

## [WiMax, VoIP, and the Metropolitan Area Network](#)

The emerging IEEE 802.16 standard, commonly known as WiMAX, promises to deliver last mile wireless broadband internet access capable of carrying data intensive applications, such as VoIP and streaming video, to Metropolitan Area Networks, as well as sub-urban and rural communities. WiMAX is considered a disruptive technology, designed as an alternative to fixed line DSL and coaxial technologies, and with its 802.16e revision, the cell phone networks as well.

Worldwide Interoperability for Microwave Access will operate over licensed and non licensed frequencies using non line of sight (NLOS) and line of sight technologies, extending broadband coverage to cities and towns wirelessly via a metro area network. Additionally, because of its far reaching capabilities and ease of implementation, WiMAX is the one technology likely to bridge the Digital Divide, connecting underdeveloped regions and sparsely populated rural areas much more cost effectively than deploying a wireline infrastructure.

### WiMAX and WiFi Compared

The widespread adoption of the wireless LAN in the business community, as well as the emergence of WiFi hotspots in public areas, airports, hotels and cafes, has been of tremendous significance in providing mobility to business people and consumers alike. Thanks to the open standards guided by the 802.11 committee and the WiFi Alliance, WiFi technology is becoming ingrained in our society. WiMAX plans to take WiFi a step further.

While the two technologies may sound the same, they are from their conception designed for totally different applications. WiFi is a short range standard that was designed primarily as an extension of the local area network (LAN) to provide mobility for the end user. It operates over unlicensed frequencies and has a range of about 100 meters, depending on obstructions. Typically one access point will be connected to a fixed line network, either a wired LAN or a DSL/cable broadband connection, and the range can be extended by adding more access points at appropriate distances.

WiMAX, on the other hand, is designed to function as a carrier network, or a wireless Internet service provider (WISP), blanketing whole cities and regions with broadband Internet access comparable to DSL. Coverage in optimal conditions could reach 50 kilometers, but in reality are more like 5 km for users with NLOS customer premise equipment (CPE), or up to 15 km with a CPE connected to an external line of sight antenna.

As the older more established technology, the 802.11 WiFi has been used in a mesh topology to cover larger areas such as college campuses and municipalities, for example to connect the terminals in police vehicles to their database. The emerging 802.16 WiMAX will be better suited for larger deployments, and will in fact compliment the private WiFi networks by offering a cheaper and more secure Internet access for data and voice applications.

### The WiMAX Standards: Fixed, Nomadic, and Mobile

The 802.16 standard developed by the IEEE envisions a fixed wireless broadband network operating in the spectrum range of 10 GHz to 66 GHz. Originally, only the licensed spectrum was addressed in this range, and line-of-sight multipath technology was dealt with by adopting OFDM as the standard. Subsequent revisions added the 2 GHz to 11 GHz band to the spectrum, and incorporated support for non-line-of-sight technologies and Quality of Service (QoS) techniques, a prerequisite for such time sensitive applications as voice and video.

The revision known as 802.16-2004(d) rolled up all the previous revisions and then added some. Most of these original issues dealt with the Physical and Media Access Control layers, and resulted in a standards list of optional and mandatory elements by which vendors could design their products.

The resulting fixed WiMAX standard has a data rate of up to 40 Mbps, support for half and full duplex transmission, improved QoS, and the incorporation of multiple polling techniques, ultimately reducing packet collisions and overhead.

Base stations are to support several different topologies, such as wireline backhauling, microwave point to point connections, and the ability for the WiMAX base station to backhaul itself by reserving a part of the bandwidth for that purpose.

By design, 802.16d would cater to the residential and small business markets offering wireless broadband access with speeds comparable to DSL. Enterprise markets could be served at T1/E1 data rates.

While this version of WiMAX is called fixed, it is in all actuality nomadic. Users on a private WiFi network indoors could be passed off seamlessly to the public WiMAX network when moving outdoors, their hardware determining the best network available. Devices on the WiMAX data network would include laptops, PDAs, and smart phones equipped with an on board WiMAX capable chip or PC card, utilizing the spectrum for voice, data, video,

and music transfers.

Nomadic WiMAX provides for limited mobility in that the range of coverage is handled by the same base station.

#### WiMAX Goes Mobile

With the adoption of the 802.16e revision in late 2005, all the hype has been on Mobile WiMAX, a technology designed to compete with the cellular networks.

With major support from manufacturers like Intel, Motorola, Siemens, and Nokia among others, mobile WiMAX is built on open standards and is purported to be 4 times faster than the cellular 3G technologies (EVDO, HSDPA). Significant cost savings can be achieved for voice applications by placing calls over the Internet through VoIP.

802.16e provides for fast and seamless handoffs between base stations, with a cell radius of about 3 miles, similar to cellular networks. The standard was ratified in late 2005, and real world applications are beginning to show up in 2007, with more robust development expected throughout 2008.

Because this technology is such a threat to the legacy telecommunications industry, it is no surprise that Sprint Nextel will be deploying WiMAX as opposed to EVDO in its 4G network. Sprint has been buying up much of the WiMAX spectrum, and has recently announced a partnership with Nokia to deploy WiMAX to four Texas cities by mid 2008. This is not their first WiMAX network, and telcos around the globe have been doing the same.

The 802.16 standards are a work in progress, and as such, are subject to changes and revisions. As the standards committee works on the technology, the WiMAX Forum hopes to do what the WiFi Alliance did for the 802.11 standards, by promoting interoperability between components through testing, and offering WiMAX certification to vendors that conform to the 802.16 standards.

It should be noted that many of the WiMAX implementations at the time of this writing are proprietary, and thus do not necessarily follow the recommendations of the IEEE or the WiMAX Forum. The broadband wireless ISP Clearwire Communications has over 200,000 subscribers in 375 sites, and calls its service a WiMAX-class solution, utilizing next-generation, non-line-of-sight wireless technology. Other early adopters of pre-WiMAX technology are forging ahead, providing wireless broadband access to residential consumers and the small business market, with many companies climbing aboard the evolving standards bandwagon to assure interoperability and backwards compatibility of devices and applications.

#### About the Author

Michael Talbert is a certified systems engineer and web designer with over 7 years experience in the industry. For more information on [VoIP, WiMAX, and related technologies](#), visit the website [VoIP-Facts.net](http://VoIP-Facts.net) for up to date industry news and commentary.

Source: <http://www.onlineearnings.net>