

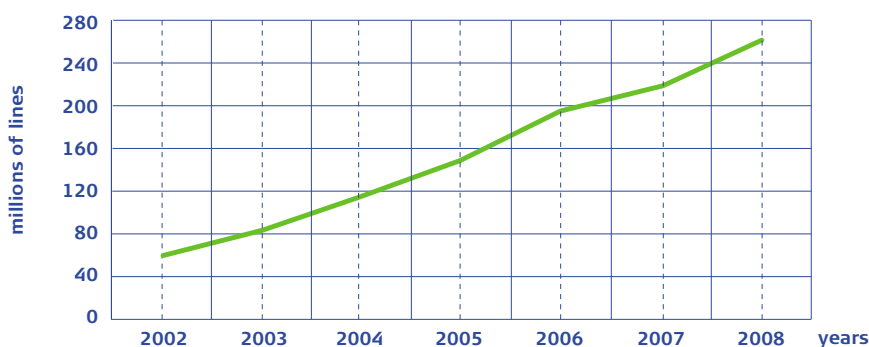


Introducing WiMAX

The next broadband wireless revolution

The vision: Broadband everywhere

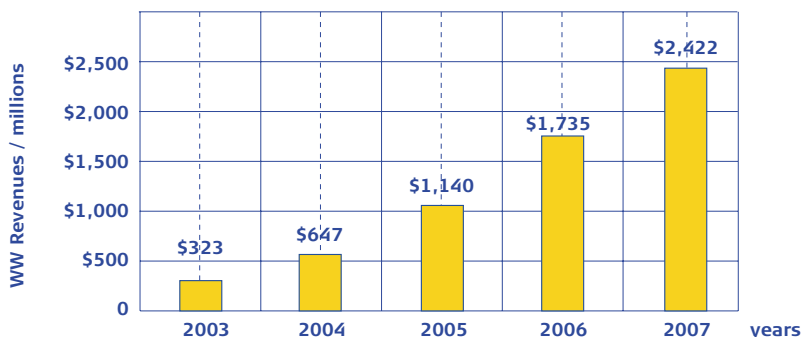
In recent years, Broadband technology has rapidly become an established, global commodity required by a high percentage of the population. In the past two years alone, the demand has risen rapidly, with a worldwide installed base of 57 million lines in 2002 rising to an estimated 80 million lines by the end of 2003. This healthy growth curve is expected to continue steadily over the next few years and reach the 200 million mark by 2006 (see Figure 1 below). DSL operators, who initially focused their deployments in densely-populated urban and metropolitan areas, are now challenged to provide broadband services in suburban and rural areas where new markets are quickly taking root. Governments are prioritizing broadband as a key political objective for all citizens to overcome the "broadband gap" also known as the "digital divide".



Source: Allied Business Intelligence Inc 2003

Figure1: Worldwide Broadband Market Growth

Wireless DSL (WDSL) offers an effective, complementary solution to wireline DSL, allowing DSL operators to provide broadband service to additional areas and populations that would otherwise find themselves outside the broadband loop. Government regulatory bodies are realizing the inherent worth in wireless technologies as a means for solving digital-divide challenges in the last mile and have accordingly initiated a deregulation process in recent years for both licensed and unlicensed bands to support this application. Recent technological advancements and the formation of a global standard and interoperability forum - WiMAX, set the stage for WDSL to take a significant role in the broadband market. Revenues from services delivered via Broadband Wireless Access have already reached \$323 million and are expected to jump to \$1.75 billion by 2006 (see revenue projections in Figure 2 below).



Source: Skylight Research September 2003

Figure 2: Worldwide - Sub-11 GHz PMP Broadband Wireless Access - 5 Year Forecast

The challenge: Meeting the demand

The desire for bandwidth-intensive Internet access and other voice and data services has never been greater across all geographies and market segments despite the economic downturn of recent years and the air of uncertainty in the global telecommunications industry.

The DSL market, based on a variety of wireline infrastructures, has succeeded in reaching millions of business and private subscribers and continues on a rapid growth curve. But supplying the quick rollout of infrastructure to the last mile has become a difficult and expensive challenge for carriers who cannot possibly keep pace with the demand. This has brought about a situation wherein subscribers living in developed areas with broadband-ready infrastructure can enjoy all the benefits of DSL services while those who do not, require another technology solution to fill the void. Broadband wireless technology - and specifically the introduction of the new WiMAX standard - fits this agenda perfectly.

Typical point to multipoint Broadband Wireless Access (BWA) systems are composed of two key elements: base station and subscriber equipment. The base station connects to the network backbone and uses an outdoor antenna to send and receive high-speed data and voice to subscriber equipment, thereby eliminating the need for extensive and expensive wireline infrastructure and providing highly flexible and cost-effective last-mile solutions.

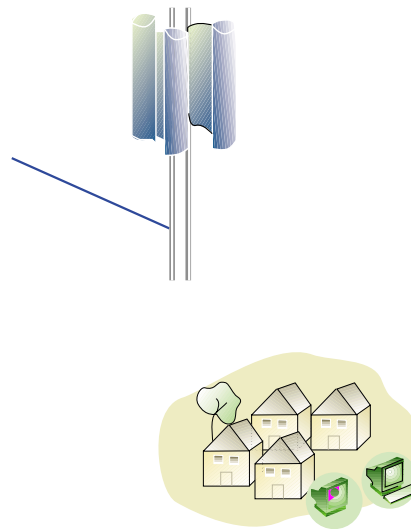


Figure 3: 802.16/HiperMAN - Broadband Wireless Access in the Last Mile

WiMAX is revolutionizing the broadband wireless world, enabling the formation of a global mass-market wireless industry. Putting the WiMAX revolution in the bigger context of the broadband industry, this paper portrays the recent acceleration stage of the Broadband Wireless Access market, determined by the need for broadband connectivity and by the following drivers:

- The worldwide deregulation process
- The standardization progression; and
- Revolutionary wireless technology.

Deregulation: Creating new opportunities on the horizon

A major driver impacting the broadband wireless explosion is the advent of global telecom deregulation, opening up the telecommunications/Internet access industries to a host of new players. As more and more countries enable carriers and service providers to operate in a variety of frequencies, new and lucrative broadband access markets are springing up everywhere. Wireless technology requires the use of frequencies contained within a given spectrum to transfer voice and data. Governments allocate a specific range of that spectrum to incumbent and competitive carriers, as well as cellular operators, ISPs, and other service providers, enabling them to launch a variety of broadband initiatives based exclusively on wireless networking solutions.

There are two main types of spectrum allocation: licensed and unlicensed.

- Licensed frequencies are typically awarded through an auction or “beauty contest” to those who present the soundest business plans to the regulatory authorities overseeing the process.
- Unlicensed frequencies allow multiple service providers to utilize the same section of the spectrum and compete with each other for customers.

Recent examples of the global spread of bandwidth allocations/licenses that are available to wireless operators as a result of deregulation include: Italy - 26GHz and 28GHz bands; UK - 2.4GHz, 3.5GHz, 10.5 GHz and 28GHz bands; France - 2.4GHz, 3.5GHz, and 26GHz bands; Sweden - 3.5GHz band; EC - 5.4GHz, to be made available for carriers throughout continental Europe; China - 2.4GHz, 3.5GHz, 5.8 GHz and 26GHz bands; and Brazil - 3.5GHz and 10.5 GHz bands.

The result: millions of new subscribers worldwide are benefiting from broadband access services delivered over wireless networks.

Standardization:
WiMAX - Worldwide Interoperability for Microwave Access

The WiMAX Forum is a non-profit trade organization, founded in April 2002 by leading vendors of wireless access equipment and telecommunications components. The Forum's mission is to lay the groundwork for an industry-wide acceptance and implementation of the IEEE 802.16 and ETSI HiperMAN standard, covering the 2-11 GHz bands for Wireless Metropolitan Area Networks (Wireless MAN). The Forum hopes to jump-start this crucial industry by establishing rigorous definitions for testing and certifying products for interoperability compliance. The issuing of a "WiMAX-Certified" label will serve as a seal of approval that a particular vendor's system or component fully corresponds to the technological specifications set forth by the new Wireless MAN protocol.

In order to ensure the success of wireless technology as a stable, viable and cost effective alternative for delivering broadband access services in the last mile, the introduction of industry standards is essential.

The companies that have already joined the WiMAX Forum represent over 75% of revenues in the global BWA market. Moreover, membership of the WiMAX Forum is not limited to industry leading BWA providers, numerous multinational enterprises like Intel and Fujitsu have also joined the WiMAX Forum. The Forum represents a cross-industry group of valued partners, including chip set manufacturers, component makers and service providers. All of these organizations recognize the long-term benefits of working with standardized, interoperable equipment and are committed to the design, development and implementation of WiMAX-compliant solutions. Furthermore, the fact that Intel, the world's leading developer of microprocessor chips, and Alvarion, the foremost global provider of BWA systems, are both putting their full weight behind the Forum and its agenda, just further attests to the expected demand and success of WiMAX.

The following is a partial list of key members of the WiMAX Forum:

Alvarion	Fujitsu Microelectronics America	RF Integration Inc.
Andrew Corporation	Hughes Network Systems	RF Magic
AT&T Wireless	Intel	The Telnecity Group
Atheros Communications, Inc.	NEWS IQ	Winova Wireless
China Motion Telecom	Nextel	Yahoo!
Compliance Certification Services	FDM Forum	
Filtrionics	Raytheon RF Components	

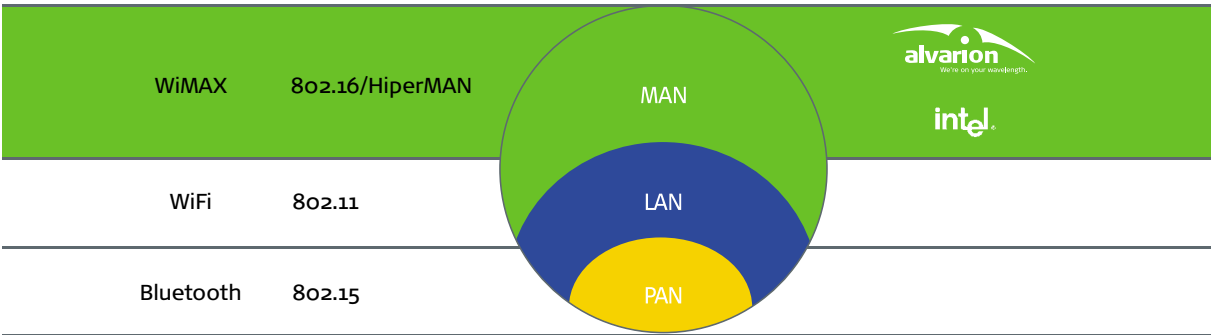


Figure 4. Wireless standards and their networking environments

Ensuring continuity: WiMAX is to 802.16/HiperMAN as WiFi is to 802.11

WiMAX seeks to build on the success of established business models that have reaped benefits in the field. Just as the WiFi and DSL forums ensured the success of WLAN (802.11) and DSL, WiMAX represents a significant leap forward in ensuring the standardization of the Wireless MAN protocols.

Over the coming year, the WiMAX Forum intends to develop equipment conformance tests to be performed in reputable certification labs.

Application	Association / Forum	Technology
BWA / WDSL →	WiMAX →	802.16/HiperMAN
WLAN →	WiFi →	802.11
Broadband Wireline →	DSL Forum →	DSL

Table 1: Standardization for success

The WiMAX standard is beneficial to every link in the broadband wireless chain:

Operators:

- Wireless systems significantly reduce operator investment risk
- Common Platform drives down costs, fosters healthy competition and encourages innovation
- Enables a relatively low initial CAPEX investment and incremental expenditures that reflect growth
- No more commitments to a single vendor, a typical by-product of the proprietary technology model

Consumers:

- Receive services in areas that were previously out of the broadband loop
- More players in the market translate into more choices for receiving broadband access services
- Quick "trickle down" effect of cost savings to consumers, translating into lower monthly rates

Component Makers:

- Standardization creates a volume opportunity for chip set vendors/silicon suppliers

Equipment Vendors:

- Concentrate on specialization (i.e. Base Stations or CPEs) - no longer need to create an entire end-to-end solution as in proprietary model
- Standards-based, common platform fosters rapid innovation and the addition of new components and services.

Revolutionary Technology: 802.16/HiperMAN - Tailor-made for Wireless MAN applications

Technological improvements in the broadband wireless arena have been rapid and significant in recent years, offering operators greater performance and flexibility in their deployments while reducing their investment risks and ongoing operating expenses.

The 802.16/HiperMAN for 2-11 GHz is a wireless metropolitan area network (MAN) technology that provides broadband wireless connectivity to Fixed, Portable and Nomadic users. This powerful OFDM and NLOS technology can be used to backhaul 802.11 hotspots and WLANs to the Internet, provide campus connectivity, and enable a wireless alternative to cable and DSL for last mile broadband access. It provides up to 50-kilometers of service area range, allows users to get broadband connectivity without needing direct line of sight with the base station, and provides total data rates of hundreds of Mbps per base station - a sufficient amount of bandwidth to simultaneously support hundreds of businesses with T1/E1-type connectivity and thousands of homes with DSL-type connectivity with a single base station.

802.16/HiperMAN Technology Specs

- Based on IEEE 802.16 and ETSI HiperMAN - WiMAX selected the common mode of operation of these two standards - 256FFT OFDM.
- Concentrated in 2-11GHz Wireless MAN (Metropolitan Access Networks), with the following set of features:
 - Service area range 50km
 - Non Line of Sight
 - QoS designed in for voice/video, differentiated services
 - Very high spectrum utilization: 3.8 bit/Hz
 - Up to 280Mbps per base station
 - True broadband for portable users - based on IEEE 802.16e enables the creation of a 'CPE-less' broadband market, providing broadband connectivity for laptops and PDAs with integrated WiMAX technology

The following table illustrates the improvement and advancement of Broadband Wireless technologies between 2000 - 2005 as well as the evolution from proprietary to Standard-based solutions

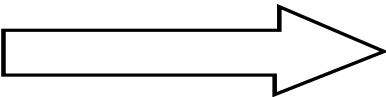
2000	2001	2002	2003	2004	2005
Proprietary Solutions					Standard-based WiMAX Solutions
Data rate: 2-11 Mbps peak		Data rate: 6-54 Mbps peak		Data rates: Up to 72 Mbps peak	
Chip sets: 802.11/b RF and PHY or proprietary		Chip sets: Vendors develop their own; some use 802.11a RF & PHY		Chip sets: Volume silicon supplier	
Air interface: Frequency hopping and Direct Sequence		Air interface: OFDM and SCDMA approaches		Air interface: 256 FFT OFDM and OFDMA	

Table 2 Broadband Wireless Progress Chart

Alvarion: An integral proponent of WiMAX

Alvarion, the world's premier provider of BWA solutions, has over ten years of experience with over 1,500,000 deployments in a wide variety of point-to-multipoint networking environments worldwide where wireless infrastructure is making a genuine and considerable impact on network efficiency and on improving bottom line expenditures. The breadth of our modular product offering and excellent onsite consulting and deployment services, make Alvarion the ideal partner for empowering operators with field-proven solutions that are fully WiMAX-compliant.

Alvarion embraced the arrival of the WiMAX Forum from the beginning and is proud to hold the two vice-presidency chairs of this prestigious organization. Our involvement with standards compliance is nothing new; the company also Chairs the ETSI BRAN HiperMAN alliance and sits on the Board of the Wireless Communication Association (WCA) where it serves in several key capacities. The company has also been a pioneer and major contributor in the creation and development of wireless technology for over a decade, including significant contributions to the 802.11, 802.11a and 802.16/HiperMAN standards.

Alvarion and Intel: Partnering for perfection

Alvarion's industry leading expertise and vast experience as a pure-play wireless vendor makes it the logical choice to be the first to work in conjunction with Intel on producing a product line that integrates WiMAX technology. By merging our industry leading strengths, we hope to live up to the promise of a stable, interoperable standard as set forth in the WiMAX Forum mission.

The Alvarion-Intel system cooperation is a strategic relationship launched by the two vendors to produce superior wireless chips (Intel) and systems (Alvarion) that will serve as a benchmark for all other wireless vendors as they move towards a comprehensive adoption of the WiMAX standard. Intel is designing the chip, guided by our system definition and design, which will be incorporated in our product line over the coming year.

Summary

The growing demand for broadband services on a global scale is clear and uncontested. Businesses, public institutions and private users regard it as an enabling technology and it has become a given requirement for delivering communications services in the Information Age. In last mile markets where traditional cable or copper infrastructures are either saturated, outdated or simply out of reach, Broadband Wireless Access (BWA) technology fills the void admirably, providing highly efficient and cost effective access services for millions of subscribers who would otherwise be left out of the loop.

The introduction of the Wireless MAN standards (802.16 and HiperMAN) and the guidelines set forth by the WiMAX Forum to ensure its success, will do much to encourage the growth of broadband wireless markets everywhere, benefiting everyone in the delivery chain from equipment vendors to carriers to end users. As the wireless industry's most experienced solutions provider, Alvarion has a long and impressive record of commitment to developing and introducing standardized protocols. The Company's current collaboration with Intel on a WiMAX system is an indication of the serious growth potential of wireless networking solutions in broadband markets that are underserved by wireline infrastructures.





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