



# **Standards versus Proprietary Solutions - The Case for WiMAX Industry Standards**

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## **Abstract**

WiMAX is a standards-based wireless technology providing high-speed data and voice services in networks covering long distances and wide ranges. WiMAX can be used for a number of applications including last mile broadband access, hotspot and cellular backhaul for carrier infrastructure, and high-speed enterprise connectivity. WiMAX is designed to provide E1-level bandwidth to businesses and the equivalent of cable/DSL access for home users. WiMAX will enable carrier-class solutions to scale to support thousands of users with a single base station, while providing differentiated service levels. For areas poorly served by wired infrastructure, WiMAX is expected to enable service providers to reach new businesses and residential customers, while reducing service costs.

Given the prevalence of proprietary solutions in the market, some might question whether WiMAX, or rather having a certified, standard WiMAX, is really necessary. This paper provides an overview of the WiMAX standard, discusses the pros and cons of industry standards in general, and examines the specific advantages and benefits of a WiMAX standard versus other proprietary technologies.

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## **What is WiMAX?**

### **The WiMAX Forum™**

WiMAX, the acronym for Worldwide Interoperability for Microwave Access, came into being in 2003 with the founding of the WiMAX Forum™, an industry-led, non-profit organization made up of equipment manufacturers, component suppliers and service providers. The WiMAX Forum promotes industry-wide adoption of the IEEE 802.16 and ETSI/HiperMAN wireless MAN air interface standards and certification and establishes the conformance, interoperability and compatibility of fixed, portable and mobile IP-based broadband wireless products and services. Today the Forum has more than 200 members including Intel at the helm, Alcatel, AT&T, BT, Lucent, Fujitsu, Siemens and Alvarion.

By conducting interoperability testing and awarding WiMAX certification to equipment manufacturers, the WiMAX Forum is working to jump-start the market for wireless MANs based on the IEEE 802.16 standard and ETSI/HiperMAN specifications. Just as the term Wi-Fi became associated with the IEEE 802.11 standard, WiMAX has become synonymous with the IEEE 802.16 standard.

### **WiMAX Technology**

WiMAX technology (based on the IEEE 802.16 and ETSI/HiperMAN specifications) is the standardization of the latest in broadband access technology. It provides the capacity to deliver the promise of sufficient bandwidth for the convergence of triple play services that includes, high-speed data, toll quality voice and multi-media. In the evolution path, WiMAX takes a major leap over Wi-Fi by providing last-mile broadband connectivity over a much larger geographic area. With coverage of areas ranging up to 30 kilometers radius, WiMAX primarily provides last-mile broadband access, in addition to the applications of backhaul for carrier infrastructure, enterprises and Wi-Fi hotspots. WiMAX is designed to provide high capacity SDSL access to businesses and the equivalent of cable/ADSL access for home users. WiMAX enables scalable carrier-class solutions to support thousands of users with a single base station, while providing differentiated service levels. For areas poorly served by wired infrastructure, WiMAX enables service providers to reach new businesses and residential customers, with an improved business case.

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## **WiMAX Applications and Architecture**

802.11 is a wireless LAN standard, IEEE 802.16 extends this coverage while offering the features consistent with the stringent demands of operators in a wide variety of deployment scenarios. The WiMAX (IEEE 802.16) technology fills a critical need in the end-to-end wireless network by bridging the gap between IEEE 802.11 wireless LANs and the wide area network.

WiMAX enables delivery of broadband services to residential and small-to-medium-sized business customers, and large corporations in urban, suburban and rural areas. WiMAX also facilitates continued growth of Wi-Fi hot spot deployments by providing an economic backhaul solution. With its ubiquitous coverage and support for nomadic operation, the 802.16-2004 standard can play an important role in public safety applications, enabling law enforcement, fire protection and other public safety organizations to maintain critical communications in adverse conditions.

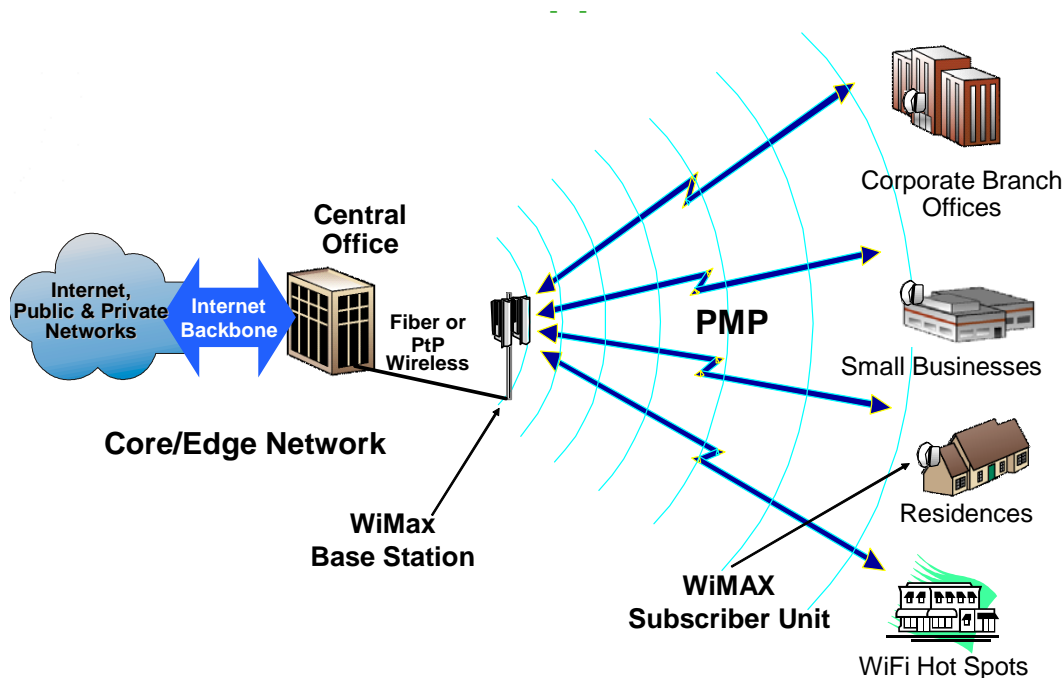
A WiMAX Metropolitan Area Network (MAN) is configured in a cellular manner with base stations strategically located to provide metro-area coverage via point-to-multipoint (PMP) microwave links.

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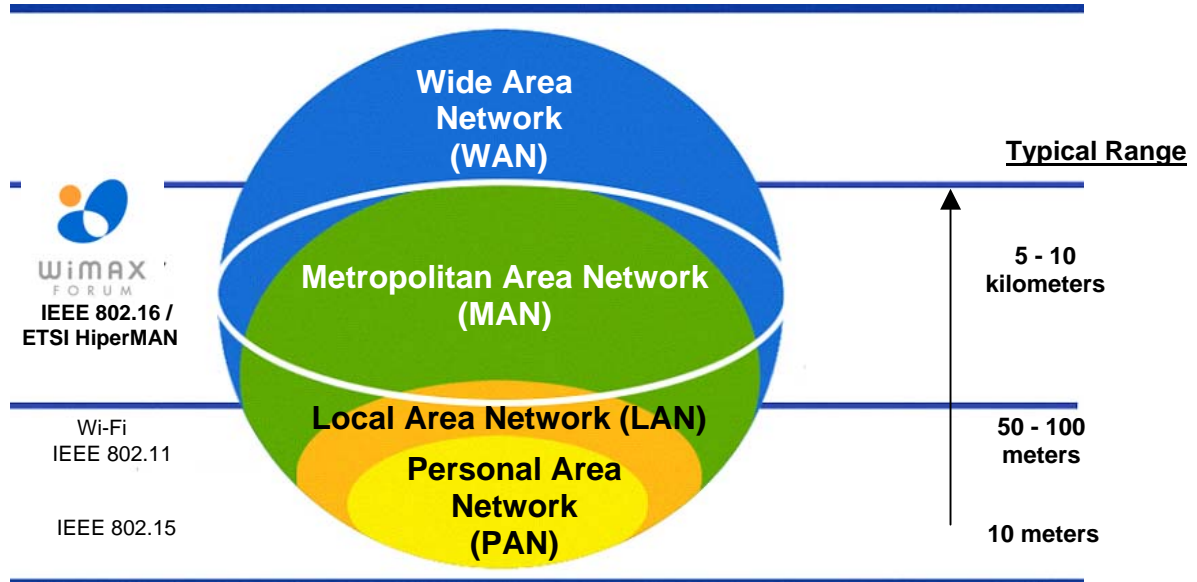
**Figure 1: WiMAX Architecture and Applications**



### WiMAX Technological Overview

The first release of the IEEE 802.16 standard addressed applications in the licensed 10-66 GHz frequency range. Subsequent amendments to the standard (802.16a/b/c/d) addressed the licensed and license-exempt bands in the sub-11 GHz frequency range. Operation in these lower frequency bands enables the technology to address non-line-of-sight (NLOS) as well as LOS applications, allowing for ubiquitous coverage in a variety of demographic environments. The release of the IEEE 802.16e amendment, which will add mobility to the suite of services covered by the standard, is expected during the later half of 2006.

**Figure 2: WiMAX Bridges the Gap between LAN and WAN**



## Key Attributes of the WiMAX Technology

The following table provides a summary of the key attributes of the WiMAX technology.

**Table 1: Key Attributes of WiMAX Air Interface Standard**

	WiMAX Air Interface Standard		
	IEEE 802.16	IEEE 802.16-2004	IEEE 802.16e
<b>Estimation Date</b>	2003	Certification in 2005	2006
<b>Frequency Band</b>	Licensed 10-66 GHz	Licensed and unlicensed sub-11 GHz	Sub-6 GHz
<b>Service</b>	Fixed	Fixed/Nomadic	Fixed, Mobile
<b>Primary Market Segment</b>	Urban: high density multi-tenant buildings	Urban, suburban, rural residential: SME, Wi-Fi backhaul	Broadband access to laptop, PDA or smart phone
<b>Air Interface</b>	SCA OFDM/OFDMA	OFDM/OFDMA	SOFDMA
<b>Range</b>	LOS up to 5 km	LOS & near-LOS up to 30 km; non-LOS up to 5 km	Non-LOS up to 10 km
<b>Channel BW</b>	20, 25, 28 MHz	Various from 1.75 to 20 MHz (depending on frequency)	Various from 1.25 MHz to 20 MHz (depending on frequency)
<b>Channel Capacity</b>	Up to 134 Mbps	Up to 70 Mbps	Up to 35 Mbps
<b>Duplexing</b>	TDD or FDD	TDD or FDD	TDD or FDD
<b>QoS</b>	Voice/data/video, differentiated services	Voice/data/video, differentiated services	Voice/data/video differentiated services

As indicated, WiMAX-based solutions exhibit a number of key technical advantages:

- Superior non-line-of-sight (NLOS) performance
- Extended operating ranges
- Flexible channel bandwidth for both licensed and unlicensed frequency bands
- High channel capacities
- High bit efficiency of more than 3b/s/Hz
- Built-in quality of service (QoS) for a range of applications and services



A number of proprietary wireless MAN solutions are available, with some even providing selected features and capabilities offered by the WiMAX standard. However, when the complete feature set is considered, WiMAX outperforms proprietary solutions.

### **Understanding the Implications of Standards**

Currently, every solution is customized and not interoperable. In the standardization process, the "rules" are set, and then every solution must be tested according to those criteria. The second stage of the process is when three vendors bring their standard-ready solutions to the laboratory, and test the equipment's interoperability. At the end of this process, every piece of WiMAX Forum Certified equipment will be interoperable with other WiMAX Forum Certified equipment. WiMAX Forum Certified means a service provider can buy equipment from more than one company and be confident about the interoperability of the equipment.

### **Advantages of Standards**

With the existence of proprietary solutions, the question arises whether the WiMAX standard is a market necessity. This is particularly relevant given that some proprietary solutions, can deliver superior technical performance on a specific feature, compared to their standards-based counterparts.

Several points can be made for and against the adoption of industry standards. Typical reasons cited **against** the implementation of a standard include:

- **Time-consuming process:** The process of developing a standard is time consuming, often lasting many years. While it drags on, market needs can go unfilled or alternatively, motivating operators to turn to 3G or other technologies.
- **Lowest common denominator:** To gain mutual agreement on a standard from all players with a vested interest, the standard gravitates to what is acceptable to most manufacturers. Therefore, the resulting solution may not satisfy user requirements.
- **Lack of innovation:** Forcing vendors to conform to an industry-wide standard potentially deprives the market of more innovative solutions.

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Typical arguments **in favor** of the adoption of an industry standard include:

- Standardization leads to **wide-scale adoption**, a market driver.
- **Reduced production costs:** Standards-based solutions are less expensive to develop and produce, since equipment manufacturers do not need to develop or outsource every unique component associated with proprietary solutions. As a result, manufacturers enjoy economy-of-scale advantages.
- **Reduced deployment costs:** The resulting lower equipment costs drive down network deployment costs for the operator. Eventually, these lower costs will be passed on to the end user.
- **Reduced development risk:** Equipment manufacturers face lower development risks, since they are no longer dependent on unique ASICs, devices and other critical components produced in lower volumes.
- **Reduced supplier dependence:** Operators are at higher risk with sole-sourced solutions. Standards-based solutions enable operators to source interoperable systems from multiple vendors.

In conclusion, WiMAX Forum certification will foster a more competitive industry with lower costs and faster growth for broadband wireless worldwide.

### **The WiMAX Experience**

**While the** development of industry standards often involves a time-consuming process that discourages innovation, the WiMAX experience has been anything but that, featuring rapid development and innovative solutions.

**Support of innovation:** The IEEE 802.16 family of standards supports variations, giving vendors the opportunity to provide state-of-the-art, differentiated solutions while remaining standards-compliant. And in the absence of an approved standard, several vendors, including Alvarion, have provided wireless MAN solutions over the past several years to meet market demands. As a result, market needs have not gone unfilled.

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WiMAX not only avoids the main disadvantages of industry standards, but also is set to deliver powerful advantages. With worldwide endorsement of WiMAX and proven equipment interoperability, the standard will provide a range of compelling benefits to all players in the industry value chain, as illustrated in Table 2.

**Table 2: WiMAX Benefits by Industry Players**

<b>Component Suppliers</b>	<ul style="list-style-type: none"> <li>• Assured wide market acceptance of developed chips and components</li> <li>• Lower production costs due to economies of scale</li> <li>• Reduced risk due to interoperability</li> </ul>
<b>Equipment Manufacturers</b>	<ul style="list-style-type: none"> <li>• Stable supply of low-cost components and chips</li> <li>• Freedom to focus on development of network elements consistent with core competencies, while knowing that equipment will interoperate with third-party products</li> <li>• Engineering development efficiencies</li> <li>• Lower production costs due to economies of scale</li> </ul>
<b>Operators and Service Providers</b>	<ul style="list-style-type: none"> <li>• Lower CAPEX – with lower cost base station, customer premises equipment (CPE), and network deployment costs</li> <li>• Lower investment risk due to freedom of choice among multiple vendors and solutions</li> <li>• Ability to tailor network to specific applications by mixing and matching equipment from different vendors</li> <li>• Improved operator business case with lower OPEX</li> </ul>
<b>End Users</b>	<ul style="list-style-type: none"> <li>• Lower subscriber fees</li> <li>• Wider choice of terminals enabling cost-performance analysis</li> <li>• Portability of terminals when moving locations/networks from WiMAX operator “A” to operator “B”</li> <li>• Lower service rates over time due to cost efficiencies in the delivery chain</li> </ul>



## **Alvarion and WiMAX**

Alvarion has been instrumental in driving WiMAX to its current market prominence. Recognizing the value of a worldwide wireless MAN standard, Alvarion has made significant contributions to the development of the IEEE 802.16 and ETSI HiperMAN standards. One of the many contributions was in the drafting of the mobile PHY/MAC features of the wireless protocol and creating the definition profiles for 802.16-2004.

Alvarion has played a key role in the WiMAX Forum since its inception. As a founding member, Alvarion holds several key positions in the Forum, with Dr. Mo Shakouri at the helm of the Marketing Working Group and the AVP of the Forum's Marketing Division. Alvarion also chairs the ETSI BRAN HiperMAN Alliance, and its representatives serve on the Board of the Wireless Communication Association (WCA) in several key capacities.

Since July 2003, Alvarion maintains a strategic partnership with Intel to work together to incorporate Intel's WiMAX chips into the company's Broadband Wireless Access (BWA) systems. In addition, OEM partners include major mobile players such as Alcatel, Lucent, Siemens and others to market Alvarion's WiMAX product line on a global basis.

The company's involvement with standards compliance and industry organizations is not new. Alvarion has been a pioneer in the creation and development of additional wireless technologies over the past decade, as indicated by its significant contributions to the 802.11 and 802.11a Wi-Fi standards.

These ongoing activities culminated in mid-2004 with Alvarion's launch of the BreezeMAX™ 3500, the industry's first WiMAX-ready platform in the 3.5GHz band, already installed in more than 30 countries. Subsequently in January 2005, it was the first company to announce its mobile broadband wireless access, 802.16e, plan including a pilot product approximately one year later. Based on the IEEE 802.16/ETSI HiperMAN standards and WiMAX Forum profiles, BreezeMAX incorporates core wireless innovations, and leverages Alvarion's 10-plus years of experience deploying orthogonal frequency division multiplexing (OFDM) systems in commercial broadband wireless access (BWA) networks.

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## **Conclusion**

While proprietary wireless MAN solutions will continue to exist, for the most part they will be relegated to filling specialized market needs. Industry-wide adoption of the WiMAX standard will lead to lower-cost, widely available products for the mass market. Operators will be able to choose solutions from multiple vendors, enabling the deployment of standards-based wireless MAN networks suited to particular environments and applications, while lowering their costs and improving their bottom line.

WiMAX will provide attractive benefits to all players in the industry value chain – from chip set providers, to equipment vendors to network operators to end-users. Adoption of the WiMAX standard, and the WiMAX Forum's efforts to ensure its success, will greatly encourage the growth of broadband wireless markets worldwide. Eventually, WiMAX will eliminate the remaining barrier to providing broadband access to millions of potential users in under-served markets across the globe.

WiMAX is the most cost-effective solution for delivering broadband on a ubiquitous scale. Standardization will change the BWA market from a niche market to a mass market, bringing all the economic benefits that accompany a mass market product.

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