Wireless Design & Development

Advantage Business Media

WiMAX 101 The Evolution of WiMAX

With networks built around an infrastructure of base stations and subscriber stations like WiMAX, the size of the infrastructure and the number of deployments is a key consideration.

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It is always interesting whenever a new standard is adopted or starts to gain some ubiquity in the marketplace. When this occurs, it is important to ask the question: "So what? What does this new stuff give me that I don't already have?" If the answer is not much, then there is no reason to convert or further look into the prospect of converting to this new technology. If the new technology gives you something of advantage, then knowing what the differences and advantages are of the new technology are can enable appropriate business and design decisions.

What is WiMAX?

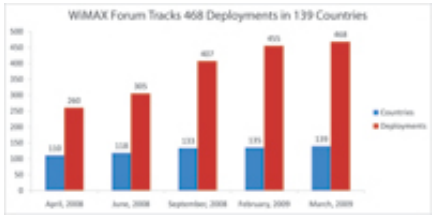

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Figure 1. WiMAX forum member survey.

WiMAX, which comes from the expression worldwide interoperability for microwave access, is the trademark name for technologies that are based on the IEEE 802.16 broadband wireless access standard. Although it is not necessarily a new standard (work began on the standard in 1999), WiMAX has gained some momentum with the 802.16d and 802.16e versions that have been ratified now for several years.

The 802.16 working group initially defined a couple of different single carrier bands. However, the most widely used implementations of the standard are 802.16d and 802.16e which instead use Orthogonal Frequency Division Multiplexing (OFDM) and Orthogonal Frequency Division Multiplexing Access (OFDMA). OFDMA is a multi-user version of OFDM and has some claimed advantages over traditional CDMA and time division statistical multiplexing methods. WiMAX, many 3G and proposed 4G networks, and the latest 802.11 versions all have chosen OFDM and OFDMA platforms, although there are a number of different flavors even within the WiMAX standard.

Several different available frequencies are defined in 801.16 including those ranging from 2.3to 2.7 GHz, 3.4 to 3.6 GHz and 5.8 GHz, with a recent survey of WiMAX forum members showing that the most popular bands are located at 2.5 GHz and 3.5 GHz (see Figure 1).

As for data rates, while you may see specifications touting 40 Mb/s, that data rate refers to a single channel that may be shared among several users. Such data rates will not, of course, be experienced by an end user. A typical end user can expect to experience data transfer speeds of 1 to 5 Mb/s.

WiMAX vs. Cellular and WiFi

Both WiFi and WiMAX were specifically designed to deal with packet based data whereas the cellular networks were designed first and foremost as channels for voice. Being a data network, WiMAX has spent a lot of effort on a testing and certification program that includes all based stations, subscriber stations and end devices. If designing something at the chip level, certification for WiMAX can be prohibitively expensive unless large volumes are involved. If, however, the design uses a module that has already gone through testing, then only some minimal final testing has to be completed and certification is on the order of half the cost of certifying a similar cellular device with a given carrier. The certification program is designed so that WiMAX will not have interoperability issues, and devices can be distributed by common retail channels.

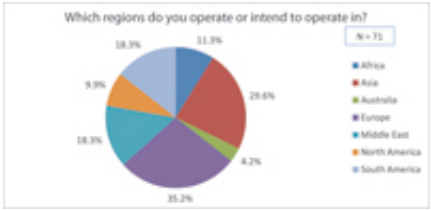

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Figure 1. The TM500 LTE test mobile's comprehensive data logging and measurements gets to the heart of development problems.

While still new, WiMAX data plans are designed to be more user friendly than cellular networks and will have an approach similar to WiFi where users have a flat plan that allows for network access for a given time period rather than paying for specific bandwidth usage.

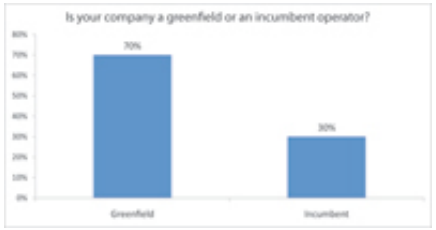
WiFi was not designed for large Metropolitan area networks and isn't really capable of large numbers of users per access point. It has proven itself as a terrific LAN technology and it is expected that it will continue to dominate the wireless landscape in that capacity for a number of years to come. WiMAX envisions itself as being complimentary to WiFi. WiFi access points would provide connectivity inside buildings and hotels and WiMAX would provide connectively outside or in mobile situations.

Cellular networks do have a number of advantages that are important to consider. The available coverage for 2G & 3G networks is unparalleled. The carriers have experience in deploying and servicing large networks, and any next generation devices that may compete with WiMAX, such as LTE (Long term evolution), would have modes to be compatible with existing 2G & 3G stations. This means that if a device is deployed where 4G LTE coverage was not available, it could revert to slower data rate standards and maintain connectivity.

The negatives of designing in cellular devices deal mostly with certification and data plans. If engineering a new product that may need cellular capability, it is often more cost effective to work with a company that is familiar with the carriers and certification process. In order for a device to work on a cellular network, commissioning with an individual carrier has to be completed before the device is allowed on the network. The cellular certification process can be time consuming and expensive. Cellular networks have to support their main legacy application of voice and the plans for data are generally designed for a particular amount of data per month. If data usage is exceeded in a given month, the overruns can be very expensive.

4G cellular is still in its infancy. While testing and demonstrations of proposed 4G LTE have been completed, actual deployments are yet to come.

WiMAX Deployments and Standards Today



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WiMAX 802.16e is also called Mobile WiMAX and currently is the most used version of the standard. The full name of the Mobile WiMAX standard is IEEE 802.16e-2005. This version of the standard was ratified in December of 2005 so it has been available for a number of years. With networks built around an infrastructure of base stations and subscriber stations like WiMAX, the size of the infrastructure and the number of deployments is a key consideration. Currently WiMAX is still experiencing growth in this area and has 468 deployments in 139 countries (see Figure 2). Location on the details of where these deployments are can be found at www.wimaxmaps.org.

It is estimated that the current deployments cover more than 434 million people across all populated continents, with estimated population coverage of 205 million, 80 million, and 28 million for Asia-Pacific, Eastern and Western Europe and North America respectively. Work is being done on the next generation of the standard which is called 802.16m. 802.16m is slated to have faster data rates and is also being considered as a 4G option.

Conclusion

There is no question that some type of mobile broadband will be a part of the IT landscape moving forward, and in fact, there may be several technologies that make up the portfolio of options. WiMAX has industry participation by a number of member companies including Sprint Nextel, Intel, Motorola, Nokia and others. As the number of networks and overall coverage continue to expand, it looks as though WiMAX will be an option for broadband connectivity and data backhaul for a number of different markets.

Note: *All graphs are used with permission of the WiMAX forum®*John Schwartz is technology strategist for Digi International. For more information, visit www.digi.com.