extended to include 802.16d, which is also for fixed wireless broadband applications. Also, in light of the

---

[46] Jim Geier, Wireless LANs (Sams Publishing, 2nd Ed. 2002), p. 61.

[47] Last July, First Avenue purchased all of Teligent's assets. The transaction closed in December of 2004.

[48] *IDT to Reorganize Winstar Division*, RCR WIRELESS NEWS, May 12, 2004.

[49] *Wireless*, COMMUNICATIONS DAILY, Jan. 15, 2004; Daniel Sweeney, *The Reappearance of LMDS*, BROADBAND WIRELESS BUSINESS, November/December 2003, at 6-9.

[50] Intel, *IEEE 802.16 and WiMax, Broadband Wireless Access for Everyone*, White Paper, at 3, available at <http://www.techonline.com/community/related_content/30627>.

significant demand for mobile wireless broadband, the IEEE 802.16 group is working toward finalizing 802.16e, a mobile wireless extension.[51] The 802.16 standard also has extensions for advanced antenna technologies, including beamforming and Multiple Input and Multiple Output (MIMO) antennas, as well as for mesh network topologies.[52] Taken together, the most important aspects of the new IEEE 802.16 standard are that: it can be used for applications in both licensed and unlicensed spectrum, increasing its flexibility of use; customer premise equipment will be interoperable with other equipment that uses the same standard; the equipment is robust from interference and does not require line-of-sight; the standard allows for use of advanced communications technologies; and, at some point in the near future, the standard will encompass both fixed and mobile wireless applications.

To promote the continued development and deployment of products that are based on the IEEE 802.16 family of standards, many wireless equipment manufacturers and service providers joined together to create the WiMax Forum. As of February 2005, there were more than 200 members of the WiMax Forum, including, among others, Intel, Cisco, Nortel, Alvarion, Airspan, Fujitsu, Nokia, AT&T, Sprint, and Vodafone.[53] WiMax-certified fixed wireless broadband equipment will likely not be available in the United States until the end of the first quarter in 2005, with mobile and portable equipment not available until the end of the third quarter in 2005. Many predict that WiMax will become a significant commercial success. Even before the first WiMax-certified equipment in the United States was shipped, one market research firm estimated that WiMax equipment sales will reach $2.2 billion by 2009.[54]

The principal spectrum bands that are the most likely for initial deployments of IEEE 802.16 and WiMax-compliant equipment are in the Broadband Radio Service (BRS)/Educational Broadband Service (EBS) in the 2.5 GHz band, and in the 3.5 GHz

---

[51] It is useful to compare IEEE 802.20, discussed earlier, and IEEE 802.16e, the proposed mobile extension of WiMax. While there is significant overlap in the functionality of technologies that will be manufactured according to the two standards, one observer noted the following distinction: "802.16e is looking at the mobile user walking around with a PDA or laptop, while 802.20 will address high-speed mobility issues." *See* "802.16e v. 802.20," available at <http://www.Wi-Fiplanet.com>. Indeed, some assert that 802.20 is more targeted as a competitor of cellular, while 802.16e is more focused on being a data technology. *See* "IEEE Scores 802.16d," available at <http://Dailywireless.org>.

[52] Beamforming and MIMO are two advanced antenna technologies. In October 2004, Belkin introduced the first MIMO Wi-Fi products. Using MIMO antenna technology, Belkin asserts that its equipment has 800% wider service coverage and 600% faster speeds than typical 802.11g deployments. *See Belkin Wireless Pre-N Networking Products Hit Store Shelves*, Press Release, <http://www.belkin.com/presspage/Releases/10_08_04WlsPreN.html>, Oct. 8, 2004. One observer noted that MIMO antennas are expected to improve transmission coverage by effectively doubling the cell radius for comparable non-MIMO antenna networks. This would thus reduce the number of base stations required in a cellular system by a factor of 16. *See* Dailywireless, *IEEE Scores 802.16d*, available at <http://Dailywireless.org>.

[53] *See generally* <http://www.wimaxforum.org>.

[54] *See* Visant Strategies, *802.16/WiMax, Strategic Overview 2004*, available at <http://www.visantstrategies.com/pr80216.htm>.

band, which is currently available for use in Europe and other countries (and whose use in the United States currently is the subject of a pending Notice of Proposed Rulemaking).[55] While product development focuses largely on outdoor wireless broadband applications, various proponents of WiMax advocate its use for indoor networking and multimedia applications as well.[56] One of the largest impediments to the deployment of WiMax for indoor applications is the current price point, which is relatively high when compared with other wireless in-home networking technologies.

One example of a WMAN deployment with proprietary equipment is Clearwire, although this equipment will later evolve to meet the new 802.16 WiMax standard. (*See* Appendix A, Field Study for Jacksonville FL.) In August 2004, Clearwire launched mobile broadband service in Jacksonville, FL using non-line-of-site OFDM equipment and spectrum leased from the Educational Broadband Service (EBS) (formerly the Instructional Televisions Fixed Service (ITFS)) licensees in the 2.5 GHz band.[57] The company has since expanded service three additional locations: Abilene, Texas; St. Cloud, MN; and Daytona Beach, FL. In October 2004, Clearwire announced a deal with Intel in which Clearwire will deploy equipment based on the 802.16 WiMax standard of which Intel has been a major proponent and developer. The equipment will be manufactured by Clearwire's subsidiary, NextNet Wireless, and will include 802.16e WiMax chipsets manufactured by Intel.[58] The 802.16e version of WiMax allows wireless broadband services to be offered on a wide-area mobile, rather than a fixed, basis.

Several equipment manufacturers also have developed proprietary equipment for use on an unlicensed basis in WMANs. For example, Motorola's Canopy proprietary WLAN system operates on an unlicensed basis in the 900 MHz, 2.4 GHz, and 5 GHz bands, and the recently-announced enhanced version of Canopy is targeted to have data rates of up to 20 Mbps.[59] Network links within Motorola's Canopy system can be up to 35 miles. Alvarion manufactures proprietary point-to-point wireless broadband access equipment as well. Both manufacturers plan to deploy equipment compliant with the WiMax standard. In June 2004, Alvarion announced the initial release of its first WiMax-compliant system, BreezeMAX.[60] Designed to accommodate services from in-

---

[55] *See id.* (noting that the 2.5 GHz band will likely be used for WiMax deployments). The 3.5 GHz band is also used for non-WiMax technologies in Europe.

[56] *See* presentation of Ken Stanwood, Cygnus Multimedia Communications, Vice-Chair, IEEE 802.16 Working Group, (presentation 9/2004), noting, *inter alia*, that IEEE 802.16 provides better quality of service guarantees than IEEE 802.11 and that it enables the use of advanced technologies that are more robust for the poor RF environment indoors.

[57] *Intel, Clearwire to Accelerate Deployment of WiMax Networks Worldwide*, News Release, Clearwire, Oct. 25, 2004.

[58] *Id.*; Howard Buskirk, *Intel Makes Major Investment in WiMax with McCaw*, COMMUNICATIONS DAILY, Oct. 26, 2004, at 7.

[59] *Motorola's Canopy Launches Next Generation Platform of is Wireless Broadband Products*, Press Release, <http://motorola.canopywireless.com/news_home.php>, Oct. 27, 2004.

[60] *Alvarion Launches BreezeMAX, Its WiMax Platform Develop from the Ground Up Based on IEEE 802.16/HiperMAN Standards*, Press Release, Alvarion, June 2, 2004.

home networking to hot spot backhaul, this system operates in the 3.5 GHz band, which is currently available for wireless broadband applications in Europe and Asia Pacific.

2. Mobile Technologies

Mobile wireless broadband services allow consumers to access the Internet and other data services at any variety of locations – at high speeds and while mobile – using a cell phone, a personal digital assistant (PDA), or a wireless modem card connected to a laptop computer. Mobile broadband services offered by cellular and PCS providers are also commonly referred to as third generation, or "3G," services or advanced wireless services.

At the current time, most mobile carriers in the United States use one of two major digital technologies to offer voice services: CDMA or GSM.[61] CDMA and GSM carriers have been deploying a separate series of technologies in order to upgrade their networks to offer data, as well as voice, services. Since 2002, several wireless began increasing the data speeds on mobile telephone networks. Specifically, many CDMA carriers have deployed a network overlay called 1xRTT, while many GSM carriers have launched GPRS.[62] 1xRTT and GPRS allow carriers to offer mobile data services at maximum data transfer speeds of 115 kbps and 144 kbps, respectively, with actual speeds ranging from 30 to 70 kbps. As of June 2004, 273 million people, or 96 percent of the U.S. population, lived in counties where 1xRTT networks had been deployed, and 264 million people, or 93 percent of the U.S. population, lived in counties where GPRS had been deployed.[63] As an upgrade beyond GPRS, some GSM carriers have also deployed EDGE technology,[64] which allows faster data transfer speeds of around 100 kbps (typical) and 384 kbps (peak).

Over the past year, several wireless carriers have begun to deploy significantly faster broadband technologies on their mobile cellular networks, and many have announced plans to launch or expand these technologies further in the future. Since October 2003, Verizon Wireless has launched high-speed mobile Internet access service using CDMA 1x EV-DO (EV-DO) technology in 30 major U.S. cities, covering 75 million people.[65] EV-DO technology increases maximum data transfer speeds to 2 Mbps, and typical, user-experienced download speeds range from 300 to 500 kbps. With the

---

[61] CDMA stands for Code Division Multiple Access, and GSM stands for Global System for Mobile Communications. The third major type of digital technology in use is TDMA (Time Division Multiplexing Access); however, the mobile carriers using TDMA are in the process of upgrading their TDMA systems to GSM. In addition, the carriers using Specialized Mobile Radio (SMR) licenses to deploy mobile telephone services, such as Nextel, use a digital technology called iDEN (integrated Digital Enhanced Network).

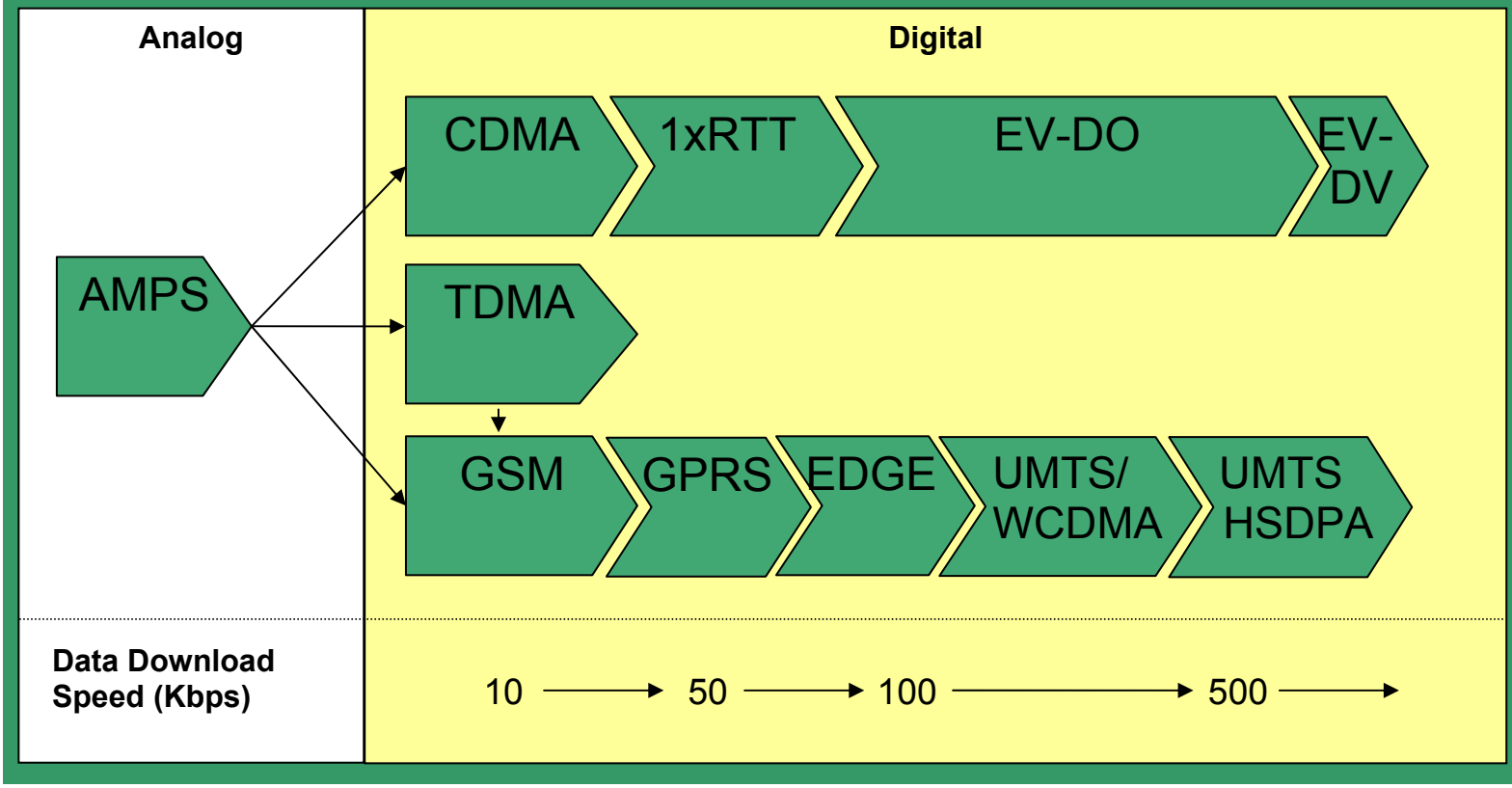
[62] GPRS stands for General Packet Radio Service.

[63] *See* Implementation of Section 6002(b) of the Omnibus Reconciliation Act of 1993, Annual Report and Analysis of Competitive Market Conditions with Respect to Commercial Mobile Services, *Ninth Report*, 19 FCC Rcd 20597, 20654 ¶ 138 (2004) (*Ninth Annual CMRS Competition Report*).

[64] EDGE stands for Enhanced Data Rates for GSM Evolution.

[65] *On Demand in the Palm of Your Hand: Verizon Wireless Launches "VCAST" – Nation's First and Only Consumer 3G Multimedia Service*, News Release, Verizon Wireless, Jan. 7, 2005.

Figure 3. The Move to 3G and Beyond:
Mobile Network Technology Evolution by U.S. Wireless Carriers



EV-DO service, subscribers can access the Internet while mobile via a wireless modem card connected to a laptop computer or PDA, or download a range of multimedia content and advanced applications, including mobile television programming, on certain handset models. Verizon Wireless plans to expand its EV-DO coverage to a total of 150 million people by the end of 2005.[66] Sprint expects to roll out EV-DO technology to cover 130 million by the end of 2005 and to cover 150 million by early 2006.[67]

During the summer of 2004, AT&T Wireless (now part of Cingular Wireless) announced the commercial availability of Wideband CDMA (WCDMA), or UMTS,[68] technology in six U.S. cities: Seattle, San Francisco, Phoenix, Detroit, San Diego, and Dallas.[69] UMTS is the next migration step for GSM carriers beyond EDGE and allows maximum downstream data speeds of up to 2 Mbps, and typical, user-experienced speeds of 220-320 kbps. In November 2004, after completing its merger with AT&T Wireless, Cingular announced that it plans to deploy UMTS/HSDPA (High Speed Downlink

[66] *Id.*

[67] Simon Flannery et al., *Sprint Corp. – With Deal Firmly on Track, Nextel is the Way to Play*, Morgan Stanley Equity Research, Feb. 11, 2005, at 2.

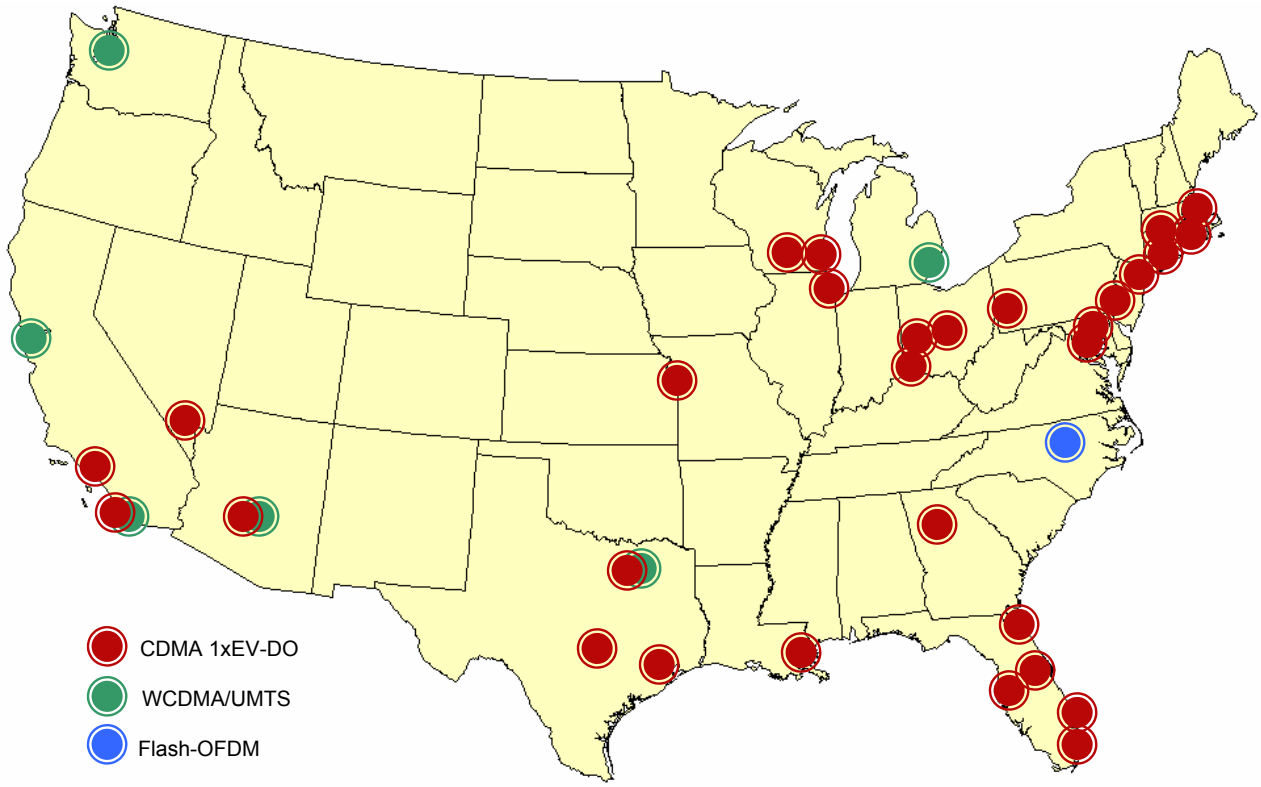
[68] UMTS stands for Universal Mobile Telecommunications System.

[69] *AT&T Wireless Extends 3G UMTS to Dallas and San Diego*, Press Release, AT&T Wireless, Sept. 1, 2004.

Packet Access) networks in several major U.S. markets beginning in 2005. HSDPA will allow average download speeds of 400-700 kbps with burst rates up to several Mbps.[70]

While many of the mobile technologies and standards developed to date are cellular technologies, several companies are now working to develop highly mobile technologies and standards that also have some of the desirable characteristics of fixed wireless broadband systems. In some ways, although they can operate at vehicular speeds, these technologies represent a technological "middle ground" between purely mobile and purely fixed systems. That is, they have generally higher data throughput rates than cellular technologies, but have lower throughput data rates than fixed technologies. At the same time, they have symmetric data rates and lower latency, when compared with the highly asymmetric data rates and relatively higher latency of cellular technologies.[71] One such developing standard is the IEEE 802.20 standard, Mobile Broadband Wireless Access (MBWA) (sometimes referred to as "Mobile-Fi"). Equipment developed according to this standard will operate in licensed frequency bands below 3.5 GHz, support peak data rates of 1 Mbps or more, and support vehicular

Figure 4. Mobile Broadband Deployment by Technology (January 2005)



[70] *Cingular to Deliver 3G Broadband Services*, News Release, Cingular, Nov. 30, 2004.

mobility of up to 250 Km/h (*i.e.*, 155 mph).[72] The coverage area will be comparable to that associated with wireless networks that cover entire metropolitan areas. This technology is sometimes touted as being a possible option for "4G" cellular networks.[73]

Flarion is one of the most active participants in the IEEE standards group working to finalize the 802.20 standard. Flarion has developed a proprietary technology, Flash-OFDM, that is closely akin to the developing 802.20 standard. In April 2004, Nextel Communications began offering wireless broadband service in Raleigh-Durham, N.C. using Flash-OFDM technology developed by Flarion.[74] Customers can purchase either a wireless modem for a personal computer or a wireless modem card for a laptop computer. Typical, user-experienced download speeds range from 950 kbps to more than 1 Mbps, with burst rates of up to 3 Mbps, and the typical uplink speed is 375 kbps with burst rates up to 750 kbps. Nextel has been currently using leased broadband PCS spectrum for the Raleigh OFDM deployment and at one time stated that it would consider using its 2.5 GHz Broadband Radio Service (BRS) licenses to deploy the Flarion service to additional markets in the future.[75] However, in February 2005, shortly after announcing its proposed merger with Sprint, Nextel announced that it would end its Flarion Service in Raleigh by June 2005.[76] In January 2005, Sprint joined the WiMax Forum, and analysts speculate whether the new, combined company may use its BRS spectrum to deploy WiMax instead of, or in addition to, Flash-OFDM or 802.20 technology.[77]

---

[71] *See id.*

[72] *See* Mark Klerer, *Introduction to IEEE 802.20*, available at <http://www.ieee802.org/20/P_Docs/IEEE%20802.20%20PD-04.pdf>, Mar. 10, 2003.

[73] *See IEEE Scores 802.16d*, available at <http://www.Dailywireless.org>.

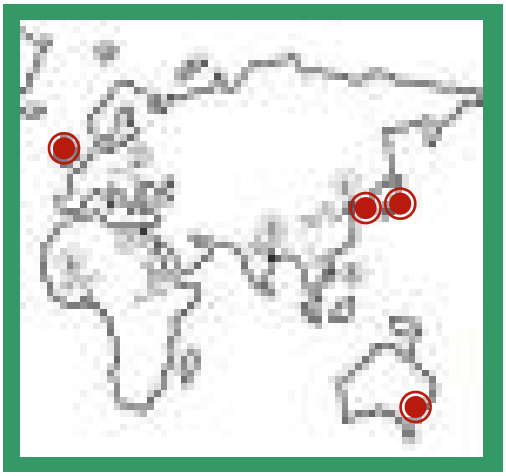
[74] *See* Appendix C (Field Study of Raleigh, NC).

[75] *Wireless*, COMMUNICATIONS DAILY, Feb. 9, 2004; Transcript, *Event Brief of Nextel Communications Earnings Conference Cal - Final*, FD (Fair Disclosure) Wire, July 21, 2004 (quoting Barry West, Executive Vice President and Chief Technology Officer, Nextel Communications).

[76] Dan Meyer, *Nextel to End Flarion Trial, Deemed Successful*, RCR WIRELESS NEWS, Feb. 8, 2005.

[77] *See Sprint Joins the WiMax Forum*, News Release, Sprint, Jan. 31, 2005; Brad Smith, *The Sprint-Nextel Merger Raises Questions about the Future of Flarion's Flash-OFDM, WiMax, and Even CDMA*, WIRELESS WEEK, Jan. 1, 2005.

Figure 5. Wireless Broadband Deployments on Licensed Spectrum: Snapshots from Other Countries



United Kingdom

In the United Kingdom, UK Broadband, a wholly-owned subsidiary of Hong Kong telecom provider PCCW, offers a wireless broadband service called Netvigator. The service, which launched in May 2004, allows consumers to connect a portable, plug-and-play wireless modem to a laptop or PC using Ethernet or USB cable, and access the Internet at speeds of 512 to 1 Mbps. The wireless modems are manufactured by IPWireless or Navini, and employ licensed spectrum in the 3.4 GHz band.

Australia

In Australia, consumers and business customers can purchase mobile broadband services that use Arraycomm's TDD iBurst technology. The technology allows typical data transfer speeds of 1 Mbps, with a maximum base station capacity of 20 Mbps. Customers can either access the Internet while mobile using a wireless modem card inserted into a laptop or PDA, or use the service on a fixed basis with a modem-sized device connected to a PC or laptop with Ethernet or USB cable. The iBurst service employs licensed spectrum in the 1900-1920 MHz band that is held by Arraycomm's subsidiary, Personal Broadband Australia (PBA), which sells wireless broadband access wholesale to other carriers and ISPs, who then market it to end user customers. The network currently covers the urban and suburban areas of Sydney, Brisbane, Melbourne, and the Gold Coast, and PBA expects it will cover over 75 percent of the Australian population when fully deployed.

Japan

Japan has been a leader in mobile data service deployment and usage. Japan's largest wireless carrier, NTT DoCoMo, was the first company to launch WCDMA services in October 2001, and the company now has over 7.5 million WCDMA subscribers in Japan. In January 2005, the company announced that it has agreed to develop, in conjunction with 25 other leading wireless carriers around the world, an advanced technology standard for mobile phones that will be capable of transporting high-resolution video in an instant. All of the member companies have agreed to support the standard, which will be compiled by 2007 and is expected to transmit data at 10 times the speed of current 3G networks.

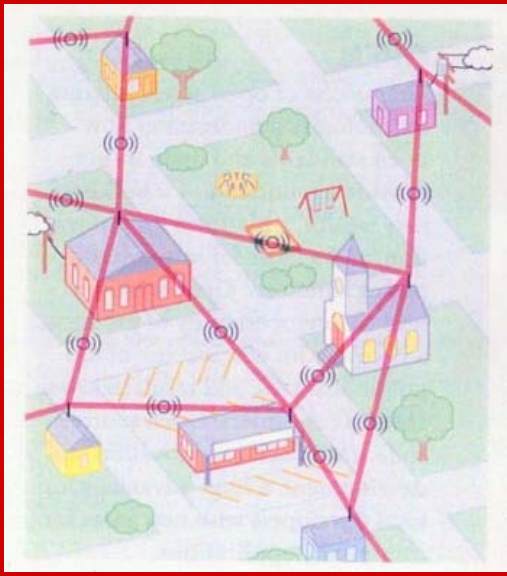
South Korea

In South Korea, two wireless carriers, SK Telecom and KT Freetel, have deployed mobile broadband services using CDMA EV-DO technology and licensed spectrum in the 1.9 GHz band. The companies launched their respective networks in 2002 and currently have a combined total of 9 million EV-DO subscribers, representing 19 percent of the country's total population.

3. Special Topics

Mesh networks. Mesh networks are a relatively new, evolving type of wireless broadband technology that may enable more flexible and more efficient expansion of wireless broadband services. Unlike traditional WMANs or WLANs, in which each "node" (or consumer device) in the network communicates only with a central antenna or base station, in a mesh network, each node can function as an access point and transmit information to other nodes in close proximity.[78] If one node goes out of service, the other nodes will route the traffic around it, making mesh networks a relatively robust communications technology. Mesh networks can either be fixed or mobile. We expect continued technological developments in this area.

Figure 6. Mesh Networks



Mesh networks allow multiple points of connection to a wireless network, with no central tower. The network consists of shorter distances between nodes, enabling each antenna to broadcast at lower power and thereby creating less risk for interference.

Integration of different wireless networking technologies. More and more, different wireless broadband technologies are being used together in a complementary way. For example, Bluetooth technology can provide broadband connectivity between devices located within a particular room of a building. This Bluetooth network can be integrated as part of a Wi-Fi network linking both different access points within the building, as well as being used to provide a broadband communications link between several buildings on an industrial campus. WMAN technologies can then be used to provide communications links between multiple campuses. With the continued developments of various wireless technologies and their increasing ubiquity, these wireless broadband technology pairings are likely to increase.

B. Examples of Wireless Broadband Deployment; Various Applications

Through its various outreach projects and research, as well as the comments received in this proceeding, the Task Force has gathered various information on the means by which wireless broadband services have been deployed and on examples of innovative wireless broadband applications. Examples of some of these are discussed below, and may be useful as both background and context as the Commission considers additional steps it may take to facilitate the deployment of wireless broadband.

---

[78] David Ewalt, *Motorola Moves Into Mesh*, Forbes.com, Nov. 16, 2004.

1. Survey of Deployment

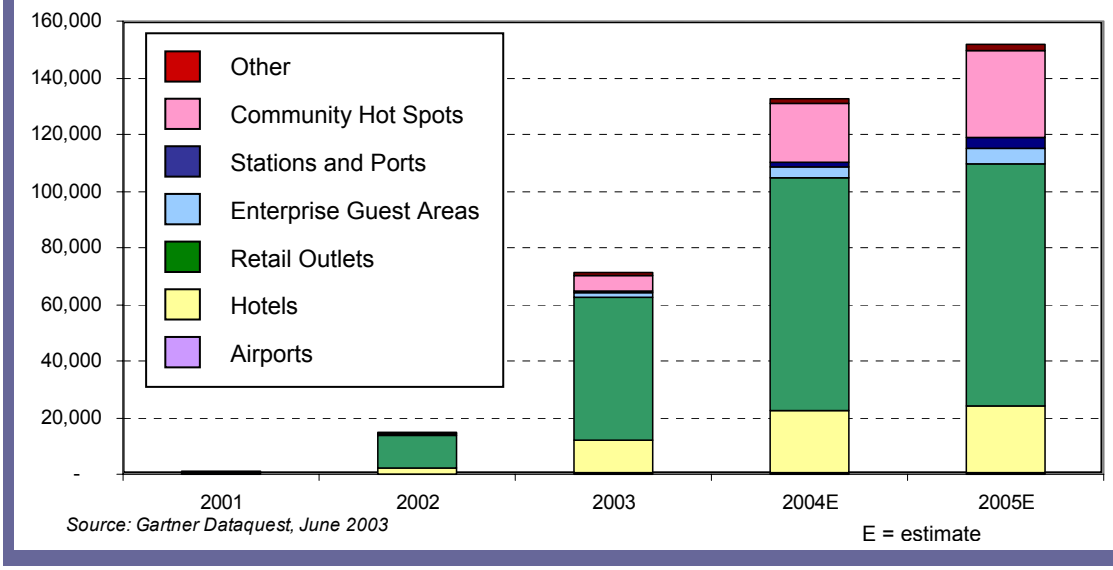
While wireless broadband services are deployed through various means and business models. A few examples of those are discussed here.

a) Wi-Fi hot spots, WLANs, and WISPs

Wi-Fi hot spots and WLANs. Wi-Fi "hot spots," which are wireless local area networks comprised of unlicensed IEEE 802.11 devices, constitute one of the principal ways in which unlicensed devices are used to provide access to broadband services. At hot spot locations located at stores or neighborhoods, consumers use mobile or portable devices, including laptops and personal digital assistants, to obtain Internet access through wireless technologies. Often consumers subscribe to a particular service provider to obtain access to multiple hot spot locations, although access to the Internet is free of charge in some hot spot locations. As discussed in Section VII.B below, several national mobile service providers use Wi-Fi hot spots to complement their licensed cellular services.

Over the last several years, the number of hot spots and hot spot users has increased dramatically. Located in retail establishments, hotels, airports, railway stations, trains, ferries, public parks, gas stations, and a host of other public places, it has been estimated that the number of hot spot users worldwide will total 30 million by the end of 2004, up from 9.3 million in 2003 and 2.5 million in 2002.[79] Figures for the total number of hot spots in the United States vary widely, in part due to the large numbers of new hot spot locations created every day. The Gartner Group predicts that there will be more than

Figure 7. Wi-Fi Hot Spots Worldwide by Type of Location (2001-2005)



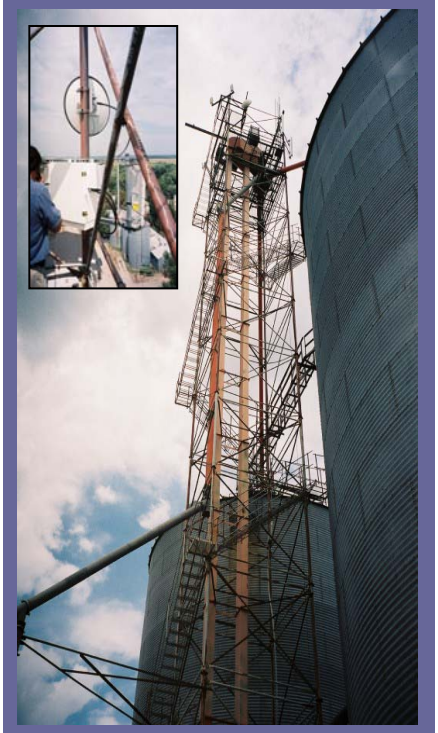
[79] *Gartner Says the Number of Hot Spot Users Worldwide to Triple in 2004; Enterprises Must Implement a Wireless Strategy*, Press Release, GARTNER, INC., Feb. 18, 2004.

150,000 hot spots by the end of 2005.[80] The potential benefits in net productivity from the ubiquitous availability of Wi-Fi hot spots are significant. By some estimates, workers' use of hot spots to access their networks from a variety of locations enables them to gain thirty minutes daily in productivity.[81]

The overall use of WLANs, beyond those specifically involving Wi-Fi hot spots, is also on the rise. We note that is has been estimated that, by the end of 2005, approximately 50% of all enterprises will use some sort of WLAN and that sales of related equipment will exceed $5 billion.[82]

Wireless Internet service providers (WISPs). The development and growth of wireless broadband services by Wireless Internet Service Providers (WISPs) constitutes another significant trend. WISPs use networks of wireless devices, typically unlicensed devices, to provide broadband connectivity, providing a facilities-based broadband alternative to cable and DSL services.[83] Often WISPs' networks span many miles, including multi-county and multi-regional geographic areas. Some WISPs serve major metropolitan areas like New York and Chicago, other WISPs serve smaller cities like Tampa and St. Louis, and yet others serve very small communities.

Figure 8. WISP Radio Equipment



WISP radio transmitter equipment on a grain elevator in Grimes, Iowa.

One of the most significant market sectors for WISPs are rural and underserved areas, many of which do not have access to either cable or DSL services. A market survey of WISPs noted that more than 40 percent of WISPs deployed wireless broadband services because there were no other broadband alternatives.[84] Subscriber bases for WISPs also vary, from fewer than 100 to tens of thousands.

Estimates for the total number of license-exempt WISPs nationwide vary significantly. One

---

[80] See Figure 8.

[81] *Gartner Says the Number of Hot Spot Users Worldwide to Triple in 2004; Enterprises Must Implement a Wireless Strategy*, Press Release, GARTNER, INC., Feb. 18, 2004.

[82] *See* Carter, Lahjouji, and McNeil, "Unlicensed and Unshackled: A Joint OSP-OET White Paper on Unlicensed Devices and Their Regulatory Issues," Federal Communications Commission (May 2003), at 33.

[83] *See* Section IV.C (additional discussion of wireless broadband's current share in the broadband market).

[84] ISP-Market, *Broadband Wireless Access 2002: Service Provider Profiles, Market Drivers and Spending Projections*, ISP-Market LLC Industry Report (2002).

analyst's report noted that there were approximately 2,500 license-exempt WISPs serving more than 6,000 markets in the United States in 2002.[85] More recent estimates are that there are between 4,000 and 8,000 WISPs.[86] While the number of license-exempt WISPs currently in operation is difficult to discern, it is clear that the total number of WISPs has significantly increased over the last several years. Notably, the Commission recently changed its broadband service reporting requirements, eliminating a minimum subscriber threshold requirement previously associated with the mandatory reporting obligation. We thus expect, in the future, that the Commission will have a more precise source of information regarding the total number of license-exempt WISPs and the associated data rates for the broadband services they offer.[87]

b) Community involvement

Community networking. Wireless community networks are interlinked computer networks using unlicensed wireless networking technologies and standardized 802.11b Wi-Fi devices to build citywide wireless networks or zones.[88] Community networks can act as a low-cost alternative where access to cable modem or DSL service is either unavailable or too expensive. These networks began with the availability of 802.11 equipment. As of mid-2002, most community networks were still developing, with small groups of people experimenting and gradually interconnecting with each other. Most wireless community networks are coordinated by citywide user groups who freely share information and often offer free Internet access to anyone with a wireless connection.[89]

There are approximately forty wireless community networks in the United States.[90] Many have deployed unique applications of wireless broadband in order to effectively serve and integrate underserved individuals and groups within their communities. For instance, in Jacksonville, FL, JaxWIZ has created a novel community networking project, installing free high-speed wireless Internet zones in underserved areas throughout the city to any electronic device enabled with industry standard 802.11b connectivity.[91] The wireless Internet zone (WIZ) program was established through a public-private partnership.[92] By 2005, the city plans to have six to ten zones in operation.

---

[85] *Id.*

[86] Wireless Internet Service Providers Association estimates that there are currently 4,000 WISPs, WISPA Comments at 1, and Part-15.org estimates that the number is closer to 8,000 WISPs.

[87] *See* Local Telephone Competition and Broadband Reporting, *Report and Order*, 19 FCC Rcd 22340 (2004).

[88] *See* Wikipedia, *Wireless Community Network*, available at <http://en.wikipedia.org>.

[89] *See id*.

[90] *See* Toaster.net, *Wireless Community Network List*, available at <http://www.toaster.net>.

[91] *See* JaxWiz Wireless Internet Zone, *About the Wiz*, available at <http://www.jaxwiz.org>. *See also* Appendix C, *infra*.

[92] Specifically, the program is made possible by a group of public and private organizations, including 1AccordSolutions, BellSouth Corporation, The Boardwalk Group, The City of Jacksonville, Connexsys, The Jacksonville Regional Chamber of Commerce, The Jacksonville Urban League and numerous other organizations donating funds and used computers. *See* JaxWiz Wireless Internet Zone, *About the Wiz*, available at <http://www.jaxwiz.org>.

Current zones include The Landing, a retail venue and five other zones exclusively serving low-income communities. The users in underserved neighborhoods are supplied with used computers donated by the city and local businesses. Through the Internet access provided by JaxWIZ, residents of low-income communities can obtain information about employment, educational and business opportunities, and access community programs and services.[93]

Similar to JaxWiz, NYCwireless supports the creation of wireless hot spots in public spaces throughout the New York City area, including parks, coffee shops and public building lobbies.[94] In particular, NYCwireless works with public and nonprofit organizations to ensure that wireless Internet access is made available to under-served communities throughout the New York City area.[95] It provides a forum for discussion and experimentation on emerging wireless technologies, especially for those related to building wireless community networks. These include the creation of interpersonal wireless networks and the use of public spaces to access the Internet via wireless technologies.[96]

Involvement of municipalities in deploying wireless broadband. Ensuring that all citizens have access to broadband services is of increasing importance to local governments. As the following examples demonstrate, a number of municipalities have undertaken various approaches to promote wireless broadband deployment. These have included: facilitating access to municipally owned facilities; cooperating in joint ventures with commercial operators; and, establishing municipally-owned and operated networks.

New York City has taken steps to promote wireless broadband by facilitating access to municipally owned facilities. In February of 2004, the city determined that access to city-owned infrastructure could provide an important incentive to spur deployment in certain areas and proposed granting access, at reasonable rates, to over six thousand of the city-owned light poles.[97] In this way, the city hoped that service

---

[93] *See id.*

[94] *See generally* NYCwireless's website, available at <http://www.nycwireless.net>.

[95] Through its various workshops and meetings, NYCwireless supplies information about wireless broadband technology to groups attempting to provide their own wireless access points, as well as wireless broadband technology developers. It serves as an advocacy group for wireless community networking through its community outreach programs, communication with the press and participation in conferences. NYCwireless also attempts to educate the public and businesses about the benefits of wireless community networking. Programs include the "Social Impact" project that seeks to assess the distinctive social changes resulting from the widespread adoption wireless Internet technologies in the New York City area. *See id.*

[96] *See generally id*.

[97] *See* <http://www.nyc.gov/html/doitt/html/miscs/rfp_mobile_wireless.shtml>. Urban areas present unique challenges to the build-out of wireless networks. The dense population and proliferation of tall buildings located close together strain both network capacity and RF propagation engineering. In this environment, local governments may control what is perhaps the ideal infrastructure for locating access points: street

providers could fill in gaps in existing coverage and build out beyond current service areas. To provide incentives for coverage in underserved areas, the city devised a pricing scheme that charged only nominal fees for poles in those districts identified as having the lowest service penetration rates. The city placed no restrictions on what services could be provided – opening these facilities not only to broadband access but also to mobile phone providers.

Other cities have cooperated in joint ventures with commercial providers of wireless broadband. For instance, when the town of Grand Haven, Michigan determined that it wanted to provide its residents with higher speeds and better coverage than was available.[98] The city found a willing partner in Ottowa Wireless, a local business, which was granted a non-exclusive contract to place access points on city-owned buildings and utility poles. Grand Haven now has Wi-Fi coverage over its entire six square mile area at subscription rates comparable to those available in larger markets. Ottowa Wireless has also begun deployment of a VoIP handset to provide voice service throughout the coverage area, bringing competition to the local phone market for the first time.[99] Similarly, the city of Cerritos, California entered into a joint venture in order to provide wireless broadband services. This city, in spite of its proximity to Los Angeles, did not have either cable modem or DSL service available for many of its residents. Cerritos city leaders had received many complaints about the lack of such services, and they realized that this was an important issue for economic development and quality of life. The city approached Aiirnet Wireless, a WISP, and proposed to grant access to city-owned facilities for the deployment of access points. As an added incentive, the city committed to become a customer of Aiirnet, ensuring that sufficient demand would exist to justify the costs of deployment.[100] By using standard 802.11b technology, broadband service is available to anyone within the city limits. Users now have free access to city web sites (*e.g.*, city services, tourist information, etc.) and for around $40 per month receive full access to the Internet.[101]

Several small cities and towns also have decided to establish municipally-owned and operated networks. For instance, local leaders in Cumberland, Maryland, a small city located three hours outside Washington, D.C., in the mountains between West Virginia, and southwestern Pennsylvania, recognized that a lack of affordable broadband was hindering the evolution of the economy from smokestack industries to the service and technology sectors. The leaders concluded that commercial service providers did not believe that sufficient demand existed to justify the costs of deploying a traditional network infrastructure to the area. Accordingly, the City of Cumberland, surrounding

---

lamps. The height, spacing, and location of these light poles, as well as their ready access to city rights-of-way, mean that service providers can place low-power base stations on literally every block.

[98] *See* <http://www.bbwexchange.com/publications/newswires/page546-1047962.asp>.

[99] By using directional antennas located at the city marina, coverage is also provided to boaters up to 15 miles out on Lake Michigan, providing offshore broadband access which, among other things, enables boaters to get accurate weather updates and other information.

[100] *See* <http://aiirmesh.com/press/2004.04.01_1.html>.

[101] *See* <http://www.fcw.com/geb/articles/2003/1208/web-cerritos-12-08-03.asp>.

Allegany County, the local school board, and public libraries, decided to form AllCoNet, a non-profit joint venture to provide their citizens with broadband service.[102] Given the local geography and topography, deploying wireline facilities would have been far beyond the financial resources available, and would have taken years. By deploying wireless access points (supplied by Alvarion) on the mountains surrounding Cumberland, AllCoNet was able to quickly deploy broadband service, and now provides a level of service that was unavailable or cost prohibitive before to area schools, libraries, government buildings, residents, and businesses.

Two other towns that have established municipally owned and operated networks are Coffman Cove, Alaska, population 240, and Scottsburg, Indiana, population 6,000. Coffman Cove is a remote fishing village on Prince of Wales Island, where even slow dial-up Internet access required a long-distance call. Local leaders were determined to provide its residents with better access to the outside world and give the local economy a boost.[103] While their village's location made wireline broadband access unfeasible, local leaders realized that complementary use of satellite and terrestrial wireless could provide the necessary level of service at a reasonable cost. The village established an ISP, to be owned and run by the local citizens. The village contracted with SkyFrames, Inc.[104] to provide satellite backhaul service, and deployed a wireless hotspot with a radius of 2 miles from the village center. SkyFrames was able to deploy the network in under one week. The village, charging monthly subscription fees to private users, quickly signed up over 50 users. The link to Coffman Cove is equivalent to a T1, and is capable of providing DSL speeds to subscribers. While Coffman Cove still is not served by roads, the villagers now have access to information and entertainment, as well as economic opportunities, previously unimaginable. Meanwhile, in Scottsburg, Indiana, local leaders concluded that their citizens did not have access to what they viewed as affordable broadband service.[105] After being unable to resolve the situation with local telecommunications service providers, the municipal council approached the town's electric utility. Through those discussions they determined that the town would be able to deploy a wireless network that would piggyback on the electric utility's fiber network at relatively low cost.

We also note that at the same time that many municipalities are implementing municipal wireless broadband systems, some state governments are also legislating on these matters. For example, in July 2004 the city of Philadelphia announced a proposal to build out its own wireless broadband network, using Wi-Fi technology.[106] In response, the Pennsylvania General Assembly passed, and the Governor signed into law, a measure that generally would prohibit Pennsylvania municipalities from constructing and

---

[102] *See* <http://www.allconet.org>.

[103] *See* <http://www.isp-planet.com/fixed_wireless/business/2003/coffman_cove.html>.

[104] *See* <http://www.skyframes.com>.

[105] According to Mayor Bill Graham, it had cost $1,300 per month to lease a T1 line in Scottsburg, compared to $300 per month for comparable service in Louisville. *See* <http://www.muniwireless.com/archives/000315.html>.

[106] *See* <http://www.phila.gov/wireless>.

operating such systems in the future if the local exchange carrier would be operating a similar system.[107] Several other state legislatures also have considered similar measures relating to municipal broadband systems. Several groups and companies have weighed in on different sides regarding municipally owned and operated Wi-Fi networks.[108]

2. Examples of Wireless Broadband Applications

The Task Force also examined several wireless broadband applications in order to gain perspective on the kinds of innovations and benefits that can arise from deployment of these services. These are only a few of the wireless broadband applications that exist today, with tomorrow promising more growth and innovation.

En route, mobile applications. Wireless broadband technologies that allow access to the Internet while traveling will greatly benefit consumers of broadband technology, particularly business consumers. Wireless broadband technologies that are supplied by transportation systems, as well as mobile phones that can serve as a mobile desktop computer,[109] can also provide seamless broadband access, which is becoming increasingly necessary for many business consumers who travel frequently or experience long commutes.[110] Further, wireless broadband networks can also serve as a short-term solution for increasing broadband capacity for special events.[111] New technologies also allow for wireless broadband service to be available on trains and ferries. For instance, PointShot Wireless works with WISPs to deliver wireless broadband service to train operators and passengers.[112] In some areas of the country, Wi-Fi access is available on commuter ferries.[113]

---

[107] *See* H.B. 30, Gen. Assy., 2003 Sess. (Pa. 2004).

[108] *See, e.g.*, Jesse Drucker, *Telecom Giants Oppose Cities on Web Access*, The Wall Street Journal, B1, Nov. 23, 2004; David Haskin, *Intel to Lobby in Support of Municipal Wi-Fi Projects*, mobilepipeline.com, Jan. 12, 2005, available at <http://www.mobilepipeline.com/showArticle.jhtml?articleID=57700748>; *Not in the Public Interest –The Myth of Municipal Wi-Fi Networks*, New Millenium Research Council, February 2005.

[109] *See* Motorola Comments at 1. Motorola is a consumer electronics and telecommunications equipment manufacturer that designs consumer devices and infrastructure for all of the telecommunications sectors, including cable, wireline telecommunications, wireless and automobile. *See id*. at 3. Motorola's "enterprise phone" uses both Wi-Fi and cellular standards to allow the user to switch voice phone calls from a wireless local area network (WLAN) to a wide-area cellular network without interruption. This phone also has the potential of providing a substitute for a wired desktop phone because of its functionality as a wireless extension of a private branch exchange (PBX). *See id.*

[110] *See* Appendix C (discussion of Smartphone device in T-Mobile Field Study).

[111] During the 2002 World Series between the California Angels and the San Francisco Giants, the Angel's hosting stadium, Edison International Field, had only two DSL connections to serve the media center. Edison Field's IT director worked with Orange County WISP NextWeb, utilizing its Event Bandwidth service, to provide a dedicated 4-Mbps wireless link to the field's media center from an existing nearby 5.8 GHz hot spot. *See* Microsoft Comments at 2 (citing Gerry Blackwell, *The Big Event (Bandwidth)*, Wi-Fi Planet, Dec. 5, 2002, available at <http://www.wi-fiplanet.com/columns/article.php/1552931>).

[112] *See generally* <http://pointshotwireless.com>.

[113] The ferry service in Washington State, run by the Washington State Department of Transportation, deployed a Wi-Fi network in early February 2005. *See Washington Ferry Goes Wireless*, FCW.com,

In addition to providing Wi-Fi hotspots at airport gates and lounges, several airports have deployed broadband networks for other, more specialized applications. For instance, the Airports Council International-North America (ACI-NA) has members made up of local, regional and state government bodies that own and operate the airports served by major air carriers in the United States.[114] ACI-NA members and their tenants have installed or plan to install both licensed and unlicensed wireless facilities. These networks may include wireless systems to advance baggage handling and gate operation functions.[115] The services deployed by the airlines work by directly communicating with travelers using portable computers and personal digital assistants (PDAs) via a wireless connection among roaming agents. Other anticipated services include portable check-in facilities and desk-to-passenger communications on airline schedule changes.[116] In the near future, we expect that passengers will have Internet access on long-distance flights.[117] Through a venture with IPass and Boeing, passengers will have access to the Internet through their laptops via Wi-Fi, or another short-range wireless link, ultimately allowing them to be connected to the office and the Internet while in-flight.[118] We note, too, that in December 2004 the Commission has proposed to auction new licenses in the Air-Ground Radiotelephone Service so that new providers can help bring broadband services to the traveling public onboard aircraft.[119]

Video on mobile telephones. In the ever-increasing variety of new and enhanced mobile services, one recent entrant has been the introduction of video services offered over mobile devices. Subscribers can use so-called smart phones to download and view a range of different channels – from news to sports to soap operas. MobiTV was the first

---

January 20, 2005, available at <http://www.fcw.com/geb/articles/2005/0117/web-wifi-01-20-05.asp>. The network was launched along an eight-mile long stretch called the Seattle-Bainbridge run, which serves over 6.5 million passengers annually. Ferry system officials began installing Wi-Fi service on ferry routes north of Seattle last year, including service on the Port Townsend-Keystone run about 50 miles north of Seattle, last June, and on the Edmonds-Kingston route last December. *See id*. In addition to Washington state, the Harbor Bay Maritime Service, which runs between San Francisco and Alameda, CA, offers wireless Internet access to its passengers. *See Washington Commuter Ferries Get Wi-Fi Go Ahead*, Wi-Fi Planet, August 20, 2003, available at <http://www.wi-fiplanet.com/newsarticle.php/3066491>. Instead of Wi-Fi, Harbor Bay's service uses wireless backhaul on return to Alameda using licensed, fixed wireless. *See id*.

[114] *See* ACI-NA Comments at 1.

[115] *See id*. at 4.

[116] *See id.* at 4-5.

[117] *See Flying on the Web, Boeing, iPass Combining Services for In-flight Internet Access*, Broadband Reports.com, August 22, 2004 (which can be found at <http://www.dslreports.com/shownews/52491>). This service already exists on some international flights (*e.g*., Boeing Connexion service).

[118] *See id*. IPass currently makes software that connects customers to their offices from remote locations and plans to provide this new service using wireless links from Boeing. Boeing provides these connections by using satellites to deliver the Internet. *See id.* Accordingly, this service is hybrid, using both Wi-Fi and satellite technologies. *See* Section VII.B (discussing hybrid networks).

[119] *See* Amendment of Part 22 of the Commission's Rules To Benefit the Consumers of Air-Ground Telecommunications Services, *Report and Order and Notice of Proposed Rulemaking*, FCC 04-287 (rel. Feb. 22, 2005).

mobile television service launched in the United States. It is currently available to Sprint, Cingular, and Midwest Wireless subscribers and offers programming available with cable television, including the Discovery Channel, CSPAN, and CNBC, and it includes programming customized for mobile subscribers.[120] Verizon Wireless recently launched its mobile streaming video service – VCAST – which is available on phones that use its EV-DO network technology. In addition to traditional programming, Verizon's service also includes short, made-for-mobile episodes – often called "mobisodes" – of existing and new programs, including "24" and several new soap operas.[121] Other planned mobile video programming services also have been announced. In November 2004, Qualcomm announced its MediaFLO service, which will be deployed over a network dedicated exclusively for mobile music and video. Qualcomm's service will include access to between 50-100 channels, including 15 live programs.[122]

Public Safety applications. Wireless broadband technologies have the potential to benefit public safety entities across the country, in large measure by virtue of its mobility. From faster data speeds to more efficient processing of job-related paperwork, these technologies assist public safety officials in performing their jobs more efficiently and effectively in an environment that often requires immediate access to large amounts of information.

Public safety officials around the country are using wireless technologies to integrate networks by linking various departments within a city or town, thus assisting in faster and better communications. For instance, in San Diego, CA, the Sheriff's Department recently began utilizing an unlicensed wireless system to facilitate a more efficient work environment for its officers. The system allows officers to complete faster and more efficient processing of paperwork and other job-related functions, such as accident reports; it also significantly enhances the information available to deputies on patrol via their mobile data computers, with stationary access points also installed at various facilities, including station houses, courts, and jails.[123] In addition, the news media and public safety can coordinate weather service centers to provide quicker, more up-to-date weather alerts and other emergency information to citizens. For instance, public television stations in Kentucky, Texas, and New York have actively implemented

---

[120] MobiTV, *Get MobiTV* , available at <http://www.mobitv.com/get/index.html>; MobiTV, *Channels*, available at <http://www.mobitv.com/channels/index.html>.

[121] *On Demand in the Palm of Your Hand: Verizon Wireless Launches "VCAST" – Nation's First and Only Consumer 3G Multimedia Service*, News Release, Verizon Wireless, Jan. 7, 2005.

[122] *Qualcomm Subsidiary to Support Nationwide Delivery of Mobile Multimedia in 700 MHz Spectrum*, News Release, Qualcomm, Nov. 1, 2004.

[123] The technologies used by the San Diego County Sheriff's Department were developed by Alvarion. *See* Alvarion Comments at 1. Alvarion provides wireless broadband solutions from 800 MHz to 26 GHz, covering applications such as high-speed Internet access, TDM voice, cellular backhaul, mobile broadband, public hotspots and enterprise bridging. *See generally* <http://www.Alvarion.com> (*State and Local Government*). The Garland, Texas police department also has found important uses for wireless broadband. It has deployed mesh network technology using a wireless broadband mobile network created by NexGen City. *See generally* NexGen City Comments.

wireless broadband services for public safety applications by introducing services that enable the sending of emergency storm alerts or other emergency responses.[124]

Figure 9. Wireless Broadband Supporting Public Safety

There are numerous ways in which the public safety community can use wireless broadband technologies to support their mission-critical work. Here, a police officer with the Pennsylvania State University Police Department uses a laptop computer with a mobile broadband connection to obtain real-time information, such as drivers license records, vehicle registrations, and local crime data.

The ComCARE Alliance (ComCARE), a national coalition of organizations that includes emergency 911 directors, emergency medical technicians, wireless companies, and public safety health officials, is working to deploy life-saving wireless communications networks and technologies that will connect America's mobile public to agencies that respond to emergencies.[125] This system will work to prevent fatalities following a motor vehicle accident by enhancing and routing wireless emergency calls, via a wireless enhanced 911 system, to the appropriate emergency workers. ComCARE plans to facilitate the network by linking various devices and technologies including "smart" cars, wireless telecommunications, and intelligent transportation applications.[126]

Public safety networks primarily rely on licensed, exclusive use wireless spectrum because public safety entities – and particularly, first responders – require unfettered and immediate access to voice and data critical to address an emergency. While, as explained

---

[124] *See* Association for Public Television Stations Comments at 3. On November 15, 2001, Kentucky Educational Television, in partnership with the local branch of the National Oceanic and Atmospheric Administration, introduced a service that employs software to enable the station to use its digital broadcast capacity to send emergency storm alerts, weather information, criminal profiles, and updates to computers around the state instantaneously. *See id*. at 3-4. Public television station KERA, partnered with the University of Texas Medical Branch-Galveston, is using digital broadcast facilities to deliver crisis communications. In addition, Thirteen/WNET in New York, with backing from the National Imagery and Mapping Agency, has developed a model emergency alert system that will use its EBS spectrum to assist in distributing emergency alerts, emergency response, and command and control information to the public, first responders, and homeland security personnel. *See id*. at 5.

[125] *See* <http://www.comcare.org/about/overview.html>.

[126] The Northern Shenandoah Valley ITS-Public Safety Initiative is one of ComCARE's state projects. It uses wireless broadband connections to enable emergency agencies to connect with first responders through a network designed to improve transportation and emergency communications throughout the Shenandoah Valley region of northern Virginia. *See* <http://www.comcare.org/projects/states/va/valley.html>. This network, created through a public/private partnership, integrates leading edge wireless technologies, including high-speed data switching and broadband, to expedite response time to emergencies throughout the area. *See* <http://www.comcare.org/research/news/comcare_insider/ComCARE%20Insider%204-02.pdf>.

above, license-exempt spectrum may be used in supplementing public safety systems, the need for dedicated spectrum for public safety will remain.

Security surveillance. Wireless broadband technologies assist many consumers in securing their homes and businesses through wireless surveillance systems. Shopping centers, transportation systems, and military bases have begun to install video surveillance in areas that are too remote, expensive or physically impossible to reach through other methods (*e.g.*, cable). Companies such as Proxim Wireless Networks have developed wireless security systems that allow relatively fast installation of an unlimited number of video surveillance cameras in new or expanded security systems.[127]

Secure networks. In addition, technological advances are enabling more secure wireless networks, safeguarding the confidentiality of the information transmitted over the network. Many of these technologies provide secure private networks to individuals and businesses that deal with highly confidential information. A number of companies have developed unlicensed wireless broadband networks that focus on secure networking. Wheatland Broadband, the broadband Internet access division of Wheatland Electric Cooperative, Inc., has deployed several technologies to offer broadband data and voice services to its 17,000 member customers.[128] Supporting both 2.4 and 5.8 GHz in a single system, Wheatland Broadband currently provides more than 1,000 wireless connections to businesses and residents throughout its eleven-county footprint.[129] Similarly, Sting Communications offers secure, fixed wireless broadband for business customers, multi-tenant facilities, healthcare organizations and educational institutions.[130] Sting's virtual private network service allows its customers to ensure that they have secure, private networks over Sting's public backbone network and the Internet, and provides accessibility for mobile users as well as VoIP service to remote facilities.[131]

Educational applications. From colleges to elementary schools, students are able to take advantage of a ubiquitous connection to their school's network via a wireless broadband connection, allowing them to receive information, complete assignments, and access the Internet from locations other than the computer lab.

---

[127] *See generally* <http://www.proxim.com>. Each security camera transmits real-time video directly to a Proxim base station in the customer's on-site security office or regional security center, from which Proxim's wireless network remotely controls the cameras. Proxim also offers outdoor broadband wireless solutions in various capacities, from small range solutions for campus and mall security to regional homeland security systems that cover thousands of square miles.

[128] *Wheatland Electric Revolutionizes Internet Access in Western Kansas by Building Vast Wireless Network*, Press Release, Alvarion, Apr. 7, 2003; *see also* Alvarion Comments at 12.

[129] *See Wheatland Electric Revolutionizes Internet Access in Western Kansas by Building Vast Wireless Network*, Press Release, Alvarion, Apr. 7, 2003.

[130] *See* Sting Communications, *About Us*, available at <http://www.stingcomm.com>; *see also* Alvarion Comments at 12.

[131] *See* Sting Communications, *Products & Services*, available at <http://www.stingcomm.com>.

Some U.S. schools are launching pilot programs using wireless broadband technology to create wireless Internet campuses. For instance, Packer Collegiate Institute in Brooklyn, NY, has turned its entire campus into a wireless Internet-access zone. Packer requires that all assignments and homework be completed and turned in online, and pencil and paper used exclusively for tests and quizzes. Packer's program provides students with continuous access to the school's network from any location, and has become a model for similar projects in other schools.[132] Similarly, the Spring Independent School District is in the process of installing Wi-Fi wireless broadband systems throughout all of its facilities. The school district currently serves Spring, TX, a north Houston suburb, including more than 27,000 students and faculty. Bammel Middle School, which opened in February 2004, is one of the first schools to have the WLAN switching system and the district's first "wireless campus."[133]

Public television stations have dedicated one-quarter of their digital channel capacity to providing future access for all Americans to formal educational services.[134] For instance, the Wisconsin Educational Communications Board has used DTV technology to deliver educational data overnight to local schools with computers equipped with DTV tuner cards.[135] Similarly, the state of New Jersey has implemented educational programs for both children and adults using wireless broadband technology.[136]

C. Trends and Drivers of Future Growth in Wireless Broadband

In the United States, adoption of broadband services is increasing dramatically. According to the latest deployment data released by the Commission, subscribership to high-speed lines, which provide Internet connections at speeds exceeding 200 kbps in at least one direction, increased from 9.6 million lines in June 2001 to 32.5 million lines in

---

[132] *See Wi-Fi Technology Finds Its Place In Classrooms,* WNBC.com, Nov. 17, 2003, available at <http://www.wnbc.com/technology/2643872/detail.html>; *see also* Lev Grossman, *Old School, New Tricks, Time Wireless Society,* Nov. 3, 2003, at <http://www.time.com/time/2003/wireless/article/old_school__new_tricks_01_print.html>.

[133] *See* Christine Hall, *Houston Area School District Goes Wi-Fi*, Houston Business Journal, Jun. 15, 2004, available at <http://www.bizjournals.com/houston/stories/2004/06/14/daily15.html>. The first phase of the installation will involve setting up Wi-Fi access points and switching systems throughout the district's 25 elementary, middle and high schools. The district currently operates a voice, video and data network that sustains 2,000 Internet protocol (IP) phones and more than 6,500 student and faculty data devices, including desktop computers, PDAs and laptops. *See id.*

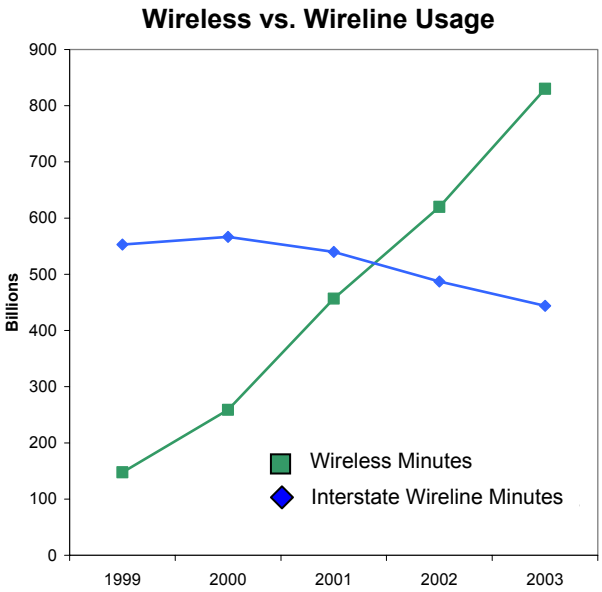
[134] *See* Association for Public Television Stations Comments at 2.

[135] *See id*. at 3.

[136] The New Jersey Network has produced video content that it transmits to its pilot site, a media server located in Columbus Elementary School in Trenton. Teachers may instantaneously download course supplements and other materials as needed. Through its New Jersey Workplace Literacy Program, the New Jersey Network has addressed adult literacy programs through a partnership with the New Jersey Department of Labor. Utilizing wireless broadband technology and its digital television signal, the network delivers training materials to welfare recipients, dislocated workers and other job seekers throughout New Jersey. *See* Association for Public Television Stations Comments at 2.

June 2004.[137] In addition, the U.S. Department of Commerce reports that the percentage of U.S. households with broadband connections grew from 9.1 percent in September 2001 to 19.9 percent in October 2003.[138] To look at it from a different angle, surveys conducted by the Pew Internet & American Life Project (Pew) demonstrate that among Internet users in the United States, the number connecting using broadband is growing.[139]

Figure 10.
An Increasingly Wireless World



Americans now spend more time talking on their cell phones than their wireline phones. This familiarity with wireless is likely to help drive demand for wireless broadband.

Wireless broadband service currently, however, represents only a small share of the total market of these broadband services. According to Pew estimates, only 1.6 million of the 48 million adult Americans who subscribe to broadband use wireless technology for the last mile.[140] And, according to Commission estimates, only 421,690 of the of the 32.5 million high-speed lines in service are offered using wireless or satellite technology.[141] Instead, cable modem and ADSL service providers offer the vast majority

---

[137] *High Speed Services for Internet Access: Status as of June 30, 2004*, Federal Communications Commission (WCB), December 2004, Table 1. Subscribership to advanced services lines, which provide at least 200 kbps in both directions, grew from 5.9 million total lines in service as of June 2001 to 23.5 million as of June 2004. *Id.*, Table 2.

[138] U.S. Department of Commerce, Economics and Statistics Administration, National Telecommunications and Information Administration, Sept. 2004, at 1.

[139] John B. Horrigan, *55% of Adult Internet Users Have Broadband at Home or Work*, Pew Internet Project Data Memo, Pew Internet & American Life Project, April 2004, at 1. As of March 1, 2004, 39 percent of all adult Internet users (or 48 million people) had broadband connections at home to access the Internet, an increase of 60 percent since March 2003. *Id.*

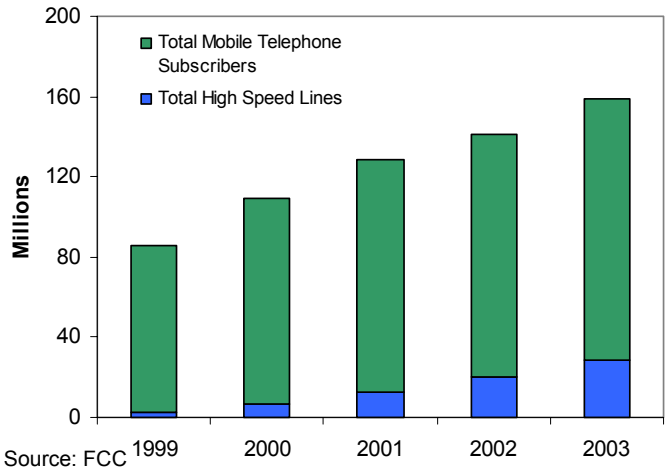
[140] *Id.* at 3.

[141] *High Speed Services for Internet Access: Status as of June 30, 2004*, FCC, December 2004, Table 1. Because the Commission has not required broadband providers with fewer than 250 subscribers in a state to report their total lines in service, Commission data does not capture broadband customers using small providers, including the hundreds of wireless ISPs that serve sparsely-populated rural areas and have a small number of customers. However, in November 2004, these thresholds were eliminated, and all broadband providers, regardless of their number of subscribers, must report their total high-speed and advanced services lines in service in each state beginning with the September 1, 2005 Form 477 filing deadline (for data as of June 30, 2005). See Local Telephone Competition and Broadband Reporting, *Report and Order*, 19 FCC Rcd 22340.

of advanced services lines, with cable representing 57.3 percent and ADSL representing 35.1 percent.[142]

Despite its relatively small share of the broadband market, wireless broadband has substantial potential for growth, as evidenced by the growing number of people who use wireless devices, such as cell phones or Wi-Fi-enabled laptops, to connect to the Internet. According to Pew, 41 percent of all Internet users – or 56 million people (28 percent of all Americans) – use devices that are capable of accessing the Internet wirelessly,[143] and 17 percent of all Internet users – or 21 million people – have used such a device to log on to the Internet.[144] Among young adults age 18 to 27, approximately 45 percent use a cell phone with wireless Internet capabilities, and 22 percent use Wi-Fi-enabled laptops.[145] While the wireless Internet capabilities of the cell phones represented in this study are not fast enough to be considered broadband, they represent the familiarity with and adoption of wireless data services generally and the potential growth of wireless broadband services, particularly among younger Americans. Several telecommunications analysts, such as Goldman Sachs, believe the use of wireless data services will grow as the younger population matures.[146]

Figure 11.
Wireless Broadband: Building on the Success of Two High-Growth Industries



Source: FCC

The emerging wireless broadband market will capitalize on the widespread use of mobile phones and the growing demand for broadband connections.

Several distinguishing features of wireless broadband should drive demand for these services. Wireless broadband devices have the ability to provide both mobility and portability when connecting to the Internet, features that many

[142] *High Speed Services for Internet Access: Status as of June 30, 2004*, FCC, December 2004, Table 2.

[143] John B. Horrigan, *28% of American Adults are Wireless Ready*, Pew Internet Project Data Memo, Pew Internet & American Life Project, May 2004.

[144] Lee Rainie, *Latest Internet Tracking Data*, Pew Internet Project Data Memo, Pew Internet & American Life Project, Apr. 13, 2004, at 4.

[145] John B. Horrigan, *28% of American Adults are Wireless Ready*, Pew Internet Project Data Memo, Pew Internet & American Life Project, May 2004.

[146] *See, e.g.,* Frank J. Governali *et al*., *Wireless Data Prospects Brightening*, Wireless-United States, Goldman Sachs, Apr. 16, 2004, at 8. In the report, the company stated, "Younger subscribers have a proclivity for data services and so are likely to use more of them as they get older and their incomes expand." *Id.*

believe will drive demand for wireless broadband. Pew reports that, among Internet users with wireless enabled devices, 44 percent have used the devices to log on to the Internet while away from home or work.[147] Another factor that will drive the demand for wireless broadband services is the increasing penetration of Internet-capable devices with enhanced features, such as improved cameras, color screens, battery life, and storage capabilities. Furthermore, in looking at which mobile applications will become widespread, two Wall Street analysts expect gaming, the capture and transmission of video and high-resolution photos, real-time streaming video, music downloading, mapping, and transaction services will be popular with consumers.[148] On the enterprise side, Goldman Sachs expects the mobilization of existing applications, as has already occurred with e-mail, will be successful, as well as field service automation, telematics, and inventory tracking. Merrill Lynch states that all types of content and communication, including voice and video, will increasingly become available in an IP format and that, as this occurs, applications and content businesses will continue to become separated from network businesses.[149]

Moreover, wireless broadband providers are developing more effective pricing plans to encourage more use of wireless broadband. For instance, wireless data providers are moving away from megabyte-based pricing schemes and toward unlimited or per application pricing models; this simplifies pricing and is easier for consumers to grasp, and in turn may drive further demand for wireless data services.[150] Finally, even though consumers may not need broadband capabilities on a wide area basis much of the time, Goldman Sachs notes that the easy availability of access to a wireless broadband network provides valuable freedoms to users – such as eliminating the need to anticipate when or where, or even why, one may need to use the service – that will lead to further demand.[151]

Another development that may lead to additional demand for wireless broadband is the evolution of Voice-over-IP (VoIP) technology. As VoIP transitions from a limited solution to a mass-market product, this technology could stimulate additional demand for broadband connections.[152] The outlook for wireless VoIP, however, is still uncertain, particularly given the current pricing structure in the mobile wireless industry, which

---

[147] John B. Horrigan, *28% of American Adults are Wireless Ready*, Pew Internet Project Data Memo, Pew Internet & American Life Project, May 2004.

[148] Mike McCormack and Phil Cusick, *Wireless Broadband: The Impact of 802 Technology*, U.S. Wireline/Wireless Services, Bear Stearns, June 2004; Frank J. Governali *et al*., *Wireless Data Prospects Brightening*, Wireless-United States, Goldman Sachs, Apr. 16, 2004.

[149] Glen Campbell *et al*., *Everything over IP*, Global Telecommunications, Merrill Lynch, June 8, 2004.

[150] Frank J. Governali *et al*., *Wireless Data Prospects Brightening*, Wireless-United States, Goldman Sachs, Apr. 16, 2004.

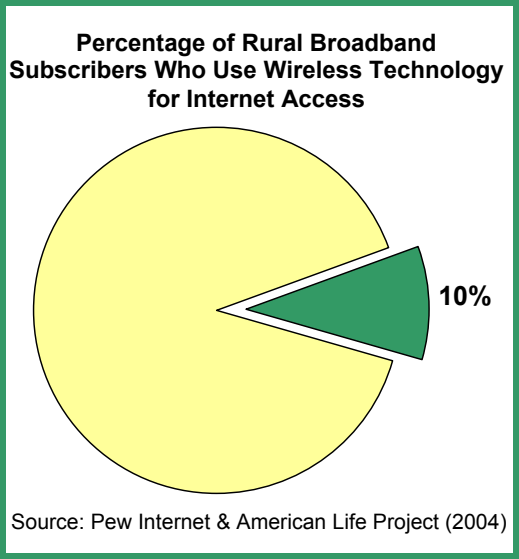
[151] *Id.*

[152] Linda Mutschler *et al.*, *European Wireless – Disruptive Technologies on the Horizon?*, Telecom Services-Wireless Cellular, Merrill Lynch, Mar. 12, 2004.

offers inexpensive per-minute rates for voice calls and relatively more expensive rates for broadband data access.[153]

Analysts anticipate several other trends that may influence the future development of the wireless broadband market. For instance, Bear Stearns believes that no single wireless broadband technology will dominate, and instead that a variety of platforms will provide different types of solutions.[154] Merrill Lynch asserts that the fragmentation of Wi-Fi networks may be transformed into a subscription model by aggregators or roaming agreements. Moreover, it believes that Wi-Fi and third generation mobile networks (*e.g.*, WCDMA and EV-DO) can develop into complementary, integrated networks, with 3G applications being mobile and less bandwidth intensive, and Wi-Fi applications being portable and more bandwidth intensive. Merrill Lynch notes that the 802.16 (WiMax) and 802.20 technology standards will help drive wireless broadband adoption by significantly lowering per-unit equipment costs, and believes that WiMax has the potential to achieve ubiquitous broadband coverage at a relatively low cost.[155] Finally, analysts at both Bear Stearns and Merrill Lynch expect the technology to become widely deployed between 2006 and 2008.[156]

Figure 12.
Wireless Broadband Increasingly A Solution in Rural Areas



In examining rural areas of the United States in particular, analysts have found that broadband adoption is lower than in urban areas. Pew reports that only 10 percent of Americans in rural areas use broadband to connect to the Internet from home, versus 24 percent of the nation as a whole.[157] Furthermore, the Department of Commerce has found that 24.7 percent of Internet households in rural areas have broadband connections versus 40.4 percent in urban areas.[158] Analysts do, however,

[153] *Id.*; *see also* Mike McCormack and Phil Cusick, *Wireless Broadband: The Impact of 802 Technology*, U.S. Wireline/Wireless Services, Bear Stearns, June 2004.

[154] Mike McCormack and Phil Cusick, *Wireless Broadband: The Impact of 802 Technology*, U.S. Wireline/Wireless Services, Bear Stearns, June 2004.

[155] Linda Mutschler *et al.*, *European Wireless – Disruptive Technologies on the Horizon?*, Telecom Services-Wireless Cellular, Merrill Lynch, Mar. 12, 2004.

[156] *See id.*; Mike McCormack and Phil Cusick, *Wireless Broadband: The Impact of 802 Technology*, U.S. Wireline/Wireless Services, Bear Stearns, June 2004.

[157] John B. Horrigan, *55% of Adult Internet Users Have Broadband at Home or Work*, Pew Internet Project Data Memo, Pew Internet & American Life Project, April 2004, at 7.

[158] *A Nation Online: Entering the Broadband Age*, U.S. Department of Commerce, Economics and Statistics Administration, National Telecommunications and Information Administration, Sept. 2004, at 1.

expect that there will be more and more deployment of wireless broadband in rural areas of the country. They note that in many of these areas, broadband services are not currently available. Because it is often less costly to deploy wireless broadband instead of DSL or cable, they expect rural telephone companies, among others, to express increasing interest in deploying such technologies.[159] One analyst predicts WiMAX will garner a 15% share of the total broadband market in metropolitan areas but as much as a 50 percent share of the broadband market in rural areas and "tier 3" towns.[160]

V. Commission Initiatives

The Commission places a high priority on ensuring that Americans have access to broadband services through multiple facilities-based platforms, including those that employ terrestrial wireless spectrum. In several actions over the last few years, the Commission has demonstrated that it is strongly committed to facilitating wireless broadband investment and deployment, particularly through making it easier for entities to gain access to spectrum and to employ new and advanced technologies that serve to provide wireless broadband to the public. Broadband wireless service has the potential to compete with wireline technologies in urban and suburban markets as a primary pipe to the home and business, to complement wireline technologies by adding a component of mobility or portability, and to lead the way in rural markets where other broadband technologies are less feasible.

Specifically, in recent years the Commission has taken significant steps to facilitate the deployment of broadband wireless services through initiatives that aim to meet three general goals: (1) increasing the availability of spectrum that can be used in the provision of broadband services; (2) allowing maximum technical and regulatory flexibility for entities seeking to provide wireless broadband; and (3) facilitating the development of the wireless broadband infrastructure by providing more regulatory certainty and removing regulatory disincentives.

A. Making More Spectrum Available

A crucial ingredient to the development of broadband applications and services over wireless networks is the availability of sufficient spectrum for the provision of wireless broadband. To that end, the Commission recently has taken several important steps to make more spectrum in several bands – in the lower, middle, and upper ranges – available for wireless broadband use for both unlicensed and licensed wireless broadband technologies.

700 MHz Band. Over the last few years, the Commission has taken several additional steps to make spectrum occupied by television channels 52-69 available for

[159] Mike McCormack and Phil Cusick, *Wireless Broadband: The Impact of 802 Technology*, U.S. Wireline/Wireless Services, Bear Stearns, June 2004.

[160] *Wireless*, COMMUNICATIONS DAILY, Feb. 17, 2005 (citing In-Stat analyst Keith Nissen).

both public safety and new advanced 700 MHz wireless services.[161] The 700 MHz band is a critical resource for wireless broadband services in particular because of its superior propagation characteristics, building penetration capability, and suitability for mobile applications. In orders adopted in December 2001 and October 2003, the Commission completed rulemakings to reallocate the non-public safety portion of the "upper" 700 MHz Band and the entire "lower" 700 MHz Band to new fixed and mobile services for a broad range of flexible uses.[162] As these channels are cleared of incumbent broadcasters, prime spectrum becomes available for uses ranging from the implementation of next generation applications and extensions of existing mobile and fixed networks to the implementation of various innovative stand-alone technologies and services. Also, because the band is situated near spectrum currently licensed to cellular and other CMRS services, this allocation creates efficiencies for carriers and manufacturers in designing new products and networks that would benefit consumers. In orders adopted in August 2002, September 2003, November 2003, and August 2004, the Commission has taken various additional actions that, among other things, serve to advance the transition to digital television. These include, respectively, its adoption of a DTV tuner mandate, rules for "plug and play" television sets, the "broadcast flag" digital content protection mechanism, and "use or lose" dates for broadcasters to transmit at full power.[163] With continued cooperation from broadcasters, cable operators, DBS providers, and consumer electronics manufacturers/retailers, the Commission seeks to transition the band to new wireless services in the most expeditious manner possible.

---

[161] As part of the transition of TV services to digital television (DTV), broadcasters are being moved from Channels 60-69 and Channels 52-59 to assignments below Channel 52. These actions will make this spectrum – 60 MHz of spectrum referred to as the "Upper 700 MHz Band" and 48 MHz referred to as the "Lower 700 MHz Band" – available for new services. Congress has mandated that 24 MHz of the Upper 700 MHz Band be reallocated to public safety services, and that the remaining 700 MHz spectrum be auctioned.

[162] *See* Service Rules for 746-764 and 776-794 MHz Bands, and Revisions to Part 27 of the Commission's Rules, Carriage of the Transmissions of Digital Television Broadcast Stations, Review of the Commission's Rules and Policies Affecting the Conversion to Digital Television, *Third Report and Order*, 16 FCC Rcd 2703 (2001); Service Rules for 746-764 and 776-794 MHz Bands, and Revisions to Part 27 of the Commission's Rules, Carriage of the Transmissions of Digital Television Broadcast Stations, Review of the Commission's Rules and Policies Affecting the Conversion to Digital Television, *Order on Reconsideration of the Third Report and Order*, 16 FCC Rcd 21633 (2001); Reallocation and Service Rules for the 698-746 MHz Spectrum Band (Television Channels 52-59), *Report and Order*, 17 FCC Rcd 1022 (2001); Service Rules for 746-764 and 776-794 MHz Bands, and Revisions to Part 27 of the Commission's Rules, Carriage of the Transmissions of Digital Television Broadcast Stations, Review of the Commission's Rules and Policies Affecting the Conversion to Digital Television, *Second Order on Reconsideration of the Third Report and Order*, 18 FCC Rcd 23308 (2003).

[163] *See* Review of the Commission's Rules and Policies Affecting the Conversion to Digital Television, *Second Report and Order and Second Memorandum Opinion and Order*, 17 FCC Rcd 15978 (2002); Implementation of Section 304 of the Telecommunications Act of 1996; Commercial Availability of Navigation Devices and Compatibility Between Cable Systems and Consumer Electronics Equipment, *Second Report and Order and Second Further Notice of Proposed Rulemaking,* 18 FCC Rcd 20885 (2003); Digital Broadcast Content Protection, *Report and Order and Further Notice of Proposed Rulemaking*, 18 FCC Rcd 23550 (2003); Second Periodic Review of the Commission's Rules and Policies Affecting the Conversion To Digital Television, *Report and Order*, 19 FCC Rcd 18279 (2004).

4.9 GHz Service. In April 2003, in the 4.9 GHz proceeding, the Commission took action to ensure that spectrum suitable for wireless broadband applications was made available in support of public safety. The Commission limited eligibility in the band to those entities that would be operating in support of public safety, and then adopted innovative approaches to allow broadband technologies to develop in the band.[164] For example, instead of only assigning narrow channels to licensees, the Commission granted licensees the authority to use the entire 50 megahertz block of spectrum. This will allow manufacturers to develop, and licensees to utilize, a variety of new broadband applications employing varying bandwidths. These applications could include high-speed digital technologies and wireless local area networks for incident scene management, dispatch operations, and vehicular operations that are both temporary and permanent in nature. In addition, the Commission developed a framework for dedicated short-range communications (DSRC) in the 5.8 GHz band that will provide the critical communications link for intelligent transportation systems (ITS).[165] Some examples of public safety short-range DSRC applications include: intersection collision avoidance, lane merge, work zone warnings, road condition warnings, vehicle stopped or slowing, vehicle/vehicle collision avoidance, imminent collision warning, rollover warning, and electronic toll collection.

70/80/90 GHz Service. In October 2003, the Commission took action to promote wireless broadband services in the upper fixed microwave bands. After working closely with the National Telecommunications and Information Administration (NTIA), the Commission was able to make spectrum in the 70, 80, and 90 GHz bands available for commercial use.[166] These bands are well-suited for licensees to offer a wide range of innovative products and services, including high-speed, point-to-point and point-to-multipoint wireless local area networks, and broadband Internet access. In order to rapidly open up this spectrum for the use of more innovative technologies, the Commission took a creative approach to spectrum access. Because of the "pencil-beam" characteristics of the signals transmitted in these bands, systems can be engineered to operate in close proximity to one another without causing interference. In light of this, the Commission adopted a non-exclusive licensing approach for these bands where each path will be registered in a database, and entitled to interference protection based on the date of registration. This approach to licensing this spectrum will provide an effective means of achieving greater spectrum efficiency by allowing a maximum number of users to share these bands while evolving their systems to meet future needs and requirements.

---

[164] *See* The 4.9 GHz Band Transferred from Federal Government Use, *Second Report and Order and Further Notice of Proposed Rule Making*, 17 FCC Rcd 3955 (2002); The 4.9 GHz Band Transferred from Federal Government Use, *Memorandum Opinion and Order and Third Report and Order,* 18 FCC Rcd 9152 (2003); *see also* The 4.9 GHz Band Transferred from Federal Government Use, *Memorandum Opinion and Order*, 19 FCC Rcd 22325 (2004).

[165] *See* Amendment of the Commission's Rules Regarding Dedicated Short-Range Communication Services in the 5.850-5.925 GHz Band (5.9 GHz Band), Amendment of Parts 2 and 90 of the Commission's Rules to Allocate the 5.850-5.925 GHz Band to the Mobile Service for Dedicated Short Range Communications of Intelligent Transportation Services, *Report and Order*, 19 FCC Rcd 2458 (2004).

[166] *See* Allocations and Service Rules for the 71-76 GHz, 81-86 GHz and 92-95 GHz Bands, *Report and Order*, 18 FCC Rcd 23318 (2003).

5 GHz proceeding. In November 2003, the Commission made available an additional 255 megahertz of spectrum in the 5.470-5.725 GHz band for unlicensed National Information Infrastructure (U-NII) devices.[167] This action aligned the frequency bands used by U-NII devices in the United States with bands in other parts of the world, thus decreasing development and manufacturing costs for U.S. manufacturers by allowing for the same products to be used in most parts of the world. As noted by the Commission, the increased demand that will result from expanding the markets for U-NII devices, coupled with the operational flexibility provided by the U-NII rules, will lead manufacturers to develop a wide range of new and innovative unlicensed devices and thereby increase wireless broadband access and investment.[168]

Advanced Wireless Services (AWS). Also in November 2003, in the Advanced Wireless Services (AWS) proceeding, the Commission made an additional 90 megahertz of licensed spectrum available for advanced wireless services that can be used in providing wireless broadband.[169] This newly available spectrum was established in the 1710-1755 MHz bands paired with spectrum in the 2110-2155 MHz bands,[170] and can be used to provide similar broadband services provided using broadband PCS spectrum in nearby bands.[171] In achieving its goal of finding additional spectrum suitable for advanced wireless use, the Commission had worked closely with federal government spectrum holders and with NTIA. In September 2004, in the same proceeding, the Commission identified an additional 20 megahertz of spectrum in four nearby bands – the 1915-1920 MHz, 1995-2000 MHz, 2020-2025 MHz, and 2175-2180 MHz bands[172] – that might be available for commercial use, and issued a Notice of Proposed Rulemaking to establish service rules that enable advanced wireless services to use this spectrum.[173]

3650 MHz proceeding. In April 2004, the Commission sought comment on amending rules governing the 50 megahertz of spectrum in the 3650-3700 MHz band. The Commission's goal is to develop policies and rules that foster the introduction of

---

[167] *See* Revision of Parts 2 and 15 of the Commission's Rules to Permit Unlicensed National Infrastructure (U-NII) Devices in the 5GHz Band, *Report and Order*, 18 FCC Rcd 24484 (2003).

[168] *Id.*

[169] Service Rules for Advanced Wireless Services in the 1.7 GHz and 2.1 GHz Bands, *Report and Order*, 18 FCC Rcd 25162 (2003).

[170] The Commission paired bands in the 1710-1755 MHz bands with symmetrical bands between 2120-2155 MHz.

[171] Broadband PCS uses the 1850-1910 and 1930-1990 MHz bands.

[172] The Commission allocated and paired five-megahertz blocks of spectrum at 1915-1920 MHz with 1995-2000 MHz, and 2020-2025 MHz with 2175-2180 MHz for AWS use.

[173] *See* Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, Including Third Generation Wireless Systems, *Sixth Report and Order, Third Memorandum Opinion and Order and Fifth Memorandum Opinion and Order*, 19 FCC Rcd 20720 (2004); Service Rules for Advanced Wireless Services in the 1915-1920 MHz, 1995-2000 MHz, 2020-2025 MHz and 2175-2180 MHz Bands, *Notice of Proposed Rulemaking*, 19 FCC Rcd 19263 (2004).

new and advanced services in the band such as wireless broadband. The Commission proposed to allow unlicensed devices in the band under higher power limits than currently authorized under Part 15 of the rules, or alternatively whether to provide a combination of unlicensed and licensed terrestrial services in the band.[174] The Commission staff is reviewing the record and preparing recommendations for further actions.

Unlicensed operation in the TV broadcast bands. In May 2004, the Commission proposed to allow unlicensed operation in the channels 2 through 51 TV broadcast bands at locations where the spectrum is not in use by licensed services.[175] The spectrum potentially included for unlicensed operations is found in the 76-88 MHz, 174-216 MHz, 470-608 MHz and 614-698 MHz bands. The Commission's proposals would provide opportunities for the development of new unlicensed wireless communications devices and systems and make more efficient use of the TV spectrum. To ensure that no harmful interference to TV stations and other authorized users of the spectrum will occur, the Commission proposed to define when a TV channel is "unused" and to require unlicensed devices to incorporate "smart radio" features to identify the unused TV channels in the area where they are located. The Commission staff is reviewing the record and preparing recommendations for further actions.

B. Permitting Flexibility to Allow the Market to Innovate

Providing greater flexibility in the service rules and in the manner in which entities can gain access to existing spectrum enhances the ability of service providers, manufacturers, and application developers to bring wireless broadband to the American people. To that end, the Commission also has made substantial efforts to allow licensees and parties seeking access to spectrum the flexibility to use spectrum for its highest and best purposes, as determined by the market.

Secondary markets in spectrum. Over the last two years, in the *Secondary Markets* proceeding, the Commission took significant action to facilitate the ability of entities seeking to gain access to any licensed wireless spectrum that could be used to provide wireless broadband services. In two separate orders, adopted in May 2003 and July 2004, the Commission established new policies and rules that permit parties to enter into a wide variety of spectrum leasing arrangements to enable them to access the amount of licensed spectrum they may need to provide service.[176] Specifically, the rules adopted

---

[174] *See* Unlicensed Operation in the Band 3650-3700 MHz, *Notice of Proposed Rulemaking*, 19 FCC Rcd 10018 (2004).

[175] *See* Unlicensed Operation in the TV Broadcast Bands, *Notice of Proposed Rulemaking*, 19 FCC Rcd 10018 (2004).

[176] *See* Promoting Efficient Use of Spectrum Through Elimination of Barriers to the Development of Secondary Markets, *Report and Order and Further Notice of Proposed Rulemaking*, 18 FCC Rcd 20604 (2003) (*Secondary Markets First Report and Order*); Promoting Efficient Use of Spectrum Through Elimination of Barriers to the Development of Secondary Markets, *Second Report and Order, Order on Reconsideration, and Second Further Notice of Proposed Rulemaking,* 19 FCC Rcd 17503 (2004) (*Secondary Markets Second Report and Order*).

in the *Secondary Markets* proceeding permit licensees holding exclusive use licenses in the Wireless Radio Services – including spectrum in the cellular, 800 MHz SMR, broadband PCS, AWS, BRS/EBS, WCS, LMDS, 24 GHz, and 39 GHz bands – to lease access to some or all of the spectrum associated with their licenses to third parties in need of licensed spectrum. In addition, the proceeding established a streamlined approval process for transfers and assignments of licenses.[177]

In the most recently issued order in this proceeding, the Commission adopted policies that permit immediate (*i.e.*, overnight) processing of certain qualifying spectrum leasing arrangements as well as certain qualifying transfers and assignments of licenses. The Commission also clarified that the spectrum leasing rules permit parties to enter a variety of "dynamic" leasing arrangements. Such arrangements, made increasingly possible by technological advances, enable licensees and spectrum lessees to enter into agreements to share use of the same licensed spectrum over the same period of time. The Commission also introduced a new, "private commons" model that permits users of "peer-to-peer" communications technologies to gain access to licensed spectrum quickly and easily. This new option has the potential to provide spectrum for *ad hoc* and "mesh" wireless broadband networks that may currently use the unlicensed bands to gain access to additional spectrum that may be less crowded or more suited to a particular application.[178] The Commission is seeking comment on ways in which it might modify or expand the private commons model, such as allowing intermediaries to facilitate transactions with users, to design and deploy networks for users, and to provide value-added services or applications.[179] The Commission staff will be reviewing the record and preparing recommendations for possible further actions.

Additionally, by facilitating the availability of spectrum through spectrum leasing, the *Secondary Markets* proceeding offers the promise of greater wireless deployment in rural America by enhancing economic opportunities and access for the provision of communications services by small businesses and enabling development of additional and innovative services in rural areas. For example, a carrier with a nationwide license can, without significant transaction costs, lease or sell spectrum to rural carriers to build networks in rural areas. Rural carriers thus have the potential to obtain spectrum and build networks suited to their particular geography, while at the same time enabling the national carrier to develop partners to fill out its service coverage areas. Spectrum leasing and transfers – along with partitioning and disaggregation – thus provide flexibility for the development of additional and innovative services in rural areas.

---

[177] In order to provide licensees more flexibility when leasing spectrum, the Commission revised the standard for determining whether a licensee retains *de facto* control for purposes of Section 310(d). It then created a new and flexible regime for parties seeking to enter into spectrum leases, allowing leases for which the licensee retains *de facto* control of the spectrum to proceed without prior Commission approval and permitting leases in which *de facto* control is transferred to spectrum lessees to proceed by means of a streamlined approval process. *See generally Secondary Markets First Report and Order.*

[178] *See Secondary Markets Second Report and Order*, 19 FCC Rcd 17503.

[179] *See id.*

Cognitive Radio Technologies. In December 2003, the Commission proposed changes to promote the use of cognitive radio technologies to facilitate more flexible, efficient, and reliable spectrum use.[180] The Commission: (1) proposed to allow the use of higher power by unlicensed devices in rural or other areas of limited spectrum use if the device incorporates a method to limit higher power operation to such areas to provide improved spectrum coverage by wireless Internet service providers (WISPs) and other parties serving rural areas; (2) sought comment on a specific technical model for the implementation of "interruptible" spectrum leasing that could be used by commercial entities or by public safety licensees; and (3) proposed changes to the Commission's equipment authorization rules to simplify the filing requirements for software defined radios. The Commission staff is reviewing the record and preparing recommendations for further actions.

Broadband Radio Service (BRS)/Educational Broadband Service (EBS). In June 2004, in the Multipoint Distribution Service/Instructional Television Fixed Service (MDS/ITFS) proceeding, the Commission provided additional flexibility in the 2495-2690 MHz bands in order to facilitate the ability of licensees and spectrum lessees to develop and deploy innovative technologies including low-power, mobile wireless broadband technologies in the band.[181] Specifically, in the newly renamed Broadband Radio Service (BRS) and Educational Broadband Service (EBS) the Commission grouped high and low power users into separate portions of the band in order to reduce the likelihood of interference caused by incompatible uses and to create incentives for the development of low-power, cellularized broadband operations that had been inhibited by the prior band plan. It is anticipated that BRS and EBS licensees will be able to provide a competitive alternative to cable modem and DSL service and thereby transform the marketplace by expanding broadband to rural areas and decreasing the price of current broadband services. In addition, educational institutions will have the flexibility to choose whether to continue delivering high-powered educational television, develop new instructional uses over the EBS spectrum, or lease excess capacity to commercial operators to fund alternative educational delivery methods.

Smart Antennas. In July 2004, the Commission amended its rules to remove unnecessary regulatory impediments to the deployment of advanced technologies for unlicensed wireless networking.[182] Specifically, the amended rules provide for the use of

---

[180] *See* Facilitating Opportunities for Flexible, Efficient, and Reliable Spectrum Use Employing Cognitive Radio Technologies, *Notice of Proposed Rulemaking*, 18 FCC Rcd 26859 (2003).

[181] *See* Amendment of Parts 1, 21, 73, 74 and 101 of the Commission's Rules to Facilitate the Provision of Fixed and Mobile Broadband Access, Educational and Other Advanced Services in the 2150-2162 and 2500-2690 MHz Bands; Part 1 of the Commission's Rules -- Further Competitive Bidding Procedures; Amendment of Parts 21 and 74 to Enable Multipoint Distribution Service and the Instructional Television Fixed Service Amendment of Parts 21 and 74 to Engage in Fixed Two-Way Transmissions; Amendment of Parts 21 and 74 of the Commission's Rules With Regard to Licensing in the Multipoint Distribution Service and in the Instructional Television Fixed Service for the Gulf of Mexico, *Report and Order and Further Notice of Proposed Rulemaking*, 19 FCC Rcd 14165 (2004) (*BRS and EBS Report and Order*).

[182] *See* Modification of Parts 2 and 15 of the Commission's Rules for Unlicensed Devices and Equipment Approval, *Report and Order*, 19 FCC Rcd 13539 (2004).

advanced antenna technologies such as sectorized and phased array antenna systems. These "smart antennas" focus their radio transmissions according to the geographic locations of their users. Use of these advanced antenna technologies provide for increased spectrum efficiency because they permit greater re-use of the same radio frequencies. The use of smart antennas also will permit WISPs to pattern their coverage areas in a way that will best suit the needs of their customers.

Rural services. Encouraging increased development and deployment of spectrum-based services to rural areas is vital to achieve the Commission's dual objectives of promoting increased facilities-based competition and providing ubiquitous, affordable broadband services to all Americans. In July 2004, continuing its commitment to ensure that wireless service offerings are available throughout the country, including to Americans living in sparsely populated areas, the Commission took specific actions to help ensure the delivery of wireless broadband service offerings to rural America.[183] Through initiatives and policies aimed directly at facilitating access to capital and lowering regulatory and market barriers to spectrum and infrastructure in rural areas, the Commission provided incentives, financing opportunities, and access to spectrum to deploy inexpensive wireless services in rural areas. In addition, to greatly enhance rural licensees' financing opportunities the Commission gave licensees the option of granting the U.S. Department of Agriculture's Rural Utilities Service (RUS) a conditional security interest in their spectrum licenses. The Commission also eliminated the cellular cross-interest rule, which previously applied only in Rural Service Areas (RSA), and transitioned to a case-by-case competitive review for all transactions involving cellular licenses, recognizing that certain transactions are in the public interest where they could lead to the creation of efficiencies enabling the delivery of inexpensive wireless broadband access to rural areas. Relaxed build-out requirements and RF emission limits for rural licensees will also increase licensee flexibility to tailor spectrum-based services to the needs of their customers located in sparsely populated areas.

Air-Ground Radiotelephone Service. In December 2004, the Commission substantially revised the rules and band plan governing the 800 MHz commercial Air-Ground Radiotelephone Service to facilitate the development of new wireless broadband services during airplane travel.[184] The Commission provided for an auction of new licenses in the 800 MHz air-ground band in three possible band plan configurations. Each band plan includes at least one three megahertz license, which will enable a licensee to provide broadband service to consumers onboard aircraft.[185] The Commission adopted

---

[183] *See* Facilitating the Provision of Spectrum-Based Services to Rural Areas and Promoting Opportunities for Rural Telephone Companies to Provide Spectrum-Based Services, 2000 Biennial Regulatory Review Spectrum Aggregation Limits for Commercial Mobile Radio Services, Increasing Flexibility to Promote Access to and the Efficient and Intensive Use of Spectrum and the Widespread Deployment of Wireless Services, and to Facilitate Capital Formation, *Report and Order and Further Notice of Proposed Rulemaking*, 19 FCC Rcd 19078 (2004) (*Rural Services Report and Order*).

[184] *See* Amendment of Part 22 of the Commission's Rules To Benefit the Consumers of Air-Ground Telecommunications Services, *Report and Order and Notice of Proposed Rulemaking*, FCC 04-287 (rel. Feb. 22, 2005).

[185] The ultimate band plan will be determined based on the results of an auction.

flexible rules that will permit a licensee to provide any type of air-ground services of any type (*e.g.*, voice, data, broadband internet).

C. Facilitating Wireless Broadband Infrastructure Development

In order to ensure the degree of reliability, higher speeds, and lower latency[186] that are required in the provision of broadband services, sufficient infrastructure (*e.g.*, antennas, towers) is critical to wireless networks. To this end, the Commission has taken steps to facilitate the deployment of infrastructure for wireless broadband networks.

Over-the-Air Reception Devices (OTARD). The Commission in February 2004 affirmed that the consumer protections for the installation and use of consumer antennas under the Commission's Over-the-Air Reception Devices (OTARD) apply to certain kinds of wireless technologies where customer-end antennas also function to relay service to other customers, as well as to unlicensed devices generally.[187] The rules generally prohibit homeowner associations, landlords, state and local governments, or other third parties from placing restrictions that impair a customer antenna user's ability to install, maintain, or use such customer antennas transmitting and/or receiving commercial non-broadcast communications signals.[188]

Infrastructure sharing. In addition, the Commission in the Rural Services proceeding in July 2004 clarified its infrastructure sharing policies to encourage licensees and equipment manufacturers to enter into beneficial infrastructure sharing arrangements.[189] In so doing, the Commission has reduced regulatory uncertainties, thus allowing providers greater freedom to enter into these arrangements in order to reduce infrastructure costs. This, in turn, frees up more resources to be made available for providing services to the public.

National Historic Preservation Act (NHPA) review. The Commission also adopted measures to facilitate the ability of broadband wireless providers to construct communications towers and other Commission-licensed facilities when it streamlined the

---

[186] Low latency, the ability to send and receive data packets with little or no noticeable delay, is critical for increasing the benefits of broadband. *See Fourth Section 706 Broadband Deployment Report* at 12.

[187] *See* Promotion of Competitive Networks in Local Telecommunications Markets, *Order on Reconsideration*, 19 FCC Rcd 5637 (2004); "Commission Staff Clarifies FCC's Role Regarding Radio Interference Matters and its Rules Governing Customer Antennas and Other Unlicensed Equipment," *Public Notice*, 19 FCC Rcd 11300 (DA 04-1844) (OET 2004).

[188] Specifically, restrictions are prohibited when the antenna is located on property within the exclusive use or control of the user where the user has a direct or indirect ownership or leasehold interest in the property, subject to certain exceptions for safety and historic preservation. *See id.*

[189] *See Rural Services Report and Order*, 19 FCC Rcd at 19139-40 ¶ 113 (replacing the *Intermountain Microwave* standard with a more flexible *de facto* control standard). Specifically, the Commission determined that a revised and more flexible *de facto* control standard adopted in the Secondary Markets proceeding should be extended to infrastructure sharing arrangements that only involve the sharing of facilities such as physical structures and equipment. This revised *de facto* control standard for spectrum leasing will apply for interpreting whether a licensee retains *de facto* control for purposes of Section 310(d) of the Communications Act when it is engaged in an infrastructure sharing arrangement.

NHPA review process for these facilities in September 2004.[190] Key elements of the agreement include: establishing categories of "undertakings" that are excluded from the Section 106 review process; outlining procedures for communicating with federally recognized Indian tribes and Native Hawaiian Organizations in order to ensure protection of historic properties to which tribes and Native Hawaiian Organizations attach religious or cultural significance; establishing standards and streamlined procedures for identifying historic properties that may be affected by an undertaking and assessing effects on those properties; and prescribing procedures and standard forms for review of applicants' determinations by State Historic Preservation Officers and the Commission. In addition, the Commission agreed with the United South and Eastern Tribes, Inc. (USET) on voluntary best practices to guide applicants and USET member Tribes in their review of the impact of wireless towers and related communications facilities on properties of Tribal religious and cultural significance.[191]

Access to utility poles. In December 2004, the Wireless Telecommunications Bureau took action to assist wireless telecommunications providers in obtaining access to utility poles at reasonable rates in order to facilitate deployment of wireless networks. In particular, after several wireless carriers had complained that they had been denied access to utility poles for the placement of wireless antennas, the Bureau issued a Public Notice reminding owners of utility poles of their obligations, under Section 224 of the Communications Act, to provide such access.[192]

VI. Policy Recommendations

The Task Force believes that the Commission's recent initiatives to provide additional wireless spectrum for both unlicensed and licensed services have been crucial in laying the foundation for more rapid deployment of wireless broadband. We also believe that additional opportunities are available for further Commission action, and we set forth our recommendations here. Commenting parties in this proceeding, participants in the Broadband Forum, and our many outreach efforts helped guide these recommendations.

A. Wireless Broadband Services Using Networks of Unlicensed Devices

Within the last several years, the Commission has adopted policies that have significantly fostered growth in the provision of wireless broadband using unlicensed devices. Part 15 of the Commission's rules sets forth the technical rules for operations of these devices, as well as specifying the permissible frequency bands. Many of the

---

[190] *See* Nationwide Programmatic Agreement Regarding the Section 106 National Historic Preservation Act Review Process, *Report and Order*, 34 Communications Reg (P&F) 112 (2004).

[191] *See FCC and United South and Eastern Tribes, Inc. Adopt Voluntary 'Best Practices' Concerning Protection of Historic Properties of Religious and Cultural Significance to Tribes in the Tower Siting Process*, News Release, Federal Communications Commission, Oct. 25, 2004.

[192] *See* "Wireless Telecommunications Bureau Reminds Utility Pole Owners of Their Obligations to Provide Wireless Telecommunications Providers with Access to Utility Poles at Reasonable Rates," *Public Notice* (DA 04-4046) (rel. Dec. 23, 2004).

technical rules governing the operation of unlicensed devices have become more flexible, enabling more diversity of operations.[193] At the same time, additional spectrum has been made available for these devices.[194] Taken together, these policies have spawned and are continuing to foster innovative wireless broadband technologies and consumer services.[195]

As discussed in greater detail above, two of the most positive developments for wireless broadband using unlicensed devices are the dramatic increase in the number of WISPs and the proliferation of Wi-Fi hot spots throughout the country.[196] With off-the-shelf or readily available equipment and minimal investment, unlicensed WISPs are providing broadband connectivity to communities that previously had no broadband access and are also providing a competitive alternative to cable and DSL services. A decade ago, WISPs did not exist as an industry and now, depending on the estimate, there are more than 8,000 WISPs in the United States. Wi-Fi hot spots provide a different sort of broadband connectivity. Their ubiquity enables consumers to have access to broadband in many places outside the home or office – from airports to coffee houses to public parks. The total number of Wi-Fi hot spot users is projected to exceed 30 million by the end of 2004, up from only 2.5 million as recently as 2002.

The trend in the number of equipment authorizations is one indicator that shows how significantly this segment of the wireless broadband market has grown. As recently as 1995, there were approximately 1,000 equipment authorizations granted annually. Last year, the number exceeded 2,500, representing a 150% increase over the span of less than a decade. While these data are useful indicators of the upward trend in the number of devices, these figures represent only the number of the types of authorized devices and do not reflect the total number of devices deployed. Wireless networking devices of all kinds represent a significant number of the total equipment authorizations. In addition to changing various Commission rules to facilitate wireless broadband, we have streamlined, and made more market-oriented, the procedures associated with the equipment authorization process, significantly reducing the time-to-market for new wireless broadband products. For example, now equipment manufacturers can select from several private certification laboratories, in addition to the Commission's laboratory.

The continued growth of the use of unlicensed devices to provide broadband services is due to the fact that there are few barriers to entry in this market. Equipment costs are relatively low and equipment is available either off-the-shelf or readily from vendors of wireless networking equipment. In part, this reflects the relative success of the IEEE 802.11 family of standards; these ubiquitous, open standards ensure the interoperability of equipment and have effectively reduced the price point for wireless networking equipment. Access to the radio spectrum is free for unlicensed devices. Continually increasing regulatory flexibility has enabled sustained growth as well. For

[193] *See* Section V.B, *infra.*

[194] *See* Section V.A, *infra.*

[195] *See* Section IV.B (including discussion of the proliferation of Wi-Fi networks and WISPs).

[196] *See* Section IV.B.1(a), *supra.*

example, the Commission rules addressing unlicensed devices do not specify the types of technologies required to be used. Rather, they establish basic technical and operational parameters, allowing manufacturers and service providers to develop and use equipment that is appropriate for a particular application. Furthermore, technological developments, including advanced antenna technologies and more robust modulation techniques, have also contributed to the growth of this market segment.

One of the Commission's most important goals is to facilitate the provisioning of broadband services in areas without access to broadband and to foster competitive alternatives for broadband services. License-exempt WISPs are furthering this goal. With these considerations as a backdrop, the Task Force has developed the following recommendations regarding areas of concern that will continue to foster increased and competitive access to broadband using unlicensed devices.

Encourage voluntary private industry frequency coordination efforts. As the radio spectrum is used more intensively, interference mitigation among unlicensed users is an increasingly important issue. Section 15.5 of the Commission's rules provides that unlicensed devices may not cause harmful interference to authorized users and must accept any interference that they receive. Moreover, unlicensed devices operating in a spectrum band do not have any preferred standing as compared to one another. Thus, as more and more devices use a particular unlicensed band in a localized area, interference mitigation will become increasingly important and, correspondingly, more technically complex. Due to the "always-on" nature of broadband service, as compared with operations of other types of unlicensed devices with relatively shorter duty cycles, WISPs are more consistent and often more bandwidth-intensive users of spectrum. Thus, WISPs have even greater incentives to develop practices and procedures to mitigate interference.

Various voluntary private industry efforts are underway in which groups of unlicensed wireless service providers have set up databases and procedures to perform frequency coordination. These groups have found that these efforts substantially mitigate potential interference and facilitate quality of service. We support these private industry efforts and particularly note two successful initiatives – Broadband Access Network Coordination (BANC) and West Texas Area Spectrum Coordination (WTASC)[197] – that may serve as model examples for other private industry groups. BANC has been in existence for several years. While originally started in the San Francisco area, the BANC model is now being used in other areas as well, most notably, Los Angeles and San Diego.[198] The WTASC was formed in 2004.

The first objective of these frequency coordination initiatives is to encourage all spectrum users in a localized area to become members. In addition to WISPs, this would

[197] The web site for the BANC frequency coordination group is <http://www.wbanc.com>. Members of the Task Force were able to see a demonstration of the BANC system, and further discussion of this demonstration can be found in the Appendix to this report. *See* Appendix C. In West Texas, more information about the frequency coordination group is available at <http://www.wtasc.org>.

[198] *See* Appendix C (BANC Field Study).

include community networks, corporate or university campus networks, local school districts operating unlicensed wireless networks, and operators of other systems that use unlicensed devices. All relevant network information, including location of network links, operating frequencies, antenna heights, and transmit powers, are entered into a shared database. Members agree to pre-coordinate any network changes or additions with other members. Usually, providers do not have access to one another's network-specific technical information, but are notified if a desired network modification will cause any interference.

One of the benefits cited for frequency coordination is the ability for more operators to share the same spectrum bands, avoiding the time consuming, costly, and often difficult task of determining the cause or source of any interference. Another principal benefit is to enhance service reliability.

In light of the benefits of frequency coordination groups and, given the continued growth in unlicensed wireless broadband services, we believe that more and more service providers will be interested in participating in frequency coordination efforts. To this end, we recently learned that the License Exempt Alliance is working to establish a nationwide frequency coordination database, which would serve a similar purpose as BANC and WTASC. While we are supportive of all of these private industry efforts, we believe that it is important that they remain voluntary industry initiatives and recommend that the Commission refrain from taking an active role in frequency coordination efforts in the unlicensed bands. We believe that industry members are in the best position to determine the optimal nature and extent of such coordination.

Encourage voluntary industry "best practices." While increased growth of frequency coordination groups will be helpful in enabling more intensive use of the radio spectrum, voluntary industry "best practices" will further facilitate this objective as well. For example, such practices could encourage the use of more-spectrally efficient directional antennas and encourage service providers to transmit only when there is data to transmit.

Currently, we are aware of some informal best practices, such as course certifications obtained from one of the wireless industry associations. For example, individuals who complete some of the course offerings of Part-15.org, can qualify for a Part-15.org License Exempt Professional Installer certification. Holders of this certification have been taught commonly accepted good engineering practices and are therefore more likely to act as good stewards of the spectrum environment.

Recently, the License Exempt Alliance has been working to establish "WISP University," which is a comprehensive collection of voluntary industry best practices. Topics cover a wide range of subjects, from network planning and design, to compliance with Commission rules, to some of the business aspects of running a WISP. We support the efforts of the Licensed Exempt Alliance and others to develop voluntary industry best practices among unlicensed users. While we believe that these efforts may have

significant benefits, we feel that it is important that best practices be developed and governed by private industry, without regulatory intervention.

Consider increasing the power limits in certain bands available for use by unlicensed devices. As discussed above, the license-exempt WISP industry is a relatively new development. Thus, some of the Commission's rules for unlicensed devices were not developed considering their potential applications for the provisioning of wireless broadband services. To this end, we recommend revisiting some of the Part 15 rules to determine whether possible revisions in some of the bands available for use by unlicensed devices should be revised. Some parties have already approached the Commission recommending changes, such as increasing the applicable power limits, in the rules applicable in the certain of these bands.[199] The Commission should consider the benefits of such changes applicable to unlicensed devices in certain bands, and also weigh any potential that such changes could cause additional interference among unlicensed devices operating in this spectrum.

Improve participation in Commission proceedings. Several current Commission proceedings may have potentially significant implications for WISPs, including, for example, the 3650 MHz proceeding and the TV White Space proceeding. Through postings on the Task Force's website,[200] the Task Force has made it easier for WISPs to become aware of ongoing Commission proceedings or events that may be of importance. Nonetheless, WISPs assert that they would benefit from additional outreach, in the form of periodic mass e-mailings to notify them of the adoption or release of relevant Commission documents. Although many WISPs have indicated that they cannot afford the time to file comments or cannot afford the cost of having a third party file comments on their behalf, we want to take this opportunity to emphasize that, in order to adopt policies that consider and address the needs of WISPs, we benefit from fuller participation by WISPs in Commission proceedings. The Commission comment filing procedure is fairly straightforward and is set forth in detail on the Task Force website. We encourage WISPs to feel free to contact Commission staff in the relevant Bureau(s) or Office(s) for assistance with Commission procedures for filing comments or otherwise participating.

Consider holding WISP forum on an annual or periodic basis. In addition to finding ways to improve WISP participation in Commission proceedings, the Task Force recommends that the Commission consider hosting a forum on an annual or periodic basis. Such a forum could be similar to the Rural WISP Forum held in 2003[201] or last year's Wireless Broadband Forum. This proposed forum would provide WISPs and

---

[199] For instance, one party has petitioned the Commission requesting that the power limits be increased in the 60 GHz band to increase the operating range of unlicensed devices and thereby improve the utility of this spectrum for wireless broadband distribution and backhaul purposes. *See* Wireless Communications Association Petition – Amendment of Part 15 Rules for License Exempt 57-64 GHz Band, filed Sept. 30, 2004.

[200] *See* <http://www.fcc.gov/wbatf>.

[201] *See* <http://www.fcc.gov/osp/rural-wisp/welcome.html>.

consumers an additional opportunity to weigh in and provide their views on a variety of issues and pending proceedings in a relatively non-resource intensive manner.

Encourage reporting of intentional violations of the Commission's technical rules under Part 15. License-exempt WISPs have reported informally that some WISPs operations are exceeding the scope of our rules, detracting from the ability of other WISPs to provide service. While the operations of license-exempt WISPs do not receive interference protection for unintentional interference, intentional interference (*e.g.*, jamming) from other unlicensed devices is not permissible.[202] Also, WISPs must comply with the technical requirements of the Commission's Part 15 rules (*e.g.*, maximum permissible power levels) and must install only FCC-certified equipment or systems. These Part 15 rules reflect a careful balance in striving to ensure the protection of licensed or authorized services from harmful interference while also trying to provide the maximum opportunity for services provided using unlicensed devices.

Disregard of the technical rules is a serious matter that effectively undermines the policies that the Commission has crafted. For the benefit of all spectrum users, we encourage WISPs to report potential violations of Commission rules so that they can be reviewed by our Enforcement Bureau. Over the past two years, the Enforcement Bureau has investigated nearly one dozen complaints related to the operations of WISPs. Many of these investigations were initiated by a report of a potential problem by another WISP. The Task Force recommends that the Commission explore whether there are additional ways to make it easier for WISPs to report potential violations or otherwise enable the Commission to take enforcement action against violators in as timely a manner as possible.

Recommendations

- Promote the continued development and use of voluntary private industry frequency coordination efforts to manage interference among unlicensed spectrum users.
- Promote the continued development and adoption of voluntary industry "best practices" among unlicensed users.
- Consider increasing the power limits in certain bands available for use by unlicensed devices in order to improve their utility for license-exempt WISPs.
- Encourage license-exempt WISPs to communicate their views on a proactive basis.
- Consider hosting a WISP forum on an annual or periodic basis.
- Encourage reporting of intentional violations of the Commission's Part 15 technical rules.

[202] *See* 47 C.F.R. § 15.5.

B. Wireless Broadband Using Licensed Spectrum

In order to promote wireless broadband, the Task Force believes that the Commission can take additional steps with regard to licensed spectrum. These include: (1) improving access to licensed spectrum; (2) increasing flexibility in the technical and regulatory policies to make existing licensed bands more available for wireless broadband and easier to access; and (3) providing clarifications regarding the regulatory status applied to wireless broadband.

1. Improving Access to Licensed Spectrum

Improve and streamline the allocation and assignment process. The Task Force recommends that the Commission explore innovative ways to improve and streamline the process of allocating and assigning licensed spectrum. Although using licensed spectrum provides many advantages for wireless providers, one of the disadvantages is the lengthy period of time taken to allocate and assign new spectrum. Shortening the amount of time it takes to get spectrum out of the government's hands and into the market, where companies can use it to provide services that consumers demand, is critical in the fast-paced and ever-changing world of technology and broadband.

The Task Force recommends that the Commission continue to explore new ways to reduce the amount of time between allocation and assignment. For example, the Commission could simultaneously allocate and propose service rules for spectrum, as it did recently in the Advanced Wireless Services proceeding.[203] Furthermore, in cases where parties disagree on the appropriate band plan for a new spectrum block, the Commission could consider resolving technical disputes over allocation schemes at auction by using competitive bidding to determine the band plan most highly valued by prospective licensees.[204] The Commission could then move forward with licensing based on the winning band plan.

The Task Force also recommends that the Commission consider ways to further automate the process of licensing spectrum in order to shorten the amount of time between the auction and licensing. In particular, the Task Force recommends that the Commission eliminate the requirement that bidders file duplicative information in both pre- and post-auction submissions, and that it centralize and link bidder or licensee ownership information currently reported on multiple forms (including FCC Forms 175, 601, and 602).

---

[203] Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, including Third Generation Wireless Systems, *Sixth Report and Order, Third Memorandum Opinion and Order, and Fifth Memorandum Opinion and Order*, 19 FCC Rcd 20720 (2004); Service Rules for Advanced Wireless Services in the 1915-1920 MHz, 1995-2000, 2020-2025 MHz, and 2175-2180 MHz Bands, *Notice of Proposed Rulemaking*, 19 FCC Rcd 19263 (2004).

[204] The Commission's recent order relating to the Air-Ground Radiotelephone Service is an example of this type of approach. *See Air-to-Ground Report and Order.*

Consider ways to improve international harmonization. As noted by several commenters, the Commission should continue its efforts to allocate spectrum that is in harmony with international spectrum allocations.[205] The use of a single band for the same service across multiple countries can create economies of scale in the production of wireless end-user equipment. This in turn can lower the cost of broadband-capable devices, thereby increasing the demand for broadband services and making them more accessible to a wider base of consumers. Global harmonization can also facilitate international roaming, which can increase the productivity of workers who use broadband devices when traveling around the world. We recognize that international harmonization is one factor the Commission currently considers in spectrum allocation proceedings and that it is not always feasible to match the allocations of the rest of the world.[206] While there are many factors to consider in spectrum allocation, we believe the Commission should continue to take into account the impact of international harmonization on the timely and affordable deployment of wireless broadband services in the United States.

Expedite the DTV transition to free more spectrum for wireless broadband. A number of commenters asserted that spectrum below 1 GHz is ideal for wireless broadband services due to propagation characteristics, and that the Commission should advance its efforts to make spectrum available for such services in the 700 MHz band.[207]

The Task Force recommends that the Commission continue to make every effort to ensure the availability of this spectrum in the most expeditious manner possible. The Task Force recommends that the Commission work with Congress to consider mandating a hard deadline for the completion of the DTV transition so as to free up spectrum for public safety and advanced wireless services and provide clarity to the industry and the public.

In the meantime – or in the case that a specific deadline is not set – the Task Force believes the Commission also should consider additional mechanisms for allowing 700 MHz channels to be used for wireless broadband services before the completion of the DTV transition. For instance, the Commission could consider ways to make it easier for wireless licensees to make use of the spectrum for wireless broadband services during the transition pursuant to more flexible policies that permit such licensees to use the

---

[205] *See, e.g.*, IP Wireless Comments at 15; Telecommunications Industry Association Comments at 5; Presentation of Pierre de Vries at the Commission's Wireless Broadband Forum (May 19, 2004); Presentation of Brian Markwalter at the Commission's Wireless Broadband Forum (May 19, 2004).

[206] For example, in allocating bands for second generation mobile services, the United States chose 1850-1990 MHz for broadband PCS while most European countries chose spectrum in the 900 MHz and 1700-1800 MHz bands because other factors, such as the existing uses of those bands when the need for spectrum for mobile voice services arose, took precedence and made global harmonization impossible. On the other hand, the 2.4 GHz band was allocated for unlicensed use worldwide from its inception.

[207] *See, e.g.*, Microsoft Comments at 5; Presentation of Peter de Vries at the Commission's Wireless Broadband Forum (May 19, 2004); Presentation of Charles Townsend at the Commission's Wireless Broadband Forum (May 19, 2004); Presentation of Gary Grube at the Commission's Wireless Broadband Forum (May 19, 2004); Presentation of Michael R. Anderson, President, Part-15.Org, at the Rural Wireless Broadband Hearing, Rapid City, SD, May 25, 2004.

spectrum so long as such action does not result in undue displacement of television viewers.[208] In this regard, the Commission might consider clarifying or revising this interference criteria, and/or devising a streamlined process by which licensees can establish that their operations comply with the applicable interference criteria or only result in a *de minimis* impact on viewers.[209] In addition, we recommend that the Commission consider allowing television broadcasters to use secondary market mechanisms – *i.e.*, spectrum leasing and private commons arrangements – to provide access to spectrum (*e.g.*, outside the station's hours of operation) for entities seeking to use this spectrum in the 700 MHz band or under a station's authority to offer ancillary or supplemental services. Under this latter proposal broadcasters would still have to meet their primary programming obligations under their DTV authorizations.[210]

Consider asymmetric pairing of spectrum bands. As part of the process of establishing service rules for spectrum, the Commission very often determines how and whether spectrum bands should be paired. For mobile services, the Commission has traditionally paired two licenses of equal size, one for upstream (mobile to base station) and one for downstream (base station to mobile) communications.

Broadband services differ from traditional mobile telephony services in that they often involve a high volume of downstream traffic – the result of consumers/users downloading large music and video files, as well as graphics-rich content – and a lower volume of upstream traffic. Given this paradigm, it may make sense for the Commission to consider asymmetric spectrum combinations for spectrum that is used for broadband networks carrying large volumes of Internet traffic in addition to or instead of circuit-switched voice service. Certain companies have encouraged the Commission to consider asymmetric spectrum pairing for such reasons.[211] We believe that the Commission should ensure that its rules are flexible enough to allow, but not require, pairing between asymmetric bands. Specifically, the Task Force recommends that the Commission ensure that its rules do not prevent an operator from combining multiple spectrum bands to form a single service. In addition, we believe that the Commission should consider innovative ways to assign spectrum that would allow potential licensees to acquire asymmetrically paired spectrum blocks or unpaired spectrum for the deployment technologies such as time division duplex (TDD), which do not require paired bands.

---

[208] *See, e.g.,* 47 C.F.R. § 27.60 (TV/DTV interference protection criteria).

[209] We note, for instance, that the Wireless Telecommunications Bureau just recently granted the waiver request of one wireless licensee to operate in this band provided that certain precautions were taken with regard to mitigating potential interference concerns. *See generally* Aloha Partners, L.P. Request for Waiver of Section 27.60, FCC File No. 0001777981, *Memorandum Opinion and Order* (DA 05-460) (rel. Feb. 18, 2005) (WTB 2005).

[210] *See* 47 USC § 336(a)(2), (b), (d).

[211] *See, e.g.*, IP Wireless Comments at 2-3. We note that several parties (including AT&T Wireless, Cingular Wireless, CTIA, Motorola, and WCA) in another proceeding, the AWS Allocations Proceeding (ET Docket No. 00-258), have also recommended that asymmetric pairing be considered.

2. Increasing Technical and Regulatory Flexibility

The Task Force also believes that the Commission should take additional steps to enable wireless broadband providers to use spectrum in licensed bands and to gain access to that spectrum.

Adopt more "flexible use" policies. In addition to making new spectrum available and further facilitating the development of secondary markets for spectrum, the Commission can promote the efficient use of spectrum by giving licensees the flexibility to choose which technologies and services to deploy using the spectrum they hold. The Commission has already adopted "flexible use" regulatory models for several spectrum bands, including broadband PCS, WCS, AWS, and BRS/EBS.[212] Under this spectrum management model, licensees can deploy the technologies or services that best fit their business plans and that meet the demands of their customers, as long as doing so complies with the technical requirements of the license and does not cause interference to adjacent licensees.[213] Due to the growing demand for spectrum that can be used for new and emerging technologies, it has been increasingly important for Commission spectrum allocations and subsequent service rules to be flexible and designed to facilitate as many types of offerings as possible.

As compared to other alternatives, we believe the general adoption of a more flexible and market-oriented approach to spectrum policy is the better course to provide incentives for users to migrate to more technologically innovative and economically efficient use of the spectrum, and to provide the services that markets determine are most valued, including broadband services.

In order to provide more flexible use policies, we encourage the Commission to explore proposals to transition spectrum from traditional "command and control" regulation to more efficient, flexible frameworks. The purpose of any such efforts would be to improve spectrum access opportunities by providing licensees with the rights to flexibly use spectrum so as to facilitate the development of new and innovative communications services and devices, including wireless broadband services and equipment. Any such efforts by the Commission to alter its rules should seek to provide spectrum users with the maximum possible flexibility to determine the uses or services to be provided on the spectrum, and the ability to choose a technology that would be best for that spectrum. This would be subject only to limitations that may be necessary to

---

[212] *See generally* Part 24 (broadband PCS); Part 27 (WCS and AWS); *BRS and EBS Report and Order*, 19 FCC Rcd 14165 (EBS licensees, however, must continue to comply with existing educational programming requirements).

[213] Other countries are implementing flexible use spectrum policies as well. In November 2004, the UK's telecommunications regulator, Ofcom, announced its intentions to liberalize the rules governing a substantial portion of the country's spectrum by allowing spectrum trading and flexible use, so "users can change the technology or type of use that they make of the spectrum they hold." Ofcom stated, "[a]llowing the users of the radio spectrum to decide on the best use for it will result in the spectrum being used for the most valuable purposes, and will make it much simpler, cheaper, and quicker for new applications and technologies to emerge." *See* Ofcom, *Spectrum Framework Review*, Nov. 23, 2004, available at <http://www.ofcom.org.uk/consultations/current/sfr/?a=87101>.

afford others reasonable access to spectrum and to address any technical concerns. These steps should also complement the Commission's current policy initiatives and public interest objectives, including its existing efforts to facilitate access to and promote more efficient use of spectrum, as well as promote development of broadband services for all Americans, facilities-based competition among telecommunications service providers, and the development of additional, innovative broadband services in rural areas.

Consider various mechanisms for providing additional flexibility to incumbent licensees. The Commission should consider developing innovative approaches to enable incumbent licensees to obtain additional flexibility that would facilitate the ability of such licensees to provide wireless broadband and other advanced services.

One approach would be for the Commission to consider granting additional flexibility to incumbent licensees through significant revisions of the applicable service rules. Such an approach would be similar to the manner in which the Commission granted incumbent licensees in the MMDS and ITFS services additional flexibility, respectively, in the new BRS and EBS services.[214]

Alternatively, the Task Force recommends that the Commission consider various possible market-based auction mechanisms that could be used to provide additional flexibility to incumbent licensees. For instance, the Commission could consider employing mechanisms whereby spectrum previously licensed to incumbent licensees would be made available at auction with different rights (*e.g.*, flexible use), and potentially could be combined with other spectrum, including spectrum not previously licensed (*e.g.*, "white space"). Such mechanisms could give incumbent licensees the option to return their current licenses in exchange for means to obtain comparable spectrum access. In this regard, we recommend that the Commission explore various methods by which this framework might be implemented. These include providing an auction in which incumbents would exchange their licenses for tradable bidding offset credits, the value of which would be linked to the winning bids for licenses sold in the auction. Another possible option would be to conduct an auction which permits incumbents to participate not only as potential buyers, but also as sellers of their existing licenses, with the right to set a reserve price below which they would choose not to sell the licenses.

Further facilitate secondary market arrangements. In addition to providing for more technical flexibility in existing service rules, the Commission should promote innovative, market-based policies that provide new entrants greater access to licensed spectrum, all the while protecting the rights of incumbent licensees. As discussed earlier, in the *Secondary Markets* proceeding the Commission has already taken several steps towards meeting this objective with its new policies that enable licensees and parties seeking access to spectrum to enter into spectrum leasing and private commons arrangements using licensed spectrum.[215] Several commenters recommended that the

[214] *See* Section V.B, *infra.*

[215] *See* Section V.B, *infra.*

Commission continue to take steps to facilitate the development of secondary markets in spectrum usage rights.[216] We believe the Commission should continue to monitor the development of secondary markets in spectrum and support further revisions, if necessary, to enable parties to enter into spectrum leasing arrangements quickly and efficiently and to improve policies applicable to private commons arrangements. Facilitating the ease with which parties may enter into these types of arrangements will significantly aid in the deployment of wireless broadband service.

3. Applying a Deregulatory Framework to Wireless Broadband

The Task Force recommends that the Commission apply a deregulatory framework – one that minimizes regulatory barriers at both the federal and state levels – to wireless broadband services. Several commenters have expressed concern that states and localities are imposing unnecessary and conflicting regulatory requirements on wireless broadband providers, which in turn impede the deployment of these services. In the absence of clear federal guidance, a number of states have begun to regulate these services, resulting in additional costs to the providers and, ultimately, to consumers.

Specifically, commenting parties have indicated that the prospect of inconsistent and burdensome state regulations threatens to hinder investment in, and delay deployment of, wireless broadband services. They assert, for instance, that adoption of varying and inconsistent state and local regulation harms consumer welfare by reducing the economic efficiencies inherent in a national market, such as national advertising, marketing, and pricing plans. They contend that providers must incur significant costs to comply with the specific requirements of varying consumer protection laws and these costs then must be borne by consumers. They also assert that different state and local regulations potentially increase up-front service costs, reduce customer choice, create customer confusion, and impose costs on consumers.[217] In addition to these concerns over inconsistent state regulations, commenters are requesting clarity and certainty regarding the regulatory framework in which wireless broadband providers operate. Commenters argue that regulatory certainty spurs investments and allows broadband providers to use market efficiencies in a manner to best plan network deployment.[218] Consistent with these comments, the Task Force believes that additional regulatory certainty, through the establishment of a consistent national framework applicable to wireless broadband services, will best ensure the rapid and ubiquitous deployment of these services.

---

[216] *See, e.g.*, NTCA Comments; Verizon Comments; WCA Comments.

[217] *See, e.g.*, BellSouth Comments at 16-17; CTIA Comments at 11-12. These sorts of additional costs might include significant administrative costs resulting from having a national call center that must answer questions based on 50 separate state laws. This can also cause customer confusion: customers may be unclear as to which laws apply when a customer lives in one state, works in another state, and uses his or her service in both states (such as those wireless broadband customers in the DC area).

[218] *See* BellSouth Comments at 11 ("Only if the rules are established in advance, can potential providers evaluate the value of licenses and make reasoned, market-based decisions about whether, and how much, to bid and construct networks."); *see also* Cingular Comments at 11-12 (lack of regulatory certainty creates market inefficiencies).

The Commission has an obligation to evaluate the regulatory scheme for wireless broadband to ensure that these services are being deployed ubiquitously, with the fewest possible regulatory barriers consistent with the public interest. Under Section 706 of the Telecommunications Act, the Commission is directed to "encourage deployment of advanced telecommunications capability to all Americans."[219] Indeed, pursuant to this Congressional mandate, in order to encourage deployment of advanced services such as broadband services, the Commission must "utilize, in a manner consistent with the public interest, convenience, and necessity . . . regulatory forbearance, measures that promote competition in the local telecommunications market, or other regulating methods that remove barriers to infrastructure investment."[220]

In recommending that the Commission adopt policies that establish a deregulatory framework for wireless broadband, the Task Force adheres to the following general, overarching principles:

- Minimize regulatory barriers at the federal level through a deregulatory approach. The Commission should eliminate unnecessary federal regulatory barriers that impede the development of wireless broadband services. This will allow market incentives to bring about rapid and ubiquitous broadband deployment and innovation. To the extent possible, it should ensure that all types of wireless broadband – mobile, portable, and fixed – are regulated in a similar manner. Given the rapidly evolving and innovative nature of the broadband services generally, the Commission generally should let the marketplace direct the development of services over wireless broadband rather than risk hindering its growth through regulation. (We note, however, that in developing this deregulatory scheme, we anticipate that the Commission would consider whether and how certain discrete regulatory requirements – such as those designed to ensure law enforcement access, universal service, disability access, and emergency 911 services – should be applied in order to fulfill important federal policy objectives.)

- Take a pro-competitive, pro-innovative market-based approach. Equally importantly, the Commission should not attempt to pace the technological advancements and changes in consumer preferences with its rules, but should instead allow the market to determine the development and resulting deployment of broadband services. The Commission recognized the importance of protecting the flow of investment capital to the development of CMRS, and should do the same with the development of wireless broadband.[221] By clarifying regulatory classifications applicable to wireless broadband providers, the Commission can ensure that the market-driven

[219] Pub. L. No. 104-104, Title VII, § 706, Feb. 8, 1996, 110 Stat. 153, reproduced in the notes under 47 U.S.C. § 157 ("Section 706").

[220] *Id.*

[221] *See* Implementation of Sections 3(n) and 332 of the Communications Act, *Second Report and Order*, 9 FCC Rcd 1411, 1421 (1994).

framework established by Congress is fully realized as wireless services evolve from narrowband to broadband capacity.

- Adopt a framework that prevents inconsistent regulation and minimizes regulatory requirements at the state level. Extensive regulation at the state level could create certain disincentives to deploy broadband facilities. Inconsistent state regulations could delay the provision of the service in some areas of the country, impacting the services offered even outside of the heavily regulated states. Further, burdensome regulations can inhibit innovation in wireless broadband services and deny national providers the ability to achieve the benefits of economies of scale that their products need to succeed. The Commission should clarify, where possible, the scope of state authority in regulating wireless broadband. Such regulatory certainty and consistency is necessary to encourage industries to make long-term investments in capital-intensive wireless broadband networks.

The Task Force believes that the development of wireless broadband will best be fostered by the application of a primarily federal deregulatory framework. A deregulatory and pro-competitive framework for regulating Commercial Mobile Radio Services, as specified in Section 332(c) of the Communications Act, has resulted in a successful and flourishing market for mobile telephone services.[222] Accordingly, the Task Force recommends that the Commission adopt a deregulatory approach for wireless broadband. We believe that a market-based approach to newly developing wireless broadband services, absent unnecessary legacy regulations, will best foster the growth of these services and result in the maximum benefits to consumers of such services.

The Commission has a number of options it could choose in order to set a deregulatory framework for wireless broadband services. Specifically, the Task Force recommends that the Commission should consider the several options listed below. We encourage the Commission, when considering these or any other options, to adhere to the general principles and recommendations listed above in deciding which regulatory approach(es) to take.

Consider classifying wireless broadband Internet access and other wireless broadband services as "information services." The Commission has already determined, in the cable modem proceeding,[223] that broadband Internet access services provided over cable should be classified as an "information service,"[224] and has

---

[222] *See Ninth Annual CMRS Competition Report*, 19 FCC Rcd 20597.

[223] *See* Inquiry Concerning High-Speed Access to the Internet Over Cable and Other Facilities, *Declaratory Ruling and Notice of Proposed Rulemaking,* 17 FCC Rcd 4798, 4820-24 ¶¶ 34-41 (2002) (*Cable Modem Declaratory Ruling*), *aff'd and rev'd in part*, *Brand X Internet Services v. FCC*, 345 F.3d 1120 (9th Cir. 2003), *cert. granted*, 125 S.Ct.654, 655 (U.S. 2004).

[224] The Commission used "enhanced services" in the *Computer Inquiry* decisions, but the Communications Act uses "information service." The Commission has determined that Congress' use of "telecommunications service" and "information service" in the Telecommunications Act of 1996 (1996 Act) was intended to parallel the Commission's use of "basic service" and enhanced service" in the

tentatively concluded that wireline broadband Internet access services should be classified in the same manner.[225] The Task Force recommends that the Commission consider classifying wireless broadband Internet access service as an "information service" as well. This classification also would be consistent with the Commission's finding that traditional Internet access service is an information service.[226] The Commission should also consider whether there are grounds for classifying wireless broadband services other than Internet access as information services as well. We note that several commenters have requested Commission guidance on these matters.[227]

We believe that wireless broadband Internet access and related applications could rightly be classified as information services, even if providers are not at this time offering functions (*e.g.,* e-mail, web hosting) beyond high-speed access to the Internet.[228] Further, to the extent that wireless broadband Internet access is offered as a single, unified service, the transmission component should be deemed "telecommunications" and not a

---

Computer II proceeding. *See* Federal-State Joint Board on Universal Service, *Report to Congress*, 13 FCC Rcd 11501, 11511 ¶ 21 (1998) (*Universal Service Report to Congress*). The Act defines "information service" as "the offering of a capability for generating, acquiring, storing, transforming, processing, retrieving, utilizing, or making available information via telecommunications …" *See* 47 U.S.C. § 153(20). These issues currently are being considered by the U.S. Supreme Court.

[225] *See* Appropriate Framework for Broadband Access to the Internet Over Wireline Facilities, *Notice of Proposed Rulemaking,* 17 FCC Rcd 3019, 3032-33 ¶¶ 24-25 (2002) (*Wireline Broadband NPRM*).

[226] *Universal Service Report to Congress*, 13 FCC Rcd at 11536 ¶ 73.

[227] Further, we note that the Commission is beginning to receive inquiries asking for clarity about the obligations of wireless broadband providers. In addition to informal inquiries, we have examples on our WBATF record of providers seeking clarification of these issues, such as the extent to which – or even whether – federal and/or state governments can regulate broadband services. *See, e.g.*, CTIA Comments at 13 (asserting that some states are essentially increasing the costs of providing wireless broadband service through certain legislative actions, that Congress has made clear that Internet-based communications should be free from cumbersome federal or state regulations and that, consistent with the Act's advanced services and pro-competitive goals, the Commission should make clear that states and localities may not impose regulatory requirements on CMRS providers' wireless broadband services). BellSouth proposes that the Commission should make clear that wireless broadband Internet access service is an "information service" not subject to state public utility regulation. *See* BellSouth Comments at 16-17. This conclusion is supported by the Commission's tentative conclusion that wireline broadband Internet access service is an information service. *See, e.g.,* Appropriate Framework for Broadband Access to the Internet Over Wireline Facilities*, Notice of Proposed Rulemaking,* 17 FCC Rcd 3019, 3027 (2002). Moreover, BellSouth states that the Commission has held that a single given service can be either an information service or a telecommunications service, but not both. *See, e.g*., Inquiry Concerning High-Speed Access to the Internet Over Cable and Other Facilities, *Declaratory Ruling and Notice of Proposed Rulemaking,* 17 FCC Rcd 4798, 4823-24 (2002) (*Cable Modem Declaratory Ruling*), *aff'd and rev'd in part*, *Brand X Internet Services v. FCC*, 345 F.3d 1120 (9th Cir. 2003), *cert. granted*, 125 S.Ct.654, 655 (U.S. 2004). Addressing the current uncertainty in the classification of services, however, BellSouth asserts that to the extent wireless broadband service is deemed to include a telecommunications service component, that component would fall within the statutory definition of commercial mobile service. *See* 47 U.S.C. § 332(d)(1).

[228] *Cable Modem Declaratory Ruling*, 17 FCC Rcd at 4823 ¶ 38. This is consistent with section 230(f)(2) of the Act where Congress defined the term "interactive computer service" to mean "any information service, […] including a service or system that provides access to the Internet …" 47 U.S.C. § 230(f)(2).

"telecommunications service."[229] By classifying wireless broadband Internet access and related applications as an information service, the Commission could ensure the more rapid deployment of wireless broadband services. Classifying these services as Title I information services – and not common carrier or telecommunications services – also removes other regulatory hurdles, and would limit the ability of states to adopt inconsistent regulations.[230]

Consider examining whether wireless broadband might constitute an "interstate" service. Another possible approach is for the Commission to consider determining whether wireless broadband Internet access and other services are "interstate services."[231] Similar to defining wireless broadband Internet access or other wireless broadband services as "information services," this approach would allow the Commission to set up a federal deregulatory framework for wireless broadband.

The Commission has recently acted to limit state regulation of other emerging services. In the order concerning Pulver.com's Free World Dialup (FWD) VoIP service, the Commission found that FWD is an information service, and affirmed that the states have a very limited role in regulating information services, in particular those that are not wholly intrastate services.[232] Then, in the *Vonage* order, the Commission found that Vonage's DigitalVoice VoIP service cannot practically be separated into interstate and intrastate components, and that state tariffing, certification, or other entry requirements conflicted with our federal deregulatory policies and were therefore preempted[233] Similar principles may be involved for wireless broadband services. That is, the Commission has deregulatory policies in place for CMRS and a mandate to promote advanced services generally, and it may be difficult to separate wireless broadband by jurisdiction such that

---

[229] *See Wireline Broadband NPRM*, 17 FCC Rcd at 3032-33 ¶¶ 24-25; *Cable Modem Declaratory Ruling,* 17 FCC Rcd at 4824 ¶ 41. The Act defines "telecommunications service" as "the offering of telecommunications for a fee directly to the public, or to such classes of users as to be effectively available directly to the public, regardless of the facilities used." 47 U.S.C. § 153(46). "Telecommunications" is "the 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 sent and received." 47 U.S.C. § 153(43). Of course, the Commission awaits the Supreme Court's decision in *Brand X*, where the Ninth Circuit ruled that the transmission component of cable modem Internet access is a "telecommunications service," not merely "telecommunications." *Brand X Internet Services v. FCC*, 345 F.3d 1120 (9th Cir. 2003), *cert. granted*, 125 S.Ct.654, 655 (U.S. 2004).

[230] We note that by classifying wireless broadband as an "information service" that lacks a separate "telecommunications service" or "common carrier" component, it is arguable that the Commission would not need to justify forbearance from common carrier regulation under Sections 10 or 332 of the Act, respectively.

[231] The Commission has initiated a proceeding to consider the appropriate classification and jurisdiction of "IP-enabled services" over various platforms, including wireless platforms. *See* IP-Enabled Services, *Notice of Proposed Rulemaking*, 19 FCC Rcd 4863 (2004).

[232] *See* Petition for Declaratory Ruling that Pulver.com's Free World Dialup is Neither Telecommunications Nor a Telecommunications Service, *Memorandum Opinion and Order*, 19 FCC Rcd 3307 (2004) (*Pulver.com Order*).

[233] *See* Vonage Holdings Corp. Petition for Declaratory Ruling Concerning an Order of the Minnesota Public Utilities Commission, *Memorandum Opinion and* Order, 19 FCC 22404 (2004).

state regulation would not infringe on these federal policies. In particular, the portable and mobile features of wireless broadband could make it impractical to determine the geographic locations of users, or wireless broadband providers may have no service driven reason to determine their users' locations.[234] We also note that broadband Internet access provided over cable modem, as well as ADSL telecommunications services used to provide Internet access, have been found to be interstate for at least some purposes.[235] We recommend that the Commission consider whether wireless broadband should also be so classified on any of these bases. Adopting such an interpretation could help create a federal deregulatory framework that would allow wireless broadband services to flourish.

Alternatively, consider applying the deregulatory principles applicable to Commercial Mobile Radio Services (CMRS) under Section 332(c) of the Act, or use the CMRS regulatory scheme as a model for wireless broadband. Alternatively, the Commission could consider, to the extent legally permissible, whether to extend the same deregulatory approach applied to Commercial Mobile Radio Services (CMRS), pursuant to the deregulatory provisions of Section 332(c) of the Communications Act, in order to foster the development of these services.[236] Extending this deregulatory approach to cover wireless broadband services would be consistent with several comments in this proceeding.[237]

In Section 332(c), Congress replaced traditional regulation of mobile services with an approach that brings all mobile service providers under a comprehensive, consistent regulatory framework and gives the Commission the flexibility to establish appropriate levels of regulation for mobile radio services providers. Section 332(c) generally subjects a CMRS provider to treatment as a "common carrier," but allows the Commission to forbear from applying certain common carrier provisions.[238] The Commission frequently has exercised its forbearance authority in order to promote the development of CMRS.

Section 332(c)'s departure from traditional state regulation and conventional regulation under Title II of the Communications Act was intended by Congress to

---

[234] *See Pulver.com Order*, 19 FCC Rcd at 3320 ¶ 20.

[235] *See Cable Modem Declaratory Ruling*, 17 FCC Rcd at 4832 ¶ 59 (finding that "cable modem service is an *interstate* information service") (emphasis added); GTE Tel. Operating Cos., GTOC Tariff No. 1, GTOC Transmittal No. 1148, *Memorandum Opinion and Order*, 13 FCC Rcd 22466 (1998) (finding that federal tariffing was appropriate for GTE's jurisdictionally mixed ADSL service), *recon. denied*, 17 FCC Rcd 27409 (1999).

[236] *See generally* 47 U.S.C. § 332(c). CMRS includes any mobile service "that is provided for profit and makes interconnected service available (A) to the public or (B) to such classes of eligible users as to be effectively available to a substantial portion of the public." 47 U.S.C. § 332(d)(1); *see also* 47 C.F.R. § 20.3 (defining CMRS).

[237] For instance, commenters assert that wireless broadband access and advanced services provided by CMRS fall within the definition of "commercial mobile service" in the same way the Commission has already found voice service offered through a laptop-sized mobile unit and intended to compete with wireline local exchange service to qualify as CMRS. *See, e.g.,* Cingular Comments; BellSouth Comments.

[238] We note that the Commission has additional forbearance authority under Section 10 of the Act.

establish the pro-competitive framework needed to foster the development of a new nationwide competitive service.[239] Because we believe that this deregulatory approach has been instrumental in the rapid growth of CMRS voice service, we recommend that the Commission adopt the same approach for as many wireless broadband services as may qualify as CMRS, including data services. In addition, we recommend that the Commission consider working with Congress to evaluate possible statutory changes that would extend the same deregulatory approach applicable to CMRS to wireless broadband services generally.

Consider clarifying the scope of state authority, under Section 332(c), in setting "other terms and conditions" as applied to all CMRS, including wireless broadband services. In addition, because Section 332 may currently apply to certain wireless broadband services, the Task Force recommends that the Commission consider clarifying the scope of state authority under Section 332(c)(3) in setting "other terms and conditions" for all CMRS.[240] Section 332(c)(3) of the Act provides states with the authority to regulate "other terms and conditions" of CMRS.[241] While the Commission already has taken several actions to clarify the delineation between rate and entry regulation and "other terms and conditions,"[242] the Task Force recommends that the Commission consider further clarification regarding the states' authority to regulate these matters. Ambiguity concerning the scope of "other terms and conditions" has resulted in several disputes at the Commission, in state regulatory bodies, and in the courts, and has caused significant regulatory uncertainty.[243] Continued uncertainty will adversely affect

---

[239] *See* Implementation of Sections 3(n) and 332 of the Communications Act, GN Docket No. 93-252, *Second Report and Order*, 9 FCC Rcd 1411, 1418 (1994); *see also Southwestern Bell Mobile Systems, Inc.,* 14 FCC Rcd 19898, 19902 (1999) ("We agree that, as a matter of Congressional and Commission policy, there is a 'general preference that the CMRS industry be governed by the competitive forces of the marketplace, rather than by governmental regulation.'").

[240] *See* 47 U.S.C. § 332(c).

[241] *See* 47 U.S.C. § 332(c)(3).

[242] 47 U.S.C. § 332(c)(3)(A). *See, e.g.*, Southwestern Bell Mobile Systems, Inc, Petition for a Declaratory Ruling, *Memorandum Opinion and Order*, 14 FCC Rcd 19898 (1999); Wireless Consumers Alliance, Inc., Petition for a Declaratory Ruling, *Memorandum Opinion and Order*, 15 FCC Rcd 17021 (2000); Petition of the Connecticut Department of Public Utility Control, *Report and Order*, 10 FCC Rcd 7025, 7060-7061 ¶¶ 79-82 (1995), *aff'd sub nom. Connecticut Department of Public Utility Control v. FCC*, 78 F.3d 842 (2d Cir. 1996).

[243] *See, e.g.,* Michael Katz, *Measuring Competition Effectively*, In the Matter of Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993; Annual Report and Analysis of Competitive Market Conditions With Respect to Commercial Mobile Services, WT Docket No. 04-111, filed May 10, 2004 (filed as an attachment to the Reply Comments of CTIA); Michael Katz, *Consumer Harms from Applying the Rules To Wireless Telecommunications Service Providers*, appended to Petition of Cingular Wireless. LLC, Cricket Communications, Inc., Nextel of California Inc., Omnipoint Communications, Inc., dba T-Mobile, Sprint Telephony PCS, L.P., Sprint Spectrum L.P. as agent for Wireless Co., L.P. dba Sprint PCS, Verizon Wireless, Western Wireless and CTIA-The Wireless Association for Modification of Decision 04-05-047, CPUC Rulemaking 00-02-004 (January 6, 2005); Mark Lowenstein, *An Update on the State of Wireless Industry Growth, Competition, and Innovation*, appended to Petition of Cingular Wireless. LLC, Cricket Communications, Inc., Nextel of California Inc., Omnipoint Communications, Inc., dba T-Mobile, Sprint Telephony PCS, L.P., Sprint Spectrum L.P. as agent for Wireless Co., L.P. dba Sprint PCS,

investment in and deployment of wireless networks and services critical to this country's broadband future. Accordingly, we believe that it is time to reflect on the potential regulatory directions state and local jurisdictions could take and define as precisely as possible what is reserved for federal jurisdiction with respect to wireless services, including wireless broadband services.

Recommendations

- Improve access to licensed spectrum –
  - Improve and streamline the allocation and assignment process;
  - Expedite the transition of DTV spectrum to wireless broadband;
  - Consider asymmetric pairing of spectrum bands.
- Increase technical and regulatory flexibility regarding the use of licensed spectrum –
  - Adopt more "flexible use" policies;
  - Consider various mechanisms for providing additional flexibility to incumbent licensees;
  - Further facilitate secondary market arrangements.
- Clarify that a deregulatory framework applies to wireless broadband services –
  - Consider clarifying that wireless broadband constitutes an "information" service;
  - Consider examining whether wireless broadband constitutes an "interstate" service;
  - Alternatively, consider applying the deregulatory principles applicable to CMRS under Section 332(c) of the Communications Act, or use the CMRS regulatory scheme as a model for wireless broadband; and
  - Consider clarifying the scope of state authority, under Section 332(c), in setting "other terms and conditions" relating to wireless broadband services.

VII. Convergence of Wireless Broadband with Other Broadband Services

A. The Convergence of Different Facilities-Based Broadband Networks

Increasingly, broadband services are being offered using a combination of more than one type of facilities-based platform, including, but not limited to, networks that combine broadband over power line with wireless technologies, wireline with wireless technologies, terrestrial wireless with satellite technologies, and licensed wireless with unlicensed wireless technologies. In addition, even if the actual underlying networks are not composed of multiple technologies, some service providers bundle together service offerings for different types of networks. A common example of this today can be found when cellular carriers also provide access to Wi-Fi hot spot networks.

Verizon Wireless, Western Wireless and CTIA-The Wireless Association for Modification of Decision 04-05-047, CPUC Rulemaking 00-02-004 (January 6, 2005).

While deployment of hybrid networks is a relatively nascent trend, it is likely that these hybrid networks are harbingers of the future of broadband more generally. As broadband technologies become increasingly interoperable with one another and to the extent that service providers have the flexibility to tailor their networks for particular applications or service areas, the platform for delivery of broadband services will more likely be some combination of different broadband technologies.

This section will set forth some examples of these hybrid networks, discuss some of the reasons for this new trend, and, finally, will identify some of the regulatory considerations that the increasing use of networks that combine more than one type of technology present.

B. Examples of Hybrid Networks

Service providers employ multiple broadband technologies when providing services to the public, and do so for a variety of service quality, technical, economic, and marketing reasons. Different types of wireless technologies are frequently paired together as part of one service. In addition, wireless technologies are used in conjunction with other broadband technologies to expand the service area or to provide less expensive alternatives for some segment(s) of another type of network.

- *Cellular and Unlicensed Wireless Devices (Wi-Fi).* Broadband services provided over exclusively wireless technologies are using combinations of licensed services and unlicensed devices. Since 2002, one cellular provider, T-Mobile, has provided the ability to subscribe separately or jointly to both its cellular voice network and its network of Wi-Fi hot spots. T-Mobile's hot spots are located in airports, hotels, and retail outlets, including Starbucks's coffeehouses and Border's book stores. In November 2004, T-Mobile announced an international Wi-Fi roaming agreement enabling its subscribers in the United States to access more than 11,500 Wi-Fi hot spots around the world.[244] In October 2004, SBC announced a plan for Wi-Fi/cellular convergence.[245] Their more than 3,500 hot spot network will be used to offload traffic from Cingular Wireless's cellular voice network. SBC asserts that consumers will benefit through lower per-minute rates and that, overall, using SBC's Wi-Fi network to offload traffic could enable Cingular to use its spectrum more efficiently.

- *Broadband over power line and Unlicensed Wireless Devices (Wi-Fi).* Several service providers that use broadband over power line (BPL) technology as the principal method for broadband access are combining BPL with unlicensed wireless devices, either employing Wi-Fi access points within the BPL network to transmit information from one power line to another or to use wireless networking technologies to reach from utility poles to individual homes. In Menlo Park, California, AT&T and Pacific Gas & Electric have deployed BPL/Wi-Fi using Amperion equipment on a trial

[244] *Mobile Hotspot Announces Wi-Fi Roaming With Six Other International Wireless Carriers,* Press Release, T-Mobile, Nov. 10, 2004.

[245] Ellen Muraskin, *SBC to Offer Cingular-Wi-Fi Roaming to Businesses*, eWeek, Oct. 15, 2004.

basis to an area covering more than 300 homes.[246] Broadband services are delivered over power lines to central points in the suburban neighborhood, and then the services are delivered to individual homes using Wi-Fi technology. Similar trials using BPL/Wi-Fi combinations are being done in other communities, including Raleigh, North Carolina and Allentown, Pennsylvania.[247]

- *Wireline and Licensed Wireless.* BellSouth has conducted several trials extending the coverage of its DSL service offerings with licensed wireless technologies. An initial trial in Daytona, Florida was expanded to rural Palatka, Florida. BellSouth characterizes its initial results as "encouraging" and is interconnecting some Wi-Fi hot spots as part of the trial as well.[248]

- *Satellite and Unlicensed Wireless.* In rural or remote areas, networks of unlicensed wireless devices are often used in conjunction with satellite services. The satellite service serves as the backhaul for the terrestrial Wi-Fi network, which provides last-mile connectivity. For example, in Coffman Cove, Alaska, a remote fishing village located off the coast of British Columbia, municipal employees constructed a Wi-Fi hot spot covering a two-mile radius around the village. The hot spot connects to a Very Small Aperture Terminal (VSAT) link. Data rates for this service are 128 kbps upstream and 1 Mbs downstream.

As can be seen from these four examples, there are several reasons that service providers elect to use different types of broadband access technologies. Often there are technical reasons for using different types of broadband technologies, including increasing service coverage area in the absence of other broadband infrastructure. Economics are a factor as well. It can be relatively less expensive to use a wireless link than to provide the equivalent link using different broadband technologies. And, as is the case with combining cellular service with access to Wi-Fi hotspots, mixing and matching broadband access technologies can increase the diversity of available service offerings and provide a differentiated service that may appeal to consumers.

In addition to combining both traditional mobile and fixed or portable wireless data services, like cellular and Wi-Fi, convergence of different types of services is on the rise more generally. One interesting recent development in this regard has been the series of recent announcements related to mobile television services, including those by Qualcomm and Verizon Wireless. Qualcomm plans to operate a nationwide "mediacast" network, which will deliver between 50-100 video and audio channels to third-generation mobile wireless phones using the 700 MHz band.[249] The company asserts that this new system will provide broadcast and cable networks an additional distribution channel for their services, providing access to mobile phone subscribers. Thus, the Qualcomm

---

[246] Rebecca Wallace, *Menlo Park residents test new Internet technology*, The Almanac, (Jul. 21, 2004).

[247] *See* Appendix C (Field Studies for Northern California and for Raleigh, NC).

[248] *See* Appendix C (Field Study of Palatka, FL).

[249] QUALCOMM Subsidiary to Support Nationwide Delivery of Mobile Multimedia in 700 MHz Spectrum, Press Release (Nov. 1, 2004).

service will combine mobile wireless broadband service with multimedia content delivery. In January 2005, Verizon Wireless announced the launch of a mobile entertainment service, VCAST, which will allow access to television programming from networks such as Comedy Central, MTV, and NBC News, as well as live-action, 3-dimentional games. VCAST will be available as of February 2005 on new, select handset models that operate on the company's EV-DO network.[250]

C. Industry and Standards Developments

Several recent industry and standards developments further support the emergence of this trend for convergence of broadband access technologies. This fall, the Alliance for Telecommunications Industry Solutions (ATIS) announced a work plan to develop new industry standards for multiplatform networks.[251] These standards are being developed to facilitate interoperability for wireline, PCS/cellular, and Wi-Fi networks and services.

Last summer, several major global telecommunications service providers formed an industry alliance to foster the development of products and services designed for both wireline and mobile wireless applications. Principal members include BT, Swisscom, Korea Telecom, NTT DoCoMo, Brazil Telecom and Rogers Wireless. The group, called the Fixed-Mobile Convergence Alliance, is working to develop common technical standards that would enable seamless handoffs between wireline and mobile wireless networks. Ultimately, the goal is "for people to use one phone with one number, address book and voicemail bank, taking advantage of cheap, high-speed connectivity in their fixed-line home or office setting, while enjoying mobility outside in the wide-area mobile phone network."[252] In addition to enhancing the flexibility of service offerings to consumers, service providers also see potential savings by merging currently separate internal network infrastructures. Although the Fixed-Mobile Convergence Alliance effort has been criticized by some for having too few members and therefore too few resources to tackle the difficult technical problems of developing appropriate air interfaces and associated handset features,[253] this development nonetheless is a sign that significant industry members believe that broadband facilities convergence is a near term possibility.

Moreover, because it is increasingly important to provide both fixed and mobile functionality in wireless services, several of the developing IEEE wireless standards are incorporating both fixed and mobile components. For example, the IEEE 802.16, or WiMax standard, will have both fixed wireless and mobile protocols. Furthermore,

---

[250] *On Demand in the Palm of Your Hand: Verizon Wireless Launches "VCAST" – Nation's First and Only Consumer 3G Multimedia Service*, News Release, Verizon Wireless, Jan. 7, 2005.

[251] *Telecom Industry Releases Mobile Wireless Services Work Plan*, Press Release, <http://www.atis.org/PRESS/pressreleases2004/101104-2.htm>, Oct. 11, 2004.

[252] John Blau, *BT Heads Fixed Mobile Convergence Drive*, ComputerWeekly.com, June 9, 2004.

[253] Bhawani Shankar, *Alliance for Fixed-Mobile Convergence Needs More Members*, GARTNER FIRSTTAKE, July 21, 2004.

entirely new networking topologies like mesh networks are being included as part of standards development as well.

D. *Regulatory Considerations*

As the above discussion demonstrates, the trend towards convergence of both different broadband technology platforms and different types of services is continuing. Indeed, given the recent attention in the industry and standards groups, it is likely that this trend will accelerate. In part, this trend reflects both the technical and regulatory flexibility service providers currently have in determining how best to provide service in a particular geographic area or to a particular subscriber base. A positive consequence of this development is that more consumers are getting access to broadband services and competition for broadband services is increasing. Indeed, from a consumer perspective, among the factors that are most important in terms of choosing a particular broadband service provider are issues like service quality, functionality (*e.g.*, fixed, mobile, or portable), reliability, and data rates – as an independent factor, the type of technological platform is likely only a secondary consideration, if at all.

Cross-ownership rules in the face of convergence

One particular example of where it may be useful to review the Commission's rules in light of the increasing convergence of different technologies and services is the area of cellular and MVDDS cross-ownership restrictions. More and more service providers are using terrestrial wireless services that historically were used solely for telecommunications services to deliver video and audio content. As a result, distinctions among different types of services for purposes of determining common ownership may no longer serve their intended purpose.

The Commission has already scaled back certain cross-ownership restrictions in those wireless services which offer a video component, including LMDS, MMDS, MDS and ITFS, in order to promote competition and to allow for greater participation in emerging technologies, including broadband services. However, cross-ownership restrictions continue to apply to MVDDS and cellular service provided in urban areas. These restrictions should be reviewed by the Commission to determine whether they too can be relaxed to further facilitate increased access to broadband services. Such scaling back of the rules may be beneficial since video-related services make up only a small part of the current wireless broadband market, and easing the restrictions in these services could further the Commission's goals of promoting competition and efficiency in broadband services at large. Importantly, the Commission has specifically determined in several instances that, in light of the current level of competition in the CMRS industry, relaxing of the ownership restrictions would not adversely impact competition – one of the principal underlying concerns behind the cross-ownership restrictions. Other means could be used to accomplish the other objectives of the cross-ownership rules, such as imposing build-out or reporting requirements to guard against warehousing of spectrum and to ensure that it is being used efficiently.

Given that one of the overarching goals of the Commission is to facilitate increased access to broadband services and that the regulatory regimes applicable to these different technologies and services are often significantly disparate, we recommend that the Commission actively consider the impact of both technological and service convergence in future proceedings and strive to evaluate on an ongoing basis whether there is a sufficient basis for disparate regulatory paradigms for different broadband access technologies and services. Our review of these issues shows some of the positive benefits to be gained from convergence generally and, as a result, we would recommend that the Commission accord service providers an increasingly flexible regulatory environment.

Recommendations

- Pro-actively consider, in ongoing and upcoming proceedings, the impact of the nascent, yet increasingly rapid, convergence of wireless broadband with other broadband technologies and services.
- Evaluate, on an ongoing basis, whether it is time to eliminate many of the disparate regulatory paradigms that apply to different broadband access technologies and services.
- Look for opportunities to remove outdated rules, and accord an increasingly flexible regulatory environment for service providers, to facilitate the convergence of wireless broadband and other broadband services and technologies.

VIII. Commission Outreach and Industry Analysis

In fostering greater deployment of – and access to – wireless broadband services, Commission outreach to various agencies, governments, and constituencies becomes crucial. The Commission can share information and partner with other federal agencies with similar broadband goals. The Commission also can reach out to state and local governments to help them in their efforts to deploy wireless broadband and realize the benefits to their states and communities. Finally, the Commission can reach out to consumers, users of broadband, and providers of broadband service to monitor the progress of wireless broadband deployment and provide useful information to the public.

A. Intergovernmental Collaboration

In pursuit of the goal of facilitating further wireless broadband deployment, the Task Force recommends that the Commission reach out to other federal agencies, states, and local governments, as well as tribal governments, in order to share information and harmonize our mutual efforts in bringing wireless broadband to all Americans. We believe that a collaborative effort will enable us to develop policies that complement each other and enable speedier deployment of wireless broadband.

Continue to build upon current partnership with NTIA. The Task Force recommends that the Commission continue to work together with NTIA to make additional spectrum available for wireless broadband – including the relocation and reimbursement of government incumbents – in a manner similar to the successful agency partnership with regard to making more spectrum available in the in the AWS and 70/80/90 GHz proceedings.[254]

[254] *See* Section V.A, *infra.*

Collaborate with the Rural Utilities Service (RUS). At the federal level, one partnership that holds great potential for increasing availability of wireless broadband services in rural America is the Commission's on-going cooperation with Rural Utilities Service (RUS). RUS is the rural development agency within the United States Department of Agriculture (USDA). We recommend that the Commission continue these efforts in providing outreach with RUS and assisting with whatever technical information and support it can to help RUS staff understand wireless technologies.

In July 2003, the Commission and USDA announced creation of the Federal Rural Wireless Outreach Initiative. Pursuant to that initiative, the agencies agreed to begin reviewing their respective programs and regulatory structures so that they might coordinate activities and therefore expedite the build-out of wireless communications throughout the nation. Most notably, through discussions between the agencies and RUS's participation in the Commission's proceeding examining how to increase rural investment and facilitate deployment of spectrum-based services in rural areas, the Commission provided licensees the option of granting RUS a conditional security interest in their spectrum licenses to assist rural wireless providers in obtaining low-cost capital.[255]

Chairman Powell and USDA Secretary Ann M. Veneman, building upon the on-going coordination occurring between the agencies, signed a Memorandum of Understanding (MOU) in August 2004. The purpose of the voluntary MOU is to (1) maximize federal resources through a partnership between telecommunications regulators and financiers; (2) harmonize rules, regulations, and outreach efforts; (3) jointly establish model community projects; and (4) explore new areas of cooperation on the identification and development of rural telecommunications, new efficiencies, and activities. Each agency agreed to take various actions to implement the MOU. One of the first efforts, and one contemplated in the MOU, is the Rural Wireless Community VISION Program (VISION Program). The VISION program's goal is to create wireless broadband model communities in rural areas through the shared expertise of the agencies.[256]

In furtherance of the MOU, and as part of ongoing joint outreach efforts, the Task Force notes that the Commission has partnered with RUS in a number of instances to promote broadband deployment in rural areas, including wireless broadband. In each of the last three Indian Telecommunications Initiatives' Regional Workshop and Roundtable events, for example, the RUS participated in panel discussions to discuss various loan and grant programs available through its office.[257] This joint federal partnership, which

---

[255] *See Rural Services Report and Order*, 19 FCC Rcd 19708.

[256] As of December 2004, more than 100 rural communities had applied to participate in the VISION program.

[257] "FCC and Affiliated Tribes of Northwest Indians to Host Indian Telecommunications Initiatives Regional Workshop and Roundtable Planning Session November 9-10 on the Coeur D'Alene Reservation," *Public Notice* (DA 04-3059) (rel. Sept. 29, 2004); "FCC to Hold Second Indian Telecommunications Initiatives Regional Workshop and Roundtable in Rapid City, SD, May 26 and 27," *News Release*, Federal Communications Commission (May 21, 2004); "FCC to Host Indian Telecommunications Initiatives Reno

helps link Commission programs with RUS financial resources, is an important means to promote broadband deployment on Tribal lands – bringing important economic development, educational, and health care opportunities to traditionally underserved rural communities. Together with state stakeholders, the Commission and RUS have engaged in similar outreach efforts in Tennessee and in rural Kansas to share how respective federal programs can be utilized to improve broadband deployment in rural communities.[258]

At the same time the Commission is taking these actions, some of the unlicensed WISPs report that they often experience difficulties associated with RUS processing of their applications for broadband loans. Accordingly, the Task Force recommends that the Commission, in its continuing outreach with RUS, provide whatever technical information and support it can to help RUS staff understand wireless technologies – both licensed and unlicensed – while recognizing that the RUS's programs are technology neutral.

Collaborate with Appalachian Regional Commission and Delta Regional Authority. As part of its rural outreach initiative, the Commission has partnered with the Appalachian Regional Commission (ARC) and the Delta Regional Authority (DRA) to pursue joint opportunities to improve access to telecommunications services in areas where needs are particularly acute.[259] Together with the ARC, the Commission has held events through the Appalachian region to learn, first hand, about the need for broadband deployment to meet critical economic development and health care objectives.[260] The DRA has raised similar concerns about the state of broadband deployment in the Mississippi Delta region, where penetration rates for basic telecommunications services are in the lowest ten percent of the Nation. Both the ARC and the DRA are exploring wireless solutions as potentially cost-effective and expedient means to bring broadband deployment to its rural constituency. The Task Force recommends that the Commission continue its partnership with ARC and DRA to further explore wireless broadband solutions in those regions.

Regional Workshop and Roundtable July 17-18, 2003, in Reno, Nevada," *News Release*, Federal Communications Commission (June 17, 2003).

[258] "FCC Chairman Powell to Visit Tennessee Telecom Facilities; Visit Will Emphasize How Rural Access to Broadband Can Spur Economic Development," *News Release*, Federal Communications Commission (June 25, 2004); Remarks of Michael K. Powell, Chairman, Federal Communications Commission at the Kansas Rural Broadband and Telemedicine Summit (Feb. 20, 2004).

[259] These organizations were established by Congress to promote economic and social development in their respective geographic regions. The Appalachian Regional Commission serves communities in Alabama, Georgia, Kentucky, Maryland, Mississippi, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, Virginia and West Virginia. The Delta Regional Authority targets communities throughout Alabama, Arkansas, Illinois, Kentucky, Louisiana, Mississippi, Missouri, and Tennessee.

[260] "FCC Chairman Michael Powell Promotes Rural Telemedicine Technology at University of Virginia Demonstration," *News Release*, Federal Communications Commission (Nov. 7, 2003); "FCC Chairman Powell to Visit Tennessee Telecom Facilities; Visit Will Emphasize How Rural Access to Broadband Can Spur Economic Development," *News Release*, Federal Communications Commission (June 25, 2004) (Tennessee Visit News Release).

Collaborate with the Department of Homeland Security (DHS). The Commission's relationship with DHS also holds promise for increasing the deployment of wireless broadband technology in support of public safety missions around the country. The Commission heeded the public safety community's need for spectrum suitable for broadband applications when it adopted rules dedicating 50 megahertz of spectrum in the 4.9 GHz range in support of public safety services.[261] This broadband spectrum may be used for a diverse range of public safety services, but may be especially valuable for establishing WLANs at the scene of major incidents. There are a range of other applications, such as video transmission. In adopting the rules for the 4.9 GHz band, the Commission chose operating parameters that closely matched those of commercial and consumer equipment in nearby bands. In so doing, the Commission afforded the public safety community the benefits of economies of scale because equipment used in great quantity in these nearby bands is readily adaptable to the 4.9 GHz spectrum environment. The Homeland Security implications of the 4.9 GHz rules are significant because entities engaged in Homeland Security efforts will be able to integrate their operations with public safety by simply inserting a low-cost 4.9 GHz PCI card into a laptop computer and signing on to the LAN that has been established at the incident scene. We also note that there is no technical reason why 4.9 GHz technology need be limited to a specific incident scene and that, given the low-cost of the technology, there is no reason why public safety hot spots could not be established throughout a metropolitan area. Moreover, the 4.9 GHz rules have created a broadband "pipe" sufficiently flexible to accommodate Homeland Security applications that have not even yet appeared on the drawing board.

Through its participation as a partner with DHS in Project SAFECOM, the Commission is able to craft rules in the 4.9 GHz band and other bands that address public safety needs that are also attuned to the evolving needs of Homeland Security. The Commission participates in SAFECOM to "provide an effective forum for informed, innovative and on-going exchanges aimed at ensuring steady progress towards achievement of nationwide interoperability capability"[262] and effective public safety communications. Staff of the Wireless Telecommunications Bureau meets regularly with DHS representatives and participates in SAFECOM's Executive Board Committee meetings. The Task Force recommends that the Commission continue to take advantage of its relationship with DHS to bring Homeland Security issues to the forefront in the activities of such organizations as the National Public Safety Telecommunications Council and the Public Safety Regional Committees that the Commission has established to promote, among other things, interoperability in the 800 MHz band and the 700 MHz Public Safety band.

---

[261] We discussed the 4.9 GHz proceeding in Section V.A, above.

[262] *See* John B. Muleta Testimony before the U.S House Government Reform Committee on National Security, Emerging Threats, and International Relations Subcommittee; First Responder Interoperability: Look Who's Talking Now (July 20, 2004).

Collaborate with state and local governments and governmental organizations, including the Commission's Intergovernmental Advisory Committee (IAC). State and local governments can play a critical role in the deployment of wireless broadband services through their jurisdiction over municipal resources, zoning, rights-of-way, and related matters. Increasingly, state and local governments are realizing the benefits that wireless broadband service can bring to their constituents and are working with industry to facilitate community solutions. In September 2004, for example, the Commission participated in a two-day conference sponsored by the South Dakota Public Utilities Commission to explore options to speed wireless deployment to rural communities.[263] The conference brought together representatives from state, local and tribal governments, other federal agencies, academia, and industry to explore the barriers to wireless deployment and focus on cost-effective, practical solutions. Other state and local governments, along with industry groups, are exploring similar opportunities.[264]

The Commission should build upon its relationships with state and local governments and governmental organizations to identify additional partnership opportunities to facilitate wireless broadband deployment.[265] In particular, the Commission should draw from the expertise of the IAC to work collaboratively with industry to identify models for success in making wireless broadband services available in an expeditious manner. The Task Force notes, for example, that municipal governments often control access to facilities, such as light poles, water towers and government building rooftops, that are ideal for deployment of wireless broadband technologies. Municipal governments also manage access to local rights-of-way that are critical to enabling wireless broadband deployment. Numerous unlicensed WISPs have reported that expeditious, cost-efficient access to such facilities and rights-of-way is an essential component of these business plans. At the same time, local governments have legitimate governmental interests in managing their limited resources effectively. The Task Force recommends that the IAC be tasked to work with industry to identify models for success in facilitating wireless broadband deployment that address legitimate industry and governmental needs.

---

[263] "Technology on the Horizon: 2004 Wireless Conference," sponsored by the South Dakota Public Utilities Commission (Sept. 26-28), Spearfish Holiday Inn and Convention Center. *See* <http://www.state.sd.us/puc/2004/WirelessConference>.

[264] *See, e.g.* "[North Dakota] PSC Unveils New Wireless Outreach Initiative," *News Release*, Federal Communications Commission (July 26, 2004). *See* <http://www.psc.state.nd.us/jurisdiction/pud/telecom/wireless>. Among other things, the Outreach Initiative includes a "Zap the Gap" effort that is designed to encourage wireless investment in the state, especially currently underserved areas. In part, the PSC will serve as an information clearinghouse and facilitate discussions between communities that want wireless service, and providers that may be able to fill the gap.

[265] The Task Force notes that the Commission maintains ongoing relationships with a number of state and local government organizations, in addition to individual state and local government stakeholders. Among other groups, the Commission works regularly with the National Association of Regulatory Utility Commissioners, National Conference of State Legislatures, National Governors Association, National League of Cities, US Conference of Mayors, and the National Association of Counties.

B. Consumers, Institutional Users, Service Providers, and Industry

The Commission's current outreach efforts to consumers, institutional users, and service providers relating to wireless broadband have provided agency staff with valuable insights about technical and industry developments that can be used to assist the Commission with developing effective policies that facilitate the development of wireless broadband. These outreach efforts also enable Commission staff to learn how to provide better information regarding wireless spectrum to the wireless broadband communities, including means by which they can obtain access to this valuable resource. Accordingly, the Task Force believes that these and similar outreach efforts will continue to be important as the Commission develops policies to promote the development of wireless broadband.

Continue outreach efforts to gain insights about developments in wireless broadband. The Commission's agency staff, including those that have participated in the Task Force, have made an effort to promote Commission representation at wireless broadband industry events. Such events provide agency staff with valuable insight into the regulatory hurdles and issues affecting the deployment of wireless broadband. Having agency presence at industry events also provides first-hand information relating to Commission polices and ongoing rulemakings impacting the wireless broadband community. We recommend that these outreach efforts be continued.

For instance, the Task Force conducted several field studies to examine how different types of wireless broadband networks are being deployed. Detailed discussion of these field studies, as well as the insights they provided to the Task Force, are set forth in Appendix C.[266]

Participation by Commission staff in conferences and other similar events significantly improves the ability of the Commission to develop policies that address emerging concerns relating to wireless broadband deployment. For example, the Commission recently was represented at conferences held by the Wireless Communications Association International (WCA), CTIA, and Part-15.org. At these events, Commission staff are able to gather detailed, first-hand information on new technologies and new applications being developed by the industry, to discuss with industry representatives the major economic and regulatory factors that are influencing wireless broadband deployment, and to provide information on Commission initiatives related to wireless broadband.

Improve industry analysis regarding wireless broadband. At the present time, the Commission reviews wireless broadband developments and deployments as one part of two different reports, the annual *CMRS Competition Report*[267] and the Section 706 Broadband Deployment Report.[268] The Task Force believes that additional efforts should

---

[266] *See* Appendix C.

[267] *See, e.g.*, *Ninth Annual CMRS Competition Report*, 19 FCC Rcd 20597.

[268] *See, e.g.*, *Fourth Section 706 Broadband Deployment Report*.

be made to provide more focused and in-depth analysis of industry developments in wireless broadband that could be used as the basis for the Commission's policy decisions affecting wireless broadband.

The annual *CMRS Competition Report* examines "mobile data offerings" by CMRS carriers, but does not consider broadband offerings by other types of wireless carriers.[269] Similarly, the Section 706 Broadband Deployment Report reviews the availability of broadband across all technologies, but includes only a limited discussion of wireless broadband.[270] As the Commission stated in the *Fourth Section 706 Broadband Deployment Report*, "[i]t is essential [for the Commission] to continue to monitor the progress of the deployment of advanced telecommunications platforms and determine if additional steps are needed to further encourage this growth" so that all Americans can enjoy the benefits of broadband.[271] We believe that additional research and monitoring of the wireless broadband sector would enhance the Commission's policy work, and that in the future these two reports should be supplemented to include more analysis of wireless broadband deployment. In this regard, we recommend the Commission research and monitor the different types of services and applications available, the areas of the country where service has and has not been launched, and the reasons behind such deployments. Furthermore, the Commission should review how many broadband providers are competing in different parts of the country and the effect of the varying levels of competition on prices and service quality. Finally, the Task Force also recommends that, in its industry analysis of wireless broadband, the Commission compare deployment in the U.S. with that in other countries and analyze the reasons for the differences across different countries and regions.

Maintain a Commission webpage dedicated to wireless broadband issues. On May 5, 2004, the Task Force launched a webpage and e-mail box dedicated to providing useful information to the public regarding both licensed and unlicensed wireless broadband services.[272] Since its launch, the website has been a popular source of information at the Commission.[273] The Task Force recommends that this webpage continually be updated to address public needs and provide the latest available information on wireless broadband development that may be useful to the public.

During its interactions with the wireless broadband community, the Task Force learned the public is often unfamiliar with wireless technologies and services that may be available. For instance, the Task Force discovered that WISPs often interact with municipalities and consumers who are unfamiliar with such technologies and services. In response, the Task Force established on its website a single location on the Commission's

---

[269] *See, e.g.*, *Ninth Annual CMRS Competition Report*, 19 FCC Rcd 20597.

[270] *See generally Fourth Section 706 Broadband Deployment Report.*

[271] *Id.* at 47.

[272] The webpage can be found at <http://www.fcc.gov/wbatf>; the e-mail address is "wbatf@fcc.gov."

[273] During the nine month span of May 2004 to January 2005, over 33,500 web visitors from outside the Commission visited the Task Force webpage.

website dedicated to information pertinent to their industry and particular needs. The webpage also includes links to various sources of information on wireless broadband, including: Commission rulemaking proceedings, Commissioner's speeches and presentations, public workshops and conferences, as well as other relevant links. The Task Force recognizes that many WISPs are often not familiar with formal Commission procedures. Therefore, the webpage also provides detailed information on how interested parties can participate in Commission proceedings. In addition, it has links to other Commission Bureaus and Offices actively involved in wireless broadband issues at the Commission.

The e-mail box provides WISPs with a resource to access additional information on wireless broadband issues at the Commission. Often small companies, like many WISPs, have regulatory questions but are uncertain who at the Commission may be able to help them. The mailbox is intended to help facilitate communication between WISPs and Commission staff involved with wireless broadband issues. The mailbox is checked on a regular basis and questions and/or comments are directed to appropriate Commission staff for a timely response.[274]

Improve the accessibility of the Commission's Universal Licensing System (ULS) and website. The Commission's website and Universal Licensing System (ULS) database contain vast amounts of information about wireless licenses, wireless services, auctions, and procedures for filing transfer and leasing applications. The Task Force believes this information should be presented in an easily accessible and user-friendly format on the Commission's website, particularly for companies seeking access to licensed spectrum either through auctions, license transfer, spectrum leasing, or a private commons arrangement. We believe that the website should provide step-by-step instructions on how to find out who the current licensees are in a particular geographic area for spectrum that is suitable for offering wireless broadband services. Making such information available in an easy-to-use format could help current and potential wireless broadband providers, including those using the unlicensed bands, gain access to spectrum for new services or expand services to new markets.

Provide additional information for consumers, institutional users, and service providers. The Task Force also recommends that the Commission provide additional information to consumers on the topics of wireless data and wireless broadband. For instance, in 2002 WTB and CGB released a consumer brochure titled "What You Should Know About Wireless Phone Service," which provided guidance for consumers on several issues related to cellular phone service. We believe a similar brochure focusing on mobile data and wireless broadband services would be helpful to consumers. This brochure would contain information and guidance on the various ways in which mobile data services are priced and sold to consumers, including flat-rate unlimited plans, a la carte plans, and per megabyte plans. Such a brochure would also contain information on

[274] Questions sent to the mailbox have included topics such as: the types of equipment, software and licensing necessary to create a WISP; Commission rules and regulations that apply to wireless broadband providers; the tower/antenna regulations applicable to wireless broadband networks; and, whether grants are available to WISPs.

how coverage areas for broadband service may differ from coverage areas for mobile voice service, as well as an overview of the different types of devices sold for mobile data services, including laptop cards, handsets, smartphones, and portable modems. In addition, we note that, in the future, consumer communications devices may not be linked to a sole service provider with which the consumer has an existing relationship, but rather such devices may agilely move from one service provider to another. In response to this trend, the Commission should evolve its outreach efforts to address consumer issues and complaints related to wireless devices and data applications, in addition to traditional concerns related wireless voice service.

The Commission also should accelerate outreach to institutional users of wireless technologies, such as hospitals and law enforcement agencies. This outreach would address such issues as the inherent trade-offs between using licensed wireless services versus services using unlicensed devices. In particular, the Commission should emphasize that users of wireless broadband services that directly affect safety-of-life – that is, those requiring the highest degree of reliability – should consider that unlicensed spectrum use is subject to greater interference concerns than licensed spectrum use. Thus, for example, wireless services using unlicensed devices could be useful in a hospital setting for improved and portable access to patient records, but less appropriate for assisting with the direction of medical instruments used in conjunction with patient operations.

In addition, the Commission should conduct outreach activities for service providers, particularly existing and potential wireless ISPs, on how to gain access to spectrum suitable for wireless broadband services. Such outreach activities would cover options of auctions, secondary markets transactions such as spectrum leasing and private commons arrangements, site-by-site licenses, and the license-free bands. These outreach efforts would include designing and distributing brochures, providing relevant information on the Commission web site and at the FCC booth at industry conferences, and conveying information through videos which could be downloaded from the FCC website and played at the FCC booth.

Recommendations

- Partner with other federal agencies and state and local governments –
    - Collaborate with Rural Utilities Services (RUS);
    - Collaborate with the Appalachian Regional Commission and Delta Regional Authority;
    - Collaborate with the Department of Homeland Security; and
    - Collaborate with State and Local governmental organizations, including the Commission's Intergovernmental Advisory Committee.
- Improve outreach efforts with consumers, institutional users, service providers, and industry –
    - Continue outreach efforts to gain insights about developments in wireless broadband;

- Improve industry analysis regarding wireless broadband;
- Maintain Commission webpage dedicated to wireless broadband issues;
- Improve accessibility of the Commission's Universal Licensing System (ULS) and website; and
- Provide additional information for consumers, institutional users, and service providers.

IX. Conclusion

This is an exciting time for wireless broadband. Through technological advances, innovative new applications, and ever-increasing deployment of wireless broadband networks in both urban and rural America, our nation is poised to experience the great freedom and promise enabled by wireless broadband. Building upon the strong foundation that the Commission already has established over the last few years, the Task Force has recommended additional steps in this report that the Commission could take to further foster wireless broadband and facilitate these exciting developments.

STATEMENT OF
CHAIRMAN MICHAEL K. POWELL

Access to broadband is a catalyst for positive change – with the potential to bring resources and jobs to communities across the country. In recognition of this, our leaders have increasingly set ambitious goals for this nation to reach. The President of the United States talked about wanting broadband availability for all Americans by 2007 – a truly bold goal that will only be met by the use of every possible broadband tool at our disposal – particularly wireless broadband alternatives.

Last May, I created the Wireless Broadband Access Task Force to study existing wireless broadband polices and make recommendations in the Commission's policies to help accelerate the deployment of wireless broadband technologies and services for all Americans. This multidisciplinary team of FCC staff met with equipment manufacturers, services providers, state and local governments, and consumers and other stakeholders around the country to assess the current state of deployment. Today, I am pleased to support their findings and recommendations.

The *Report's* findings confirm that the development and deployment of wireless broadband technologies are critical to ensuring that reliable and ubiquitous broadband services are available to all Americans. In particular, wireless broadband offers both mobility and simplicity of use. Technological advances in wireless broadband, such as mobile technologies, mesh networks and short, medium and long range wireless networks are providing a solid foundation for improved delivery of broadband services. In addition, the proliferation of new wireless broadband applications, ranging from Wi-Fi hot spots, WISPs, voice-over-IP and public safety and distance learning applications are on the rise and promise to empower users and their communities in new and exciting ways.

This Commission has put a high priority on making sure Americans have access to broadband services through multiple facilities-based platforms. Already, our wireless broadband policies and initiatives have helped foster innovation and encourage capital investment in wireless broadband services. For instance, by increasing the amount of spectrum available, allowing maximum technical and regulatory flexibility, and making it easier for entities to gain access to spectrum through secondary markets, the Commission has helped foster the introduction of new and advanced wireless broadband technologies and consumer services.

The *Report* makes several recommendations that build upon the strong foundation the Commission has already established over the last few years; including, expanding the availability of wireless broadband services offered in licensed spectrum; enhancing the success of wireless broadband via license-exempt devices and equipment; maintaining a hands off regulatory approach to IP-based services; and improving the Commission's existing outreach efforts. It is my hope that the Commission will heed these recommendations and remain proactive in identifying and understanding emerging technologies and ensuring that our policies do not hinder their advancement. The American public benefits most when our policies enable consumers and businesses to

fully tap the benefits of emerging technologies. New video and voice-over-IP and integrated wireless broadband services promise to stimulate even more significant growth in the near and long term. Thus, the Commission should continue to carry out and expand upon its accomplishments to help spawn these and other new services.

The Commission needs to continue to create an innovative regulatory environment that will provide opportunities beyond today's technological horizon. The Task Force's *Report* offers some concrete suggestions as to how we can make that possible and is a positive step for progress in implementing the Commission's broadband vision.

Finally, I commend the dedicated and talented Task Force staff for their efforts. John Branscome and Lauren Van Wazer have shown extraordinary diligence and skill in leading the Task Force over these past eight months. I also applaud the work of Paul Murray, Erin Boone, Peter Corea, Chelsea Fallon, Meribeth McCarrick, Paul Nagle, and Leon Jackler. Congratulations to their entire team.

APPENDIX A – Commenting Parties
GN Docket No. 04-163

Comments:

1. Alvarion;
2. Airports Council International – North America (ACI-NA);
3. Association of Public Television Stations (APTS);
4. Satish Bhardwaj;
5. BellSouth Corporation;
6. CTIA – The Wireless Association (CTIA);
7. Cingular Wireless LLC (Cingular Wireless);
8. Dobson Communications Corporation;
9. Global UMTS TDD Alliance;
10. IP Wireless, Inc. (IP Wireless);
11. Local and Metropolitan Area Network Standards Committee of the IEEE (IEEE 802.18);
12. Nicololaus Leggett;
13. Microsoft;
14. Motorola, Inc. (Motorola);
15. National Telecommunications Cooperative Association (NTCA);
16. NexGen City;
17. Nortel Networks;
18. Old Colorado City Communications;
19. Pegasus Rural Broadband;
20. PCIA – The Wireless Infrastructure Association;
21. Qualcomm, Inc. (Qualcomm);
22. Rist Canyon Volunteer Fire Department, Colorado;
23. School Board of Broward County, Florida (Broward County School Board);
24. SES AMERICOM, Inc.;
25. Sprint;
26. Telecommunications Industry Association (TIA);
27. Verizon Wireless (Verizon);
28. Virginia Communications;
29. Wireless Communications Association, International (WCA).

Reply Comments:

1. Satish Bhardwaj;
2. EDUCAUSE;
3. Thomas Hazlett and Matthew Spitzer;
4. IP Wireless;
5. Tropos Networks, Inc. (Tropos);
6. Verizon.

***Ex Parte* Comments:**

1. Ben Byrne;
2. Cisco Systems;
3. Nextel Communications;
4. Anthony Will.

APPENDIX B – Speakers at Wireless Broadband Forum
Federal Communications Commission
(May 19, 2004)

Panel I: Wireless Broadband Technologies

Topics:

- Latest technology developments
- Creation of seamless, integrated networks
- Device factors, such as battery life and screen size
- Wireless broadband technology standards

Speakers:

- Pierre de Vries,
  Chief of Incubation, Advanced Strategies and Policy Group
  Microsoft Corporation

- Guy Kelnhofer
  Chief Executive Officer
  NextNet Wireless

- Margaret LaBrecque
  Regulatory Task Force Chairperson, WiMax Forum
  Director of Industry Programs, Broadband Wireless Division
  Intel

- Brian Markwalter
  Senior Director, Technology and Standards
  Consumer Electronics Association

- David Reeder
  Vice President Sales, North America
  Airspan Networks

Panel II: Broadband Business Strategies

Topics:

- Mobile and fixed wireless business plans
- Impact of Wi-Fi
- Gauging consumer demand
- Ways to integrate landline and wireless networks

Speakers:

- Michael Anderson
  Chief Information Officer, PDQLink
  Chairman, Part-15.ORG

- Paul Berriman
  Senior Vice President of Strategy and Marketing
  PCCW Limited

- Atish Gude
  Vice President, Strategic Planning and Corporate Strategy
  Nextel Communications

- Doug Sobieski
  Vice President, Broadband Wireless Services
  XO Communications

- Bill Stone
  Executive Director, Network Strategy
  Verizon Wireless

- Richard Wong
  General Manager, Messaging Applications
  Openwave

Panel III: Barriers to Entry in the Broadband Market

Topics:

- Examination of regulatory and other barriers, including deployment costs, cost of capital, and access to spectrum
- Impact of regulation on investment
- Ways to maximize flexibility in allocating and licensing spectrum

Speakers:

- Andrew Kreig
  President
  Wireless Communications Association

- Rick Kunze
  President
  ColusaNET
  Part-15.ORG

- Jeanette Radcliffe
  Manager of Spectrum Marketing
  Australian Communications Authority

- Scott Slater
  Co-Founder and Strategic Advisor
  Personal Broadband Industry Association

- Charles Townsend
  Managing General Partner
  Aloha Partners
  700 MHz Advancement Coalition

Panel IV: Looking to the Future

Topics:

- Steps to making wireless the glue that will link disparate broadband networks
- Which broadband applications will be successful?
- Convergence and integration of wireless and wireline, fixed and mobile, licensed and unlicensed technologies

Speakers:

- Martin Cooper
  Chairman and Co-Founder
  ArrayComm

- Duncan Davidson
  Chairman
  SkyPilot Network

- Valerie Holt
  Consultant and Advisor
  Reciva Limited

- José Rodriguez
  Chief Executive Officer
  Hispanic Information Television Network

- Sai Subramanian
  Vice President, Product Management and Strategic Marketing
  Navini Networks

APPENDIX C -- Field Studies

As part of its review of current Commission policies, the Task Force and other Commission staff visited five different geographic areas of the country during the summer of 2004 in order to observe and learn about some of the kinds of wireless broadband deployments and related developments that have been unfolding across the United States. The Task Force has compiled observations concerning its visits – to New York, NY, Jacksonville, FL, Rapid City, SD, Raleigh, NC, and the Bay Area, CA – into "field studies" (Field Studies), which are discussed below.

(1) New York City

In September 2004, Task Force members visited New York City to examine several different examples of deployments of wireless broadband service in the area. Due in part to it highly diverse demographics and urban topography, New York City provided an excellent opportunity to examine a wide variety of issues surrounding deployment of wireless broadband in cities. As detailed below, Task Force members examined deployments in public spaces and those specifically designed to bring access to poor and marginalized urban populations. In addition, the members saw demonstrations of innovative applications of wireless broadband technologies that both create and strengthen bonds between community members. These applications are crucial to making broadband access relevant in peoples lives and driving demand for broadband services.

Bryant Park. The Bryant Park Wireless Network is a public Wi-Fi hot spot, bringing the Internet free to users of laptops and handheld devices with 802.11b Ethernet cards. In 2001, Bryant Park Restoration Corporation envisioned offering free Internet access in Bryant park, located in the middle of downtown Manhattan, but was not sure how to build such a network. After deciding against several approaches requiring wired benches, standalone kiosks, or other stationary concepts, they opted to create a wireless environment in the park. In the summer of 2002, the Bryant Park Wireless Network was launched with three access points covering the park and allowing users to surf the Internet.[275] The success of the Bryand Park Wireless Network has led to the deployment of similar public hot spots in parks and other open spaces throughout New York City and elsewhere.

Manhattan Neighborhood Network (MNN). The Manhattan Neighborhood Network (MNN) makes use of Wi-Fi technology in a novel way. MNN provides facilities that allow average citizens to produce their own programs for airing on public access channels in New York City.[276] Members of the community can rent top-quality video cameras and produce and edit their own programs using off-the-shelf equipment. Partnering with WISPs and others throughout the city, MNN can transmit live video to its studio for broadcast. In September 2004, a group of young people who ran the MNN

[275] *See generally* <http://www.bryantpark.org>.

[276] *See generally* <http://www.mnn.org>.

Youth Channel conducted a live interview of Chairman Powell at a local hot spot in New York, and transmitted it wirelessly back to the studio using Wi-Fi technology. Now, any Wi-Fi hot spot in New York can be a studio for MNN. MNN demonstrates all the good that can come from hard work and creativity – it's a genuine American success story using the unlicensed bands.

Figure 13.
Manhattan Neighborhood Network

MNN Youth Channel reporters conduct a live interview with Chairman Powell via Wi-Fi.

Community Access. Community Access is a New York non-profit that provides housing and training opportunities for residents recovering from psychiatric disorders. To better prepare their residents to transition back into society, Community Access, with the assistance of NYCWireless, deployed a wireless broadband network and distributed a number of laptops. While in the past, a computer was available for use in a common room, administrators found that the ability to access such things as job or health information in privacy was essential to the dignity of the residents. Installing a traditional wired network would have been cost prohibitive for Community Access. Wireless technology enabled Community Access to provide service throughout the facility at an affordable cost.

Mount Hope Technology Initiative. Mount Hope Housing Community was founded in 1986 as a community development organization that rehabilitates and manages affordable housing and provides services to residents to provide them with new opportunities.[277] Mount Hope manages 1,250 units in 32 buildings within a half mile radius of an impoverished area in the South Bronx.[278] The Mount Hope Technology Initiative was created to install a wireless local area network in the Mount Hope community to serve its residents with affordable high-speed Internet access.[279] Mount Hope's administrators installed antennas on the rooftops of buildings throughout the community, allowing the network to be shared by the residents for as little as seven dollars a month.[280] The goals of the initiative include, in addition to providing wireless broadband Internet access to all 1,250 units, providing computer training for families and new community-based technology careers for residents.[281]

---

[277] *See generally* <http://www.mounthopehousing.org>.

[278] *See id.*

[279] *See* Kristen Fountain, *Antennas Sprout, and a Neighborhood Goes Online*, The New York Times, June 10, 2004.

[280] *See id.*

[281] *See id.*

Mount Hope residents who do not own computers are able to purchase them inexpensively from Per Scholas, a Bronx company that gathers old computers to be refurbished and sold to residents of communities like Mount Hope. Access One was hired to install and maintain the network for the community.[282] Mount Hope management ran wires to each apartment to avoid signal blockage from apartment building walls and ensure reliability of the network, while still saving a vast amount of time and money by using a wireless system to provide connectivity between the buildings.[283]

From broadcasting via Wi-Fi to hot spots in public parks to community networking groups providing access to underserved communities, New York City demonstrates the success of wireless broadband and the opportunities it can provide as an alternative to wired networks. More than any other area throughout the country, New York City illustrates, in an urban environment, how new technologies can flourish as they are adopted for several unique uses and applications.

(2) Jacksonville, Florida

In September 2004, members of the Task Force visited the Jacksonville, FL area. Wireless broadband technologies have grown significantly in the city of Jacksonville and its surrounding areas. Private organizations are working with cities to create an environment that has become favorable to the widespread deployment of wireless broadband. The rural landscape of much of northern Florida has also made wireless Internet technology the best choice for serving outlying areas otherwise inaccessible via cable and DSL facilities. Wi-Fi hot spots, community networks and wireless technology trials make up some of the many efforts that have begun to bring connectivity to all members of the community.

JaxWIZ. The JaxWIZ project was started by the Jacksonville Chamber of Commerce through a public/private partnership. The first JaxWIZ Wi-Fi hot spot deployment was in "the Landing," a retail area near downtown, followed by five additional deployments. In the summer of 2001, the city's Telecommunications and Technology Committee released a report finding that wireless Internet access should be deployed in underserved areas. The city provided JaxWIZ with three grants, allowing it to deploy in over five underserved areas or "Zones" throughout the city. JaxWiz is currently in the process of becoming a nonprofit 501(c)(3) organization with plans for continued expansion of up to ten Zones throughout the city of Jacksonville.

JaxWIZ currently serves over 375 families using 802.11(b) point to multipoint technology.[284] It recently received a $100,000 grant from 3Com to provide equipment

---

[282] *See id*.

[283] *See id*.

[284] *See* Jacksonville Chamber of Commerce, *JaxWIz receives $100,000*, Access Jacksonville, September 2004, at 10.

and support for the existing zones and to help the program expand into other areas.[285] The city of Jacksonville donates computers and other equipment to the JaxWIZ program in order to facilitate the deployments in underserved areas. The program is supported and funded by the city, as well as several groups including Duval County Public Schools, HabiJax, Jacksonville Housing Authority, JEA, the St. Joe Company and WorkSource.[286]

JaxWIZ also provides opportunities for area students through the Career Academy Initiative, a program set up by the Chamber of Commerce in area high schools to provide students with technology training. This program allowed seventeen students from the IT Career Academies at two area high schools to complete installation and computer service support for JaxWIZ customers over the past year.[287]

Clearwire (Jacksonville, FL). Clearwire began offering wireless broadband service in Jacksonville in August 2004. The service is now available to 120,000 homes in the area, covering over 100 square miles, and delivers speeds up to 1.5 Mbps. Users connect to the Internet via a portable, plug-and-play wireless modem device attached to a personal computer or laptop, and can access the service when roaming anywhere within the Jacksonville coverage area. Clearwire's technology relies on licensed spectrum in the 2.5 GHz BRS/EBS band.

BellSouth (Palatka, FL). BellSouth is currently running wireless broadband trials in Palatka and Daytona, FL. These deployments are designed to extend the geographic coverage area of BellSouth's DSL service beyond its current reach. Trial participants use a small desktop wireless unit connected to either an Ethernet or USB port on their PC, which provides a high-speed, wireless link between a BellSouth transmission tower and the user's computers.[288] The trial will be in the 2.3 GHz WCS band, for which BellSouth holds Commission licenses throughout the Southeast. The wireless technology is provided by Navini Networks.[289]

The Palatka, FL deployment provides wireless broadband to community members within about a seven-mile radius of the service's base station. The base station is on a water tower owned by the City of Palatka that lies at the edge of BellSouth's DSL coverage area. In addition to several residential homes, customers served by the trial include the College Arms Apartments' community center, which is a federally funded housing complex, St. John's Community College and the Putnam County Regional Airport. All of the customers served by the trial are able to receive broadband speed service with downloads coming in between 1 and 1.5 Mbps, even for those as far as seven miles from the base station.

---

[285] *See id*.

[286] *See id*.

[287] *See id*.

[288] *See* Nortel Networks, *BellSouth Announces Fixed Wireless Broadband Trial in Daytona Florida*, January 13, 2003, <http://www.navini.com/pages/press/2003/pr01.13.03.htm>.

[289] *See id*.

Palatka's rural setting and dense foliage also makes it a challenge for wireless broadband service providers because dense foliage is difficult for wireless signals to penetrate. However, the service provided by the BellSouth trial allows residents as many as 6 miles away from the water tower base station to receive download speeds up to 1 Mbps. This service brings connectivity with speeds up to 1.5 Mbps to the College Arms community center where residents' children can complete research and homework requiring Internet access. At least one resident of the community also was able to download and complete an exam for GED qualification. All of these tasks would be extremely time consuming, if not impossible with a simple dial-up connection. Palatka is a prime example of another rural community where wireless broadband service is the only pipe available, and has become invaluable to the community.

Figure 14. Convergence of Broadband Networks in Palatka, Florida

Companies are increasingly combining both wireless and wireline technologies to bring broadband to consumers. In Palatka, FL, a wireless base station on a water tower is used to extend a broadband provider's network to areas where it was not feasible to deploy DSL. The inset shows the wireless broadband modems used by customers.

Palatka and Jacksonville, FL exemplify how wireless broadband has penetrated various geographical and social strata from a rural, sparsely populated community, to an urban highly populated landscape. Wireless broadband service provides high-speed Internet access to those areas, such as Palatka, which have few alternatives for Internet access. Rural residents are able to compete for jobs (on a telecommuting basis), and take advantage of distance learning opportunities previously available only to residents of cities. In areas such as Jacksonville, wireless broadband provides opportunities to the underserved in an urban setting, bringing opportunities to students and other individuals who would otherwise be marginalized in an environment where access to a high-speed information network is increasingly becoming necessary. Through the wireless broadband service provided by groups such as JaxWiz, these individuals have crucial access to employment and community information.

(3) South Dakota

In May 2004, the Task Force joined Chairman Powell and Commissioner Adelstein to visit Rapid City, SD to learn about wireless technology as a solution for bringing broadband to rural areas. They met with representatives from the following

groups: Sioux Valley Wireless, one of the leading WISPs in the state; Skybeam.net Inc., a WISP in neighboring Nebraska; the license exempt WISP industry group, Part-15.org; and the South Dakota Public Utilities Commission Chairman Robert Sahr and South Dakota Governor Michael Rounds.

South Dakota is illustrative of broadband deployment in rural areas generally, given the state's low population density of 9.9 persons per square mile, versus 79.6 persons per square mile for the U.S. as a whole.[290] In addition, 38 of the 66 counties in South Dakota have a "frontier" designation because their population density is less than seven persons per square mile.[291] According to Commission data, there were approximately 34,026 high-speed lines in service in South Dakota as of June 30, 2004, which represents 11.7 percent of the state's total households and 4.5 percent of its total population.[292]

Sioux Valley Wireless (SVW), a long-established service provider in the Sioux Falls area, is now one of the most active wireless Internet service providers (WISPs) in South Dakota. In 1989, the company began offering multichannel video service over its licensed spectrum in the 2.5 GHz BRS/EBS band. By 1998, it decided to offer two-way, high-speed fixed wireless Internet access. To do so effectively, and to provide coverage not only to Sioux Falls but to surrounding areas as well, SVW combined use of this licensed spectrum with spectrum in the 2.4 GHz band, which permits use of unlicensed devices. SVW's wireless broadband network consists of cell sites deployed on licensed spectrum using three towers in the Sioux Falls area, each with a 35-mile radius, as well as 2.4 GHz license-exempt equipment deployments that include areas not covered by the licensed spectrum. The company offers Internet access speeds of up to 1 Mbps.

Skybeam.net is a WISP providing dial-up and high speed internet services in Wyoming, Colorado, and Nebraska. Matt Larsen, COO of Skybeam.net, spoke of several benefits that WISPs provided in these states. He noted that, in addition to providing wireless broadband services to unserved or underserved in rural areas, WISPs add competition and jobs to rural economies, offer alternatives to areas with few other options for obtaining Internet access, and provide crucial tools for bridging the Digital Divide. Larsen also spoke of the need for additional available unlicensed spectrum compatible with existing commodity hardware, for a reorganization of spectrum that is currently unused or underused to facilitate use by WISPs, and for high power and reserved spectrum for Point-to-Point links. According to Larsen, with additional financial

---

[290] South Dakota Interoperability, presentation by Otto Doll, Commissioner, South Dakota Public Utilities Commission, at the South Dakota PUC Wireless Conference, Sept. 28, 2004; U.S. Census, USA Quick Facts, <http://quickfacts.census.gov/qfd/states/00000.html>.

[291] South Dakota Interoperability, presentation by Otto Doll, Commissioner, South Dakota Public Utilities Commission, at the South Dakota PUC Wireless Conference, Sept. 28, 2004.

[292] High Speed Services for Internet Access: Status as of June 30, 2004, Federal Communications Commission (WCB), December 2004, Table 8; U.S. Census, *South Dakota Quick Facts*, <http://quickfacts.census.gov/qfd/states/46000.html>.

resources and a "friendly" spectrum policy, WISPs will make drastic evolutionary steps in the quality of service provided in urban and rural areas.

Next, Michael Anderson, President of the license exempt WISP industry group, Part-15.org, discussed WISP deployments in South Dakota and gave an overview of general issues that affect WISPs operating in the license-exempt bands. According to Part-15.org's data, there are 15 WISPs operating in South Dakota. Their networks cover 23,000 square miles and provide service to over 100 hospitals, colleges, campgrounds, and truck stops. Mr. Anderson emphasized that the majority of unlicensed WISPs operating in the U.S. are small, with typically fewer than 10 employees, and serve rural, sparsely-populated areas. The number of WISPs has been growing rapidly over the past one to two years due in part to the declining cost of network equipment. The challenges that WISPs face include: addressing interference, particularly from private commercial networks, business security systems, and residential WLANs; the high cost of tower space; and obtaining access to municipal facilities.

Finally, Governor Rounds presented his vision for broadband in South Dakota, followed by South Dakota PUC Chairman Sahr's presentation on broadband deployment in the state. DSL and cable modem service are deployed in dozens of towns throughout South Dakota, covering approximately 25,000 square miles and 66.5 percent of the state's population. Because of the state's low population density, the density of wireline deployments ranges from 1.6 to 4.2 subscribers per cable mile. Furthermore, the infrastructure costs for recent wireline deployments in the state ranged from $5,700 to $11,000 per customer.

From the visit to South Dakota, the Task Force learned that there are unique challenges to serving sparsely-populated rural areas. Wireless technology is often a more cost-effective solution to serving such areas, yet challenges remain. Sioux Valley Wireless, Skybeam.net, and Part-15.org recommended certain policy changes that they believe will facilitate the deployment of wireless broadband access in rural America. These recommendations include: additional license-free spectrum allocations, as well as easier access to licensed spectrum; easier access to low interest loans and grants to deploy wireless broadband service; different treatment of urban and rural markets in the Commission's technical and licensing rules generally, and increased power limits in rural areas specifically; the opening of federal property for tower siting; strict enforcement of Part 15 power limits and interference rules; and, further outreach and guidance for local communities on the advantages of wireless broadband.

(4) Raleigh, North Carolina

In August 2004, members of the Wireless Telecommunications Bureau's Broadband Division traveled to Raleigh, North Carolina to learn about and see a demonstration of a new wireless broadband service being offered in the Raleigh/Durham area by Nextel using FLASH (Fast Low-latency Access with Seamless Handoff) OFDM (Orthogonal Frequency Division Multiplexing) technology manufactured by Flarion.

OFDM technology allows carriers to offer wireless broadband services without a direct line-of-sight between the transmitter and the receiver. Many of the wireless broadband services offered using OFDM technology, including the Raleigh trial, eliminate the need for subscribers to attach an antenna to their rooftop and instead allow them to access the Internet with "plug-and-play" modem devices connected to a computer. Another advantage of such services is that they often eliminate the need for a carrier to send technicians to install equipment at the end user's house or building. Although FLASH-OFDM is a proprietary technology, Flarion is working with the IEEE on the development of the 802.20 mobile broadband access standard, which will be substantially similar to the FLASH-OFDM standard.

Customers can access Nextel's wireless broadband service in one of two ways. First, consumers interested in using the service on a mobile or portable basis can insert a wireless modem card into a laptop computer or PDA and access the service while roaming anywhere within the 1,300 square-mile coverage area. Second, consumers wishing to use the service on a stationary basis with a desktop computer can attach a wireless modem with an antenna to the computer using either Ethernet or USB cable. Hence, the service can be a substitute for DSL or cable broadband service, but it also offers the ability to access broadband speeds while mobile.

The typical downstream data transfer speed for the service is 1.5 Mbps, with burst rates of up to 2.7 Mbps. The typical uplink speed is 375 kbps, with burst rates of up to 750 kbps. Pricing for the service begins at $34.95 per month for 15 MB of data usage, and continues to $79.95 for unlimited data service.

Nextel began testing the Flarion service in November 2003, with a closed trial in February 2004. It launched the service to the Raleigh/Durham public in April 2004. However, in February 2005, shortly after announcing its proposed merger with Sprint, Nextel announced that it would end its Flarion Service in Raleigh by June 2005.[293] In January 2005, Sprint joined the WiMax Forum, and analysts speculate whether the new, combined company may use its BRS spectrum to deploy WiMax instead of, or in addition to, Flash-OFDM or 802.20 technology.[294]

---

[293] Dan Meyer, *Nextel to End Flarion Trial, Deemed Successful*, RCR WIRELESS NEWS, Feb. 8, 2005.

[294] *See Sprint Joins the WiMax Forum*, News Release, Sprint, Jan. 31, 2005; Brad Smith, *The Sprint-Nextel Merger Raises Questions about the Future of Flarion's Flash-OFDM, WiMax, and Even CDMA*, WIRELESS WEEK, Jan. 1, 2005.

(5) Northern California

In July 2004, Chairman Powell and members of the Task Force visited organizations in the San Francisco Bay Area to learn about innovative wireless broadband deployment efforts in urban areas. In contrast to South Dakota, California has a population of 35.5 million people and a population density of 217.2 persons per square mile.

BANC. First, Chairman Powell and Task Force members visited with representatives from the Broadband Access Network Coordination (BANC) organization, a group of WISPs in northern California who coordinate and register their fixed wireless links in order to avoid interfering with one another.

As of June 30, 2004, there were 4.7 million high-speed lines in California, which represents 40.8 percent of the state's total households, and 13.2 percent of its total population. The BANC is working to diminish interference in the license-exempt bands, where it is a significant concern for WISPs serving the densely-populated areas of California. Urban areas with high broadband penetration also represent target markets for providers of innovative broadband products, such as T-Mobile's iPAQ h6315.

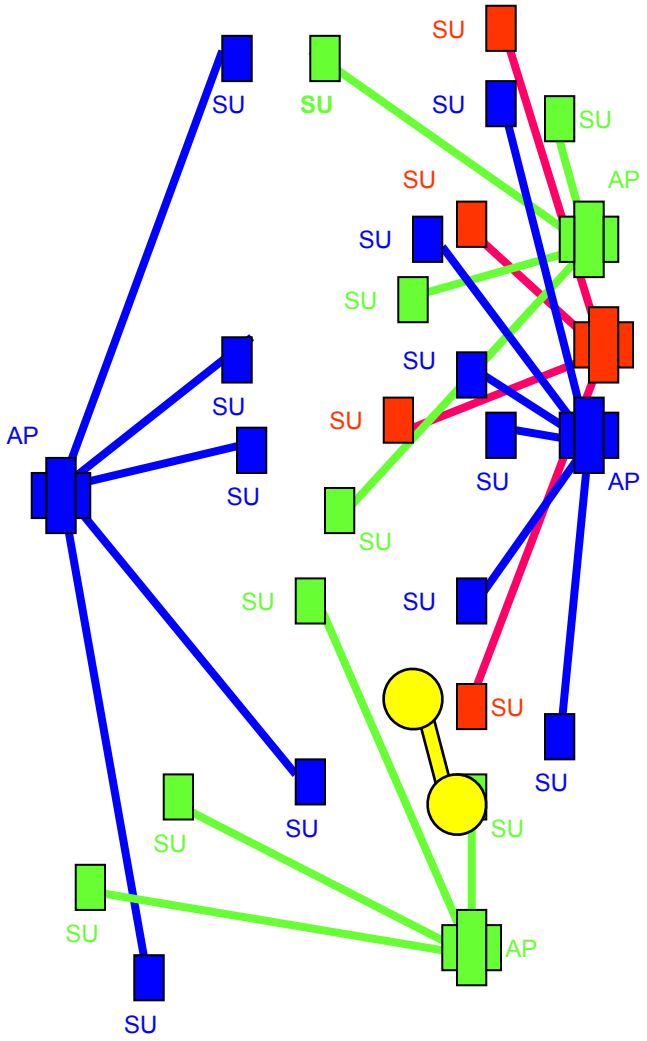
BANC was founded by two northern California WISPs: NextWeb and Gatespeed, both of whom offer fixed wireless broadband services to business and residential customers throughout the Bay Area using the 5 GHz unlicensed bands for "last mile" connections. The companies also use licensed point-to-point wireless links for backhaul connections, and the 2.4 GHz band for the customers' in-building or campus-wide wireless links.

NextWeb and Gatespeed joined forces in 2003 to address problems they had been noticing with interference, particularly customers experiencing unexplained outages with greater frequency. They have noticed more license-exempt WISPs entering the market in recent years, in large part due to the fact that equipment costs have declined substantially and that equipment has become "off-the-shelf" and easier to install. Furthermore, as the demand for broadband service has grown, the number of users per operator has grown as well. In addition, many private entities, such as school systems or industrial companies, have begun to deploy wireless networks that rely on unlicensed spectrum. The downside to the increasing use of the license-free bands has been a greater level of interference. Interference, and the need to mitigate it, tends to be a more significant issue in urban areas where there are more WISPs, more customers, and more private entities all using the same spectrum. Interference can erode both end user and investor confidence in unlicensed wireless networks, and, if not addressed properly or quickly, can make it impossible for anyone to operate in the bands.

NextWeb and Gatespeed formed BANC to track wireless deployments by WISPs in the 5.2 and 5.8 GHz license-free bands. The purpose of BANC is to manage and avoid interference in those bands, in order to improve service quality for customers, protect revenues, and maintain investor confidence. BANC members refer to their system as

"co-opetition"; while they compete with one another, they know they must coordinate and cooperate in order for any of them to continue to be successful. BANC members also view their main source of competition as DSL and cable operators, not one another. They recognize that it is difficult for individual operators to identify and resolve interference independently. For example, if WISP A were to modify its system in response to an unknown source of interference, it may then cause interference for WISP B, who may then modify its system, and so on.

Figure 15. Wireless BANC Interference Resolution System



With private industry initiatives like BANC, wireless broadband providers can work together to avoid interfering with one another and to provide more reliable service to consumers. The blue, red, and green lines represent the networks of different BANC member operators. By coordination and careful selection of frequency channels, all 3 operators are able to provide reliable, interference-free connections between their access points (AP) and customer subscriber units (SU). The yellow link represents a "rogue" interferor that causes interference for a green operator. The green operator must then switch channels, but coordinates this change with the other BANC members, so as not to cause interference on their networks.

How does BANC work? The group is based on both information exchanges and software that tracks wireless deployments. Members exchange information about new links, system tests, and unknown sources of interference via a Yahoo! chat group. In addition, the BANC software includes detailed information on where members have deployed their systems and allows them to scan the available spectrum before deploying and posting a new link. BANC requires its members pre-coordinate and register a new link before turning on a transmitter. The technical factors that are accounted for in the system and can be modified to avoid interference include the brand, frequency, and bandwidth of the equipment; the direction and beamwidth of the antenna, and the polarization. BANC tracks

unknown sources of interference as well, typically deployed by private users such as schools.

The BANC system has already been adopted in Los Angeles and San Diego, and the group hopes WISPs in other areas will adopt a similar system of best practices in order to manage and avoid interference in their respective communities. The group finds it beneficial to partner with equipment manufacturers in order to reach non-members and promote its system.

BANC members expressed hope that equipment vendors will address the interference issues in the future and produce more sophisticated technologies that can avoid interference efficiently. However, BANC is also looking to the Commission to allocate additional unlicensed spectrum and provide easier and less expensive access to licensed spectrum. The group believes that even with coordination, the spectrum suitable for long-range outdoor links will become saturated in the near future and that WISPs are beginning to look for other sources of usable spectrum.

T-Mobile. Task Force members also visited with representatives from T-Mobile in San Francisco to see a demonstration of the company's newest smartphone device, the Hewlett-Packard (HP) iPAQ h6315. The h6315 is the first device to integrate both 802.11b Wi-Fi and wide-area network cellular connections into a single device.

The iPAQ h6315 device can establish Wi-Fi data connections within T-Mobile hotspots at 1.5-11 Mbps and can connect to T-Mobile's GSM/GPRS network for voice communications and data services, such as web surfing, e-mail access, instant messaging, at 40-60 kbps when a customer is outside of a hotspot. The device employs licensed broadband PCS spectrum for voice and GPRS data connections and unlicensed spectrum in the 2.4 GHz band for high-speed data connections inside Wi-Fi hotspots. Because the different types of modems are built in to the device and because billing and authentication systems are the same for both systems, the device can move seamlessly between the two types of networks. Each device includes a single log-on, IP address, and front-end client to manage authentication/security and billing.

Figure 16. HP iPAQ h6315

T-Mobile's GPRS network covers 224 million POPs across the United States. The company plans to begin deploying EDGE to major U.S. cities during the 706 quarter of 2004. T-Mobile's Wi-Fi network includes 4,700 hotspots in the U.S. and 2,000 abroad, and, according to the company, customers in the San Francisco Bay Area exhibit the highest usage of the company's Wi-Fi hotspots. Non-T-Mobile subscribers can also use T-Mobile hotspots. If a consumer enters a T-Mobile hotspot and has a Wi-Fi card but not a T-Mobile account, he/she is automatically directed to a T-Mobile page to purchase a day pass.

T-Mobile initially launched the iPAQ h6315 device into corporate client channels during 2004 and plans to eventually release the device into the consumer markets. The company may adopt a similar integrated Wi-Fi/GPRS solution for its consumer-oriented Sidekick smartphone device. T-Mobile is also offering an integrated Wi-Fi/GPRS modem card for customers to use with laptops.

The visit with T-Mobile demonstrated the complementary nature of wireless LANs and wide area cellular networks. The company views the h6315 device as the first of many devices that will connect to and represent the convergence of multiple types of networks. According to T-Mobile, as wireless broadband networks proliferate, consumers will demand greater integration of the voice and data networks and services they use throughout the day. The greater availability of integrated networks will in turn drive demand for greater availability of wireless broadband networks, fueling the level of deployment. The integrated devices leverage the advantages of the two types of networks. With Wi-Fi networks, the equipment is relatively inexpensive to deploy and allows faster data rates, while cellular networks offer interference protection and a wider coverage area. We expect convergence and integration of cellular and Wi-Fi networks to continue in the wireless industry, on both the equipment side as well as the service provider end.

T-Mobile recommended the Commission continue to provide a flexible regulatory framework for wireless services. The company stated it will need additional spectrum to deploy high-speed data, or 3G, networks beyond EDGE and is considering the AWS spectrum auction. T-Mobile also stressed that, in order to flourish, VoIP should be classified as an information service, not a telecommunications service.

The visit to the San Francisco Bay Area highlighted both the advantages and challenges of deploying wireless broadband services in urban areas. On the one hand, because of their high population density and relatively high broadband penetration, these markets represent attractive targets for broadband providers launching innovative new technologies and products. On the other hand, urban areas can pose unique challenges to providers using the license-exempt band, as these bands become more congested and the growing number of users subject to interference.

Appendix D -- Broadband Outreach by the Consumer & Governmental Affairs Bureau

During 2004, the Commission's Consumer & Governmental Affairs Bureau staff participated in several activities and events in order to distribute information and promote the deployment of broadband, including wireless broadband. While participation in these activities and events has not focused solely on increasing awareness and deployment of wireless broadband, the Bureau included wireless broadband as an option either as a stand-alone solution, or part of an integrated solution that may include DSL, cable modem, or satellite components. Integrated solutions that include wireless broadband are often the most practical approaches in rural and remote areas and on tribal lands. Following is a recap of outreach activities where we worked to facilitate broadband deployment and increase awareness of broadband options.

- The Commission conducted an outreach campaign in November to more than 1,800 community leaders and officials in counties served by Delta Regional Authority (DRA). We provided those leaders and officials with informational materials, including the FCC's new rural publication on how to bring broadband and other telecommunications services to rural areas. This effort laid the groundwork for one or more meetings in the DRA coverage area that will include the deployment of broadband DRA communities.

- The Commission hosted a Rural Satellite forum in January at the FCC to demonstrate how satellites serve rural communities by providing broadband services that facilitate telemedicine, rural health care, distance learning, public safety, agriculture and farming, and e-commerce. The forum provided information on how leaders in rural areas can work with industry and government to bring wireless and other broadband services to their communities using a satellite backbone.

- The Commission co-hosted with the Appalachian Regional Commission a rural telecommunications event in Knoxville, Tennessee. This event was held in June and featured FCC Chairman Michael Powell, ARC co-Chair Anne Pope, RUS Administrator Hilda Legg, and Tennessee Regulatory Authority Chairman Debi Tate. Multiple events were held demonstrating the benefits of providing broadband to rural areas. These events were held at the University of Tennessee and at Technology 2020/Digital Crossing. Technology 2020/Digital crossing is an incubator focused on bringing new technologies to rural America. For all events broadband was the theme and wireless broadband an important component. A wireless broadband representative was represented at a technology roundtable.

- The Commission exhibited at the TribalNet Summit in September and met with tribal IT professionals at the summit to discuss developments relating to spectrum and universal service, broadband and competitive telecommunications services. Our exhibit focused on the deployment of advanced telecommunications services, including wireless broadband, on tribal lands.

- The Commission exhibited, attended and spoke in September at the 51st Annual Meeting of the Affiliated Tribes of Northwest Indians, in Polson, Montana to discuss a variety of telecommunications issues, including broadband deployment and the purchase of competing telecommunications services.

- The Commission exhibited at the annual Rural TeleCon 04 held in Spokane in October. The purpose of this meeting is to promote broadband deployment in rural communities and we distributed information on federal resources and assistance on how to bring broadband to rural areas. This conference, co-hosted by our Appalachian Regional Commission (ARC) partner, included an exhibit area dedicated to federal agency resources, and the FCC exhibit was located in this area. RUS, the Department of Commerce, USAC, and the HHS Office for the Advancement of Telehealth were other entities with planned exhibits in the federal resources exhibit areas. CGB Chief K. Dane Snowden and RUS Administrator Hilda Legg were keynoters at this conference.

- The Commission hosted a consumer forum on May 24, 2004 on the Standing Rock Reservation in the Tribal Council Chambers at the Tribe's Administrative Headquarters in Fort Yates, North Dakota. Attended by Tribal citizens, Tribal Council members and administrative officials, State government officials, and representatives of the local incumbent telephone cooperative, the presentations and discussions centered on universal service low income programs, billing terminology, complaint procedures, developing technologies, and selecting the most appropriate local and long-distance wireline and wireless services, broadband deployment and promoting competition among carriers.

- The Commission and the Telecom Project Manager of the Standing Rock Sioux Tribe took part in a one-hour radio show on May 24, 2004, on KLND FM, a tribally owned and operated radio station located on a high point near Little Eagle, SD and serving the Standing Rock and Cheyenne River Sioux Reservations in North and South Dakota. The show featured the FCC's Consumer programs and several aspects of the FCC's regulatory efforts and Indian Telecommunications Initiatives outreach in Indian Country, including broadband deployment.

- The Commission conducted an ITI Workshop and Roundtable in Coeur d'Alene, ID in November. The event included an exhibit highlighting the Lifeline and Link-Up programs, emerging telecommunications issues such as VOIP, the transition to digital TV, and broadband alternatives on tribal lands. The event included sessions on telecommunications topics that examined issues involving access to wireless spectrum, universal service support, as well as homeland security and communications planning and deployment of internet protocol-enabled services. Regional specific issues were examined and interactive, solution-oriented sessions targeted how telecom infrastructure deployment, emerging and different telecommunications technologies, government programs,

and multi-faceted, integrated broadband solutions can be used to benefit Tribal communities.

- The Commission exhibited at the American Library Association in June to distribute information on choices and considerations relating to the purchase of telecommunications services, including broadband options, and establishing the Commission as a resource for libraries and librarians for consumer information.

- The Commission exhibited at the Midwest Black Family Reunion held last August in Cincinnati, OH. More than 200,000 visitors attended the event. Information on FCC issues was distributed and discussed with booth visitors, including consumer telecommunications marketplace choices and broadband options available to consumers.

- The Commission participated in a lecture series for the Department of Housing and Consumer Economics at the University of Georgia in Athens last September. The lectures focused on consumer marketplace choices for telecommunications products and services, spectrum issues, and the transition from analog to digital media, and deployment of broadband.

- The Commission exhibited at Life@ 50+: AARP's National Event and Expo in October attended by more than 20,000 visitors. Staff provided information to an estimated 3,500 exhibit booth visitors on a variety of telecommunications topics including wireline, wireless, broadband and DTV marketplace choices.