A Real Market Exists for WiMAX :
Interview with Manish Gupta of Aperto Networks

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Introduction

Aperto Networks is a leading edge vendor of Fixed WiMAX (IEEE 802.16-2004) equipment. They have been shipping a proprietary version of fixed broadband wireless gear for the last five years and now count over 200 Service Provider (SP) customers in 65 countries. Aperto is now selling the Fixed WiMAX compliant PacketMAX [TM} System (consisting of base stations and subscriber stations), which has been certified by the WiMAX Forum. [Other prominent Fixed WiMAX certified vendors include: Airspan, Redline and Siemens. Alvarion claims to have "WiMAX ready" gear.]

I recently interviewed Manish Gupta, Aperto Networks VP of Marketing and Alliances, to get his perspective on the Fixed WiMAX market, which is based on the IEEE 802.16-2004 standard and WiMAX Forum certification. In particular, we discussed the real opportunities for fixed WiMAX applications and if it still has an advantage over the many proprietary systems that have been deployed over the last several years. We also touched on the evolution and potential co-existence of IEEE 802.16-2004 with IEEE 802.16-2005 (also known as the 802.16e standard or Mobile WiMAX). The latter standard supports both mobile and fixed wireless access.

Manish thinks that the lower cost and better performance of standardized IEEE 802.16-2004 gear will drive carriers to select it over proprietary broadband wireless systems. He provided his opinion on the evolving fixed WiMAX market, where the opportunities are, and suggested an upgrade path from Fixed WiMAX equipment to co-existence with IEEE 802.16e compliant gear. Because the 802.16e version of WiMAX will be able to offer both fixed and mobile Broadband Wireless Access (BWA) configurations, many believe that it will make IEEE 802.16-2004 dead on arrival. We disagree. Please read our interview with Manish and you may appreciate our point of view.

Role of the WiMAX Forum

The importance of the WiMAX Forum should not be underestimated. The Forum plays a key role in developing the WiMAX ecosystem and driving the growth of the standards based solutions. They are the only organization chartered to test and certify WiMAX compliant equipment. Aperto Networks was one of the co-founders of the WiMAX Forum and continues to serve on the Board of Directors. Aperto also co-chairs the Marketing Working Group, while previously serving as chair of the Service Provider Working Group (over 120 SPs are Forum members).

The **WiMAX Forum's key objectives for 2006** are:

- Promote and accelerate global WiMAX deployments
- Make WiMAX service the platform of choice and the worldwide market segment leader for broadband wireless
- Deliver a framework for a high performance end-to-end IP network architecture supporting fixed, portable, and mobile users
- Assure WiMAX Forum Certified products are trusted by Service Providers worldwide
- Develop WiMAX profiles based upon an IEEE 802.16 and ETSI interoperable client serving a global market
- Increase user demand by enabling competitive new applications and service models
- Promote a favorable **IPR policy**+
- Deliver the framework for deployment of personal broadband on a global scale by leveraging the contributions of the majority of players within the ecosystem

+ According to Goodman & Myers, "**An attractive IPR structure is another advantage of WiMAX compared to 3G technologies.** Royalties paid by manufacturers on WCDMA phones are an average of 10% to 15% of the Average Selling Price (ASP) of a handset, compared to a telecommunication industry norm of 2% to 5%."
In their Mobile WiMAX whitepaper, The WiMAX Forum states, "A less onerous IPR model will lead to a substantial reduction in equipment prices and fair treatment of vendors without essential IPR, which in turn will increase competition in the market and the attractiveness of WiMAX to network operators."

There are several other free white papers on the Forum's website which might be of interest to readers. Here are two of them related to fixed WiMAX:

1. Business Case Models for Fixed Broadband Wireless Access based on WiMAX Technology and the 802.16 Standard

http://www.wimaxforum.org/news/downloads/WiMAX-The_Business_Case-Rev3.pdf

2. Business Case for Fixed Wireless Access in Emerging Markets
http://www.wimaxforum.org/news/downloads/Business_Case_for_Emerging_Mkts_Rev1_2.pdf

Manish Gupta on the Fixed WiMAX Market and its Evolution

Here are several takeaways from my interview with Manish Gupta of Aperto Networks:

- **Globally, the big opportunities for broadband fixed wireless network access (Point to Multipoint topology) are in developing countries**. Those countries lack the broadband infrastructure of developed nations and they have a lot of 3.3 – 3.6 GHz spectrum available or already licensed to local carriers. In particular, India, Brazil, Russia, Eastern Europe, Middle East and Africa, and Indonesia/ South East Asia have all been very receptive to deploying fixed wireless equipment and WiMAX compliant networks. We will elaborate on these opportunities later in this article. The main point is that fixed WiMAX is currently being deployed in many developing countries and emerging economies.

- **3.5 GHz** (more precisely, 3.3 – 3.6 GHz frequency band) is the primary frequency band for **Fixed WiMAX (IEEE 802.16-2004).** All WiMAX Forum tests and certifications have been at that frequency. Gupta thinks that approximately 60% of the worldwide available wireless network licensed spectrum is at 3.5GHz. Hence, **the ability of Fixed WiMAX to proliferate at 3.5GHz in developing countries is "exceptionally promising,"** according to Manish.

- Conversely, **only 15-20% of world-wide licensed spectrum exists in the 2.5G Hz (**more precisely, 2.3 - to 2.7 GHz) frequency band, which is the primary frequency band for IEEE 802.16-2005 (the mobile version of WiMAX, which also supports fixed access). Part of the lure of IEEE 802.16-2005, at 2.3 to 2.5GHz, is that those lower frequencies can propagate radio waves further, thereby increasing distance between the Base Station and mobile/ fixed CPE.

- Another advantage of **Fixed WiMAX over IEEE 802.16-2005** is that there is currently no other standardized technology for fixed-only broadband wireless networks. Conversely, IEEE 802.16e is perceived as primarily a mobile broadband networking technology, where it runs into stiff competition from the 3G technologies such as UMT (Universal Mobile Telecommunications System) and CDMA-2000 (various versions of EVDO).
  →On the other hand, fixed WiMAX, based on **IEEE 802.16-2004,** has no other competition now at 3.5 GHz , other then proprietary systems.

- According to Gupta, approximately **15%** of fixed WiMAX configurations are being used for **wireless backhaul**, with the remaining **85%** for **broadband access**. The access segment is further split 70/30 between enterprise/ small business and residential access, respectively.

- **Intel** can stimulate the WiMAX market by making CPE, notebook PC cards and motherboards that support 802.16-2004 and 802.16e very cost effectively. Indeed, the recently announced Rosedale chip will implement both standards. *This will give WiMAX a big cost advantage over proprietary broadband wireless systems*. Of course, Intel is NOT the only supplier of WiMAX chip sets.

INTEL's WiMAX vision can be found at:
http://www.intel.com/netcomms/technologies/wimax/

- **The 5.8 GHz License Exempt** (unlicensed) band constitutes approximately 25% of the broadband wireless spectrum and deployments. Fixed WiMAX has excellent potential to be used in that band since lower chip set costs will translate into lower priced WiMAX equipment, thus making it more attractive then proprietary BWA technologies to SPs.
  Editors Note: there is a **License Exempt (LE) Task Force** within IEEE 802.16 WG, which is studying interference with other radio technologies and other issues). This author has participated in several meetings of that LE Task Force.

- One important concept of **Fixed WiMAX** is to create a giant (metro area) **hotspot** for urban areas, where you only need to sign up log-on with one SP. Contrast that with the numerous coffee shops and airport WiFi hot spot/ access point providers. This is the basic premise behind municipal wireless networks, which have opted for mesh WiFi technology, because it was and continues to be available from several vendors. WiFi access is typically in the unlicensed 2.4 to 2.5 GHz band. It remains to be seen if fixed WiMAX will be used for such metro or municipal area networks of the future. More likely (in this author's opinion) is that **IEEE 802.16e** will be a better contender then either Fixed WiMAX or mesh WiFi, because of its additional features and functionality, especially QOS.

Related to this topic, Craig Settles [craig@successful.com], a noted expert on municipal wireless networks (and mesh WiFi) states: "I don't think WiMAX will replace (muni) WiFi unless the cost of WiMAX transmitters come down significantly in price, or WiMAX can greatly increase its ability to have radio signals penetrate buildings. This latter problem is particularly an issue in urban areas. Currently, people just add more WiFi access points to create a ring around large buildings as a way to work signals externally from one side of a building to the other and keep the mesh working. If you do that with WiMAX transmitters, you quickly run up the costs for the overall network. That said, if the price of WiMAX transmitters drop and Intel can drive down the price of WiMAX chip sets to go into laptops and mobile devices, the combined effect could eventually cause WiFi to be used less for city networks."

- Common network management software could be used to overcome the potential SP problem of supporting both versions of WiMAX. Manish suggested that the same **network management software** could be used for managing both IEEE 802.16-2004 and IEEE 802.16e based networks. Of course, there would be additional managed objects/SNMP MIBs required for mobile WiMAX..

- Regarding the **evolution of 802.16-2004**, Manish suggested an overlay or co-existence of 802.16e with the 802.16-2004 infrastructures. He noted again the Intel Rosedale 2 chip, which will support both versions of WiMAX. Hence, WiMAX network equipment using such a device, could also offer both network technologies to a subscriber. In particular, a software upgrade to 802.16e would be needed to support mobility applications on the CPE side. The SP could insert

802.16e blades or circuit packs within the WiMAX Base Station, in order to offer mobile WiMAX service using 2.5GHz radios, while continuing to support Fixed WiMAX subscribers with 3.5GHz radios using 802.16-2004 based access.

Market Summary and Conclusions:

Most pundits dismiss Fixed WiMAX (IEEE 802.16-2004) as being too late for large scale BWA deployment. They say it will be eclipsed by proprietary gear and (later) by 802.16e compliant equipment. However, they miss the point that Fixed WiMAX has been optimized for 3.5GHz, which is much more widely available globally then the 2.5GHz to be used by mobile WiMAX (802.16-2005). Equally if not more important, **the real market opportunity for Fixed WiMAX is in the developing world,** which will likely embrace it as a quick way to offer BWA to many subscribers.

The WiMAX Forum has only certified Fixed WiMAX (802.16-2004) equipment with a 3.5GHz profile. They have not made any plans for 2.5GHz certification of Fixed WiMAX products. Conversely, for mobile WiMAX (802.16e) certification, the Forum has prioritized 2.5 GHz, with no plans defined for 3.5 GHz.

In North America, most of the BWA being provided by independent telcos is currently based on proprietary technology in the (unlicensed) 5.8GHz band. There may be some Fixed WiMAX based BWA opportunities in this 5.8 GHz band with **WISPs,** as well as larger **CLECs,** like Covad. Note that 802.16e will likely not be used in that band, because it was optimized for mobility at a much lower frequency (2.5GHz).

Fixed WiMAX (802.16-2004) may be effectively used for **backhaul applications**, such as from cellular base stations or WiFi hot spot access points to a telco central office [backhaul applications are predominantly point to point, rather than the point to multipoint used for broadband access]. Manish maintains that IEEE 802.16-2004 uses spectrum more efficiently then 802.16-2005 for those backhaul applications.

There is also a potential 3.65 GHz band opportunity for Fixed WiMAX, as the FCC frees up that spectrum for BWA use in the U.S. We think that much of the 3.5GHz Fixed WiMAX gear will operate correctly at 3.65 GHz.

We also think that the August 8th announcement that **SPRINT-NEXTEL** will spend upwards of $3B on WiMAX deployment augurs very well for the industry [Not to mention the $600M recently invested in **Clearwire**]. SPRINT-NEXTEL is the largest holder of 2.5GHz licenses in the top 100 U.S. markets, as well as in a number of smaller markets. Their licenses were originally intended for MMDS deployment, but that technology never gained market traction.

The 2.5GHz band might be used to build a converged fixed/mobile WiMAX network or it might be used for cellular backhaul applications. We also hear that **Bell South** has expressed an interest in making the 2.3 to 2.5 GHz band available for WiMAX deployment.

The decision to heavily commit to WiMAX may encourage smaller telcos to do likewise-either for backhaul applications, or for BWA in the 5.8 GHz or 3.65 GHz bands. We believe that chip set costs will come down as volumes increase and this will result in lower equipment prices, making standardized Fixed WiMAX gear more attractive then vendor proprietary BWA systems. Therefore, the SPRINT-NEXTEL WiMAX commitment will substantially increase the overall size of the WiMAX market in the U.S.

Appendix: Roundup of Market Forecasts:

1. Instat predicts a healthy growth for fixed broadband wireless networks, but they don't specify how much of it will be WiMAX:

Worldwide Fixed Wireless Broadband Subscriber Forecast

Subscribers(Thousands):	**% Change**
2006: 1,425	32
2007: 2,490	75
2008 4,548	83
2009: 7,201	58
2010: 10,414	45

[No forecast for what % will be WiMAX vs proprietary sytems]

2. West Technology Research Solutions, LLC (WTRS)
http://www.westtechresearch.com/

WTRS states: "It is most likely that in the **U.S.**, **fixed WiMAX** will play a minor market role and **mobile WiMAX (IEEE 802.16e) will quickly come from behind**, eclipse and take the lion's share of the WiMAX market within a very short time. Among the market inhibitors to Mobile WiMAX, the high power consumption and requirement for hundreds of components present significant challenges."

Fixed WiMAX opportunities in **Africa** are promising, according to **WTRS**:

"In Africa, generally, the opportunities for fixed WiMAX, are much brighter, as the literacy requirement is not as stringent for the use case of a simple phone and fixed WiMAX offers a lower cost infrastructure than wired equivalents. For example, in **Nigeria,** a population of roughly 130 million, **fixed WiMAX is beginning to take off with six licensees introducing services, and with 13 more in the works all in the 3.5 GHz band.** The topology of Nigeria is largely flat, hence WIMAX will fare well in that environment and, all things being equal, could become a significant factor in the economic development and modernization of the country."

3. Maravedis Inc is a world leader in market research and analysis, specializing in BWA and VoIP markets.

http://www.maravedis-bwa.com/

In May 2006 they published a report titled, "**Russian Federation Broadband and WiMAX+**." Here is their Market Forecast for Russia, as per the Executive Summary+:

"The entire market of BWA equipment is expected to reach $45-50 million in 2006 (from about $27 million in 2005)1 and $365 million by 2010. It is clear that speed of BWA deployment will vary greatly among regions, as determined by economic structure, growth rate, standard of living and distribution of wealth.

The most promising regions for the development of BWA/WiMAX networks are Moscow city, Saint Petersburg, Samara oblast, Sverdlovsk oblast, Rostov oblast, Tatarstan republic, Krasnodar krai, Tyumen oblast, Chelyabinsk oblast and Bashkortostan republic. The Central region will concentrate one-third of total subscribers.

Maravedis projects an accumulated 867,000 subscribers by 2010 among residential and business users, with **WiMAX subscribers representing one-third of the total.**

Approximately 60% of the WiMAX subscribers will be residential mobile customers, while **fixed WiMAX will continue to be driven by large corporations and gradually by SME customers." + Copyright © 2006, Maravedis Inc**

More on Russia's plans for WiMAX can be found at:

http://www.cellular-news.com/story/18307.php

4. Trendsmedia also has published a report on Russian Federation Broadband Wireless market, as well as reports on Brazil, India and other topics of interest to broadband wireless readers:

http://trendsmedia.com/publishing.html

5. **Trendsmedia/Rethink Research's** latest report was released on August 11, 2006: **"WiMAX Deployments and Investment 2006-9."** They state **that global WiMAX infrastructure spending will rocket from $655m today to $7.36bn by 2009.**

WiMAX spending will go from 22.5% of all broadband wireless spending in 2006. This will make WiMAX the dominant platform in the market, with a 63% market share. This is the first piece of research to state definitively how much money will be spent on WiMAX equipment, including core networking - including countries and applications.

The report draws entirely on operators' spending plans rather than vendor estimates. **Rethink Research** has enjoyed confidential access to the spending plans of over 200 service providers from all round the world, including how much money they have committed to future WiMAX spending, and how much they have spent so far in building out standard and pre-certified WiMAX networks. The next few years will show a remarkable pattern, with European spending skyrocketing and taking up 56% of 2006 WiMAX spending, only to be caught up by aggressive Chinese and other Asia Pacific network build. US spending will be relevant, but by no means dominant.

Though mobile operators still see WiMAX as being in the enemy camp, by 2009 mobile operators round the world will be the second largest spenders on WiMAX equipment, making up 17% of the total WiMAX equipment spend.

The report shows that the market for WiMAX equipment will be larger than many have previously suggested and informs 802.16 vendors in which territories they should be making their biggest efforts. Spending will explode on the back of rising demand for broadband to be ubiquitous and either personal or portable, and though 802.16e will be the key platform, this will span both fixed and mobile applications.

KEY FINDINGS:
• Wireless will increase its share of the broadband market from 2% to around 17% in the early years of the next decade.

• WiMAX spending will be focused almost entirely on licensed bands and the 5GHz band may not even gain a wide choice of certified equipment, relying instead on cost effective options such as Motorola Canopy. 3.5GHz. will account for 70% of spending.

• Additional 3.5GHz licenses will be offered in France, Germany, Italy and parts of Eastern Europe in 2006-7, driving a second wave of European investment, and this trend will be reflected from late 2007 in Africa and the Middle East.

"WiMAX Global Spending Plans: 2006 – 2009" includes separate detailed breakdowns of spending in the US, Caribbean/Latin America, Europe, Middle East/Africa, China and Japan, India, Pakistan, Australia and south East Asia, and costs **$1,495 for a single protected PDF copy.**

EXECUTIVE SUMMARY:
http://r.vresp.com/?Trendsmedia/315ffd61b5/669272/19f899af46/f9050d3

6. In June 2006, **Maravedis** published a report titled, "**India Broadband Wireless and WiMAX Market Analysis and Forecasts: 2006-2012, 1st Edition+."**

"In 2005, the BWA equipment market opportunity was a mere US $6 million, dominated by small deployments for backhaul applications to enterprises with outdoor equipment. However, Maravedis and Tonse believe that with the upcoming spectrum opening, the

certification of new equipment, and lower-cost CPEs, the annual **3.3 and 3.5 GHz equipment opportunity will increase from US$4 million in 2005 to US $256 million in 2012**. Maravedis and Tonse project an accumulated 18 million BWA subscribers by 2012, counting both residential and business segments. **WiMAX subscribers should represent two-thirds of this figure.** Approximately **60% of the WiMAX subscribers will be mobile customers** who are predominately residential, while **fixed WiMAX** will continue to be driven by large corporations and, to a lesser extent, by SME customers."

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Note: The survey took place from January to June 2006 and involved discussions with product managers, marketing executives, regulators, technologists and sales people at all organizational levels.
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7. In April 2006, **Maravedis** published a report titled, "**Broadband Wireless and WiMAX Brazilian Market Analysis 2005-2010+.**" They identify the many carriers who have licenses in the 3.5GHz band and are therefore potential adopters of fixed WiMAX: "The companies that acquired 3.5 GHz frequency blocks were
• EMBRATEL (TELMEX)
• DirectNet (Neovia)
• Grupo Editorial Sinos
• Vant (Brasil Telecom)
• WKVE

Also in Brazil, Neotec, a consortium of MMDS operators, has tested NextNet* equipment in urban areas, using the MMDS spectrum that many Brazilian operators own for television services."
*Editors Note: NextNet was formerly owned by Clearwire, but now owned by Motorola.
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