WiMAX Act 2: 802.16m Provides Evolution Path to 4G

As current-generation 802.16e mobile WiMAX networks are deployed globally, work continues on the next generation of the technology known as 802.16m, which will provide greater performance, capacity and flexibility over existing legacy networks.

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For the next several months, WiMAX.com and Cisco will be featuring weekly topics and perspectives from the WiMAX & wireless broadband industries. This week, we talked with the WiMAX standard's groups at Intel and Cisco on the latest developments with 802.16m and what it means for operators and their customers.

Broadband wireless technologies have continued to evolve to keep pace with the ever-growing demand for high-bandwidth data requirements and applications. From proprietary BWA (broadband wireless access) technologies came fixed WiMAX in 2004 based on the IEEE 802.16d standard - providing a common platform for fixed and nomadic wireless broadband services.

Recognizing the importance of mobility, the WiMAX Forum™ released the mobile WiMAX profile in 2005 based on the IEEE 802.16e standard - providing full mobility in addition to fixed and nomadic broadband services. Advanced antenna designs including MIMO (multiple-input/multiple-output) along with other techniques including adaptive beamforming were subsequently added to increase performance, capacity and coverage of the networks.

While mobile WiMAX provided performance capabilities that far exceeded other standard technologies currently available to date, it still fell short of the International Telecom Union's (ITU) key requirements for consideration as an IMT advanced (4G) technology - specifically, providing downlink speeds of 100 Mbps in a wide area with high-mobility. Last October at the ITU Telecom World 2009 conference in Geneva, Switzerland, the WiMAX Forum™ and member companies announced their support of the IEEE's submission to the ITU of the 802.16m standard as a candidate for consideration as an IMT advanced technology. The WiMAX Forum also announced that WiMAX Release 2, which is based on the standard, would be finalized in parallel with 802.16m, to ensure that the next generation of WiMAX networks and devices will remain backward compatible with WiMAX networks based on 802.16e. (It's worth noting that the first release of LTE also does not meet ITU's definition as a 4G technology).

"Work on the standard has been progressing very quickly," says Jose Puthenkulam, Intel's director of WiMAX standards. "The profile development time for 802.16m has been much shorter than with the prior, 802.16e profile - where the industry was still very much in a formulative state with respect to MIMO, beamforming, etc. We have taken the experiences with 802.16e and even some of the learnings from LTE and built that into the 802.16m standard."

While some companies are taking a "wait-and-see" approach before committing to the technology, companies expressing support include Beceem and Intel on the chip side, and Samsung, Huawei, ZTE, Alvarion and Cisco on the infrastructure side. Recent reports in the media of Clearwire being "in no hurry to test 802.16m" seem to have been taken out of context. According to Clearwire CTO John Saw, the operator will consider preliminary trials in 2011, which is in line with when the first available commercial equipment will be available. Understandably, Clearwire is more focused on growing their existing network and POPs coverage from 30 million to 120 million in 2010 based on commercial equipment that is available today.

Of all the WiMAX member companies, none has been more vocal in their commitment to 802.16m than Samsung and Russian WiMAX operator Yota. Last October at the ITU World conference, Yota and Samsung demonstrated a test of an 802.16m network and Yota plans to be one of the first operators in the world to install the technology once it becomes available. As one of the fastest growing WiMAX operators in the world, Yota can certainly use the extra capacity. In one month alone last year, the service provider carried over 2,290 terabytes of data on its network.

What is the Significance of 802.16m to Operators?

While 802.16m will provide increased performance for users, the main, driving factor for operators adopting the technology will be capacity. With more users with smartphones, tablets and other devices, wireless bandwidth will continue to grow.

"The driving force behind the development of 802.16m is capacity," says Intel's Jose Puthenkulam. "As you start to add more use, you start to see more capacity constraints. This will provide capacity for operators to grow their networks."

The new 802.16m standard will also provide increased performance advantages. From a technological perspective, 802.16m is capable of providing up to 120 Mbps down and 60 Mbps up in an urban setting, using 4x2 MIMO antennas on a single 20MHz-wide channel. Even higher data rates can be achieved with additional spectrum resources or more complex antenna schemes. While impressive, actual commercial performance will be considerably less based on spectrum used and other factors.

In addition to capacity and performance advantages, 802.16m will be backward compatible with existing WiMAX networks, providing ease-of-mind for operators deploying networks today. Most mobile WiMAX operators can easily convert from 802.16e to 802.16m by updating some circuit plate units and software in their bases stations. All of the 802.16e units in the field will

continue to work and customers will see no disruption in service.

"One of the most important aspects of the 802.16m networks will be the backwards compatibility with legacy systems," says Dave Marez with Cisco. "Because of this, operators don't have to wait for time to market to deploy their networks and they will never have to worry about "orphaning" their existing devices."

LTE vs. WiMAX? It Depends on the Spectrum…

Of course, no discussion of the future of WiMAX is complete without the context of how it compares with other technologies - specifically LTE (long term evolution). Both LTE and WiMAX Release 2 achieve their extraordinary performance and capacity by providing the ability to support wider 20MHz channels (in addition to 10MHZ channels). But performance is only as good as the spectrum available.

Performance of an LTE network was recently highlighted in the launch of TeliaSonera's commercial network in Stockholm. According to the company's web site, the operator was offering down load speeds of "up to 50 Mbps," but according to initial independent tests, only reached about 12 Mbps on the down link. Subsequent test provided slightly better results, but showed some of the limitations and uncertainties inherent with new technologies.

It is also worth noting that the TeliaSonera LTE network was able to deliver its extraordinary performance because it was operating using two, 20MHz channels - one for the downlink and one for the uplink. Essentially, the channel size is the size of the "wireless pipe" that operators have to work with when delivering data to users on their networks. Most 3G networks operate using up to 5MHz channels, WiMAX 802.16e networks operate using up to 10MHz, and 802.16m and LTE networks will operate using up to 20MHz channels.

To achieve the significantly higher performance as reported by TeliaSonera, LTE operators need to use the wider 20MHz channels, but that spectrum is not always readily available. In the US, Verizon which is planning to deploy its LTE network in 700 MHZ only has two, 11MHz channels nation-wide. ATT, which also plans to deploy an LTE network, only has two, 12 MHZ channels.

"Lots of the spectrum allocation are in 10MHz chunks," says Intel's Jose Puthenkulam. "The places you will find contiguous 20MHz channels do exist, but they are few and far between."

The 802.16m profile is currently under evaluation and is expected to be ratified along with WiMAX Release 2 later this year. We should then expect to start seeing the first 802.16m dongles in late 2011 and more wide-spread commercial deployments starting in 2012.