

**Business White Paper  
Broadband Wireless Access**

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**From “a” to “e”: The 802.16 Standard Evolution**

As with any communications technology, the development of an industry standard is the critical turning point for widespread adoption. The broadband wireless arena is no exception. As such, considerable efforts have been made on the part of the IEEE (Institute of Electrical and Electronics Engineers) Standards Association Working Group, the WiMAX Forum™ and vendors to adopt a standard for technology that will allow for interoperability and pave the way for future deployment. This paper will examine the overall importance of building a standard, as well as provide a brief overview of the evolution of the 802.16 and 802.16a standard for broadband wireless and how it will benefit technology adoption.

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## Introduction: Why we need standards

For any technology to thrive, developing an accepted industry-standard is critical to ongoing product development and user acceptance. Standards bodies are created to:

- Bridge the gap between research ideals/technology theory and reality
- Provide a unified voice for the underlying knowledge and potential of technology to resolve a business issue or problem
- Serve as a public policy arena where competing stakeholders interests and values are drawn together
- Help define telecommunication and data communication system outcomes for public accountability purposes
- Establish a structured decision making process to determine points for further decision making within the regulatory, vendor and user communities.

At one time, standard setting was primarily of interest to industry specialists and regulators. Now they are also engaging end user organizations such as the RBOCs (regional Bell operating companies, PTTs (providers of telecommunications training) and Cablecos - along with manufacturers - in formal exercises to define acceptable and/or desirable levels of performance for communication networks and systems. This allows the standards setting process to be viewed from a number of widely varying perspectives. The process can be viewed as a crucial intersection point, where research theory meets the “real world”.

Standards consensus – or lack thereof - can make or break a communications technology. By way of example, it is only recently that we witnessed the battle between WiFi™ and Home RF for supremacy in the wireless LAN market. WiFi™ succeeded because of the speed at which the wireless LAN industry coalesced around the standard and decided upon what elements they would and would not use to build interoperable products.

This is the same challenge now faced by the WiMAX member companies as we work on deciding the test and interoperability criteria that will lead to truly interoperable 802.16a compliant and WiMAX certified wireless WAN products.

## 802.16 and beyond

Redline has been committed to the 802.16 standards process from the outset. Since 2002, there has been much work done on matching an evolving standard to the realities of “real-world” outdoor Non-Line-of-Sight (NLOS) and Optical Line-of-Sight (OLOS) connections. In the past, these NLOS and OLOS conditions have been an impediment to widespread adoption of wireless broadband. The challenge for the industry has been to quickly resolve these conflicts through accepted standards. This is being addressed through the efforts of the IEEE, European Telecommunications Standards Institute (ETSI) and the WiMAX Forum.

In July 1999, the IEEE began the development of IEEE Standard 802.16. It specifies the WirelessMAN (Metropolitan Area Network) Air Interface for wireless metropolitan area networks in the 10–66 GHz bands. The 802.16 standard was published on April 8, 2002. It was created through an open process with the consensus of hundreds of engineers from the world's leading operators and vendors. In 2003, 802.16 emerged as the most promising networking technology standard for broadband wireless.

IEEE 802.16 addresses the "first-mile/last-mile" connection in wireless metropolitan area networks. It focuses on the efficient use of bandwidth between 10 and 66 GHz. It also defines a media access control (MAC) layer that supports multiple physical layer specifications customized for the frequency band of use. The 802.16 MAC allows multiple service flows with different Quality of Service (QoS) parameters on the same subscriber station.

The 802.16a standard, initiated on March 30, 2000 and accepted on January 29, 2003, was designed to be a MAN/WAN wireless standard from the ground up. Products conforming to the 802.16a specification will take advantage of carrier class QoS implementations using Time Division Duplex or Frequency Division Duplex access methodologies instead of a wireline CSMA/CA approach.

The 802.16a standard offers the following attributes:

- It is designed for the 2-11 GHz region and supports both licensed and unlicensed bands (Versus the original project scope of 10-66 GHz for IEEE Standard 802.16)
- It specifies the physical layer and medium access control layer of the air interface of interoperable fixed point-to-multipoint (PMP)
- It specifies optional mesh topology broadband wireless access systems in license-exempt bands, optional mesh technology (e.g. those supporting data rates of DS1/E1 or greater)

802.16 is a truly international standard. IEEE supports it on a global basis, as well as by ETSI HiperMAN for European deployments. Changes adopted by either body are being reflected in the baseline technical requirements. It is also supported by parallel interoperability efforts through the WiMAX Forum™.

Equipment based upon 802.11 WiFi™ when used as a MAN or WAN technology will likely not offer the same degree of bandwidth efficiency and bandwidth management functions as those using an 802.16 Quality of Service mechanism.

During June 2004, the IEEE-SA (Standards Association) announced the official ratification of a new standard, IEEE 802.16-2004, which revises and replaces 802.16, 802.16a, and 802.16REVd. This announcement marked a significant milestone in the development of 802.16 and the technologies advocated by the WiMAX Forum™. One key result is that the 802.16-2004 standard helps clarify the standard within the broader industry, including end-user and service provider customers. This milestone marks the beginning of a new phase for the 802.16 standard. 802.16-2004 products are expected to be as cost-effective as 802.11 technologies in the same relative timeframe: two to three years after adoption of the standard.

The next work effort in the 802.16 arena is completing extensions to the 802.16e specifications. These are designed to support mobility applications. Currently, work on the TGe extensions to 802.16 is expected to be completed by the end of 2004.

## **The benefits of standards**

According to the WiMAX Forum™, the benefits of these standards on the vendor, supplier and user community are numerous. They include:

- Larger volumes of vendor products through standardized parts for greater production efficiency
- Fewer product variants through a common subset of capabilities
- Interoperability between vendor equipment and among different generations of systems
- Less risk, lower system costs and greater return on investment
- Faster, cheaper access to more widely available, higher quality service
- Significant growth potential for broadband wireless deployment in underserved markets
- Equivalent delivery of services vs. wireline or fiber
- Guaranteed minimum performance levels

- Consistent levels of voice, video and data flow quality

## **Where it all fits**

While there is still much development work to be done, the progress that has been made to date has been instrumental in bringing broadband wireless to the mainstream. The industry is strongly committed to supporting broadband wireless adoption in the market. As such, it has spent many months developing standards that satisfy the needs of all concerned, from product developers to end-users. Vendors such as Redline, who were the first to introduce an 802.16a-based product, are ensuring that the building blocks are in place to deliver the performance, QoS and interoperability needs of the future.

**About the author: By Kevin F. R. Sutor, Vice President, Business Development**

Mr. Sutor is Vice President, Business Development at Redline Communications. He brings to Redline extensive market and technology knowledge of North American service providers and equipment manufacturers. Before joining Redline, Mr. Sutor held various senior level positions in several organizations, most recently with CopperCom's Business Development Group. Earlier, he built a solid track record at the executive level in a variety of roles with organizations such as CTI Datacom, Tekelec, DCI Digital Communication Inc. and Wandel & Goltermann. Mr. Sutor has written numerous contributed articles in a variety of industry publications and is a regular speaker on topics such as WiMAX, ATM, Gigabit Ethernet, Virtual Private Networks and Voice Services.

**Attributing company: Redline Communications Inc.**

Redline Communications is a technology leader in the development of standards-based broadband wireless access solutions. Its groundbreaking and award winning products feature longer range, more robust performance, and higher capacity than competing products. Redline is a principal member of the WiMAX Forum™, and was first in the world to market an 802.16 compliant product.

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