

Report from the 2007 WCA International Symposium

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Introduction

The 13th *WCA International Symposium*, January 16-19, 2007 in San Jose, CA provided many keen insights into the current status and future of broadband wireless networks. The subject areas we were most impressed with were: the future direction of Mobile WiMAX; additional ISPs/ network operators (besides SPRINT and Clearwire) that might deploy (Fixed or Mobile) WiMAX; the planning, experiences and lessons learned from municipal wireless networks in California; and the important new applications foreseen for those networks. On a completely different track, AT&T presented an informative and interesting session that covered RFID sensor based networks and wireless networks that could track moving vehicles (for details please contact the author).

In an exclusive interview held just after the conference closed (the afternoon of January 19th), Andrew Kreig, President of the WCA, identified four important themes of the WCA International Symposium:

- January 17th keynote speech by Anand.Chandrasekher added new dimension to Intel's expectations and predictions for Mobile WiMAX- a network that will evolve to offer users a "Personal Mobile Internet" experience. Anand's demo of a tablet- computing device, with broadband wireless access (e.g. integrated WiFi and Mobile WiMAX), gave a tangible look and feel to the vision of "Personal Mobile Broadband."
- The increasing acceptance and coming of age of Municipal Wireless Networks (built largely on mesh WiFi technology), as indicated by Silicon Valley Government officials- including Joint Venture Silicon Valley and the City of Palo Alto. Those visionary talks about network objectives, planning, and applications were followed by presentations from the vendors, systems integrators and ISPs that will build and maintain the network.
- Growing interest in new public sector applications, e.g. public safety, healthcare, intelligent transportation, etc. These may reside on a separate municipal network or in a mixed network that is shared by the public and private sectors of our economy.
- A glimpse of some new advanced wireless network applications and a more tangible sense of how to get involved in the ecosystem that will provide the foundation for those applications. These applications include; consumer entertainment, business services, location based services (e.g. hospital locator),

health record retrieval, wireless telemetry, and mobile government workers filing reports from the field.

We will elaborate on some of these themes and provide a follow up to our many articles about WiMAX (both Fixed and Mobile), with particular emphasis placed on the U.S. market and likely deployments. Readers desiring more insight and analysis from this excellent conference are invited to contact the author directly for more information.

The Personal Mobile Internet and Device(s) Needed to Make it a Reality

In a very enlightening opening keynote talk on January 17th, Anand Chandrasekher, Senior Vice President & General Manager, Ultra Mobility Group, at Intel Corp. presented a “larger vision” for Intel and WiMAX in 2007 and the years beyond. Anand observed that Internet global growth is now out stripping cellular subscriber growth. Broadband Internet growth is being driven by the phenomenal increase in video and multi-media content creation. However, broadband Internet is not yet truly mobile. What will make it happen?

According to the **WiMAX Forum**: “Personal Broadband is emerging as one of the hottest areas of growth within mobile data. It enables users to enjoy the same experience they have at home or in the office wherever they go. WiMAX is an innovative technology that will make personal broadband services profitable to service providers and widely available to business and consumer subscribers at affordable prices.”

Anand opined that the next wave of the Internet would be mobile Broadband Wireless Access (BWA) – a personalized Internet- made possible by high throughput, cost effective broadband wireless access (BWA could be via WiMAX or possibly mesh WiFi). He echoed what SPRINT executives have previously said about Mobile WiMAX- that it will offer 4x the performance at 1/10th the cost and make BWA ubiquitous. A graph illustrated a key point: that cost innovation drives liftoff of new technologies and networks. Therefore, the network performance and cost effectiveness must be excellent to create a new market.

In a mobile environment, the applications and services now available at home and in the office will become available everywhere. Ubiquitous broadband access will encourage work productivity, personal communications and entertainment on the go. New services and applications that are specifically suited to mobile usage scenarios will also appear: mobile office, on-board entertainment, mobile search, fleet management, surveillance and public safety will be the first to be adopted and more will follow. As with the transition of voice communications from fixed lines to mobile phones, the broadband connection will cease to be tied to a particular location and will become a personal service.

A new combination device – not a phone and not a notebook PC- would be needed to realize this vision. The combo device with BWA should be user friendly, easy to use, and include a large enough screen to enjoy videos and multi-media entertainment

transported over a broadband wireless network. The device must be low cost and have sufficient battery life for on the move use.

Anand demonstrated a tablet-like computing device with a large screen and no keyboard as a candidate “Personal Mobile Internet” device. He said that more details about this technology will be forthcoming at the Spring Intel Developer Forum meeting (*This author guesses that Intel is working with Nokia to make the tablet a reality.* We note that Nokia was recently chosen to be a vendor for SPRINT’s 4G- Mobile WiMAX network).

(Fixed) WiMAX trials have grown from 150 at the beginning of 2006 to over 250 currently. There are now 40 commercial deployments of Fixed WiMAX. In 2007, we will witness five large commercial deployments (SPRINT being one of them, but the others are anyone’s guess) covering 20M+ customers.

Four phases of WiMAX evolution were described:

1. Fixed WiMAX- now getting well established, particularly in developing countries
2. Mobile WiMAX- will start to be deployed. SPRINT is planning to start a massive deployment in late 2007, which will eventually pass 100M subscribers. Clearwire is “aggressively betting” on Mobile WiMAX. Anand thinks that this could be a “tipping point” for U.S. deployment of WiMAX (We disagree and don’t think there will be more than a handful of U.S. carriers deploying Mobile WiMAX. We list four in this article- see below.)
3. Personal Mobile Internet model – timeframe not specified.

Anand concluded by citing **three challenges for WiMAX**:

1. Push to trial WiMAX now (Fixed WiMAX yes; Mobile WiMAX is not ready for trial use. The WiMAX Forum has not certified any Mobile WiMAX gear and VLSI based products are not yet commercially available).
2. Drive costs down aggressively. (This will only happen if volumes ramp up)
3. Think ahead to roaming capability. (The WiMAX Forum states: “All mobile WiMAX products will support handoffs and power-saving mechanisms. More advanced mobile functionality will gradually be added through support for high-speed handoffs, **roaming** and multiple antenna technologies such as MIMO and beam forming and be available in equipment in the second half of 2007.)

Which U.S. Carriers will Deploy WiMAX?

Above all we must remember that WiMAX can only be deployed using licensed spectrum. This is a huge problem in the U.S. where 3.5 GHZ- the most popular band for WiMAX globally is reserved for government and military use. It is not at all available for commercial use, except for a complex and somewhat controversial 50 MHz allocation at 3.6 GHz that has many of the characteristics of un-licensed spectrum under the current FCC allocation scheme (which WCA and the WiMAX

Forum, among others, seeks to revise in a pending proceeding to enable more deployments).

Mobile WiMAX is based on IEEE 802.16e-2005 and will initially operate in the **2.3 GHz, 2.5 GHz, 3.3 GHz, 3.4-3.8 GHz** spectrum bands, according to the WiMAX Forum. Support for additional bands, e.g. **700 MHz and 5.8 GHz**, will be added on the basis of market demand and new spectrum allocations. This spectrum limitation creates a huge problem for WISPs, including those that own licenses in the AWS band (1.9G Ghz- 2.1GHz) and would like to deploy Mobile WiMAX. See below for more details.

There seems to be **four large Broadband Wireless Internet Service Providers** that intend to deploy WiMAX in the U.S. The first two are, of course, **SPRINT** and **Clearwire**. Both have made a lot of noise about their aggressive deployment plans and capital spending for Mobile WiMAX. Additionally, many municipal wireless networks will use Fixed or Mobile WiMAX for wireless backhaul, with mesh WiFi for access.

In a session entitled, “**System Requirements for Major New Entrant Carriers**,” both the new **AT&T** (actually Bell South) and NextWave Wireless hinted that they would be deploying WiMAX in the near future.

AT&T (the old BellSouth) owns WCS spectrum in the 2.3 GHz band and wants to roll out WiMAX technology for “**DSL fill-in**” in the southern U.S. [It’s quite likely that WiMAX in the WCS band will mature quite rapidly given the proving ground of Korea already deploying “WiBro/WiMAX” systems at 2.3 GHz.] Neal Hightower of AT&T (ex-Bell South) told me that they would be deploying WiMAX in that band, but did not say whether it would be the Fixed or Mobile version. We assume it will be fixed WiMAX, which has already been trialed by Bell South in New Orleans. The old Bell South must sell their 2.5 GHz licenses as a result of their merger with AT&T. Hence, the new AT&T will not own that frequency band, which is the spectrum that SPRINT and Clearwire will use for their (Mobile) WiMAX deployments. The old AT&T had previously talked about using Fixed WiMAX for wireless extension (tail circuits) of nxDSL facilities (private line, Frame Relay, IP VPN, etc) and had trialed that application. That still might happen in the future, but there was no discussion of it at this year’s WCA Symposium.

The fourth U.S. BWA Service Provider that will likely be deploying WiMAX is **NextWave Wireless**. In the aforementioned session, Kurt Schaubach, VP of Engineering for NextWave Wireless, articulated a vision of multi-media convergence over broadband wireless networks: “Any content from anywhere at any time.” Applications he cited included; streaming, downloading and playing digital music and videos; receiving live television; recording and managing photos; and videos, and finally voice (over IP). Power management was mentioned as crucial to extend battery life for mobile wireless access devices. Kurt suggested that WiMAX might be used for future municipal wireless network access (in addition to backhaul, which is in use now). He also stated that in the near future, a BWA user would be able to select the best network for his needs (assuming a single operator supported multiple networks, e.g. mesh WiFi, WiMAX, proprietary, etc.

In answer to a question if NextWave Wireless was going to deploy Mobile WiMAX, Schaubach did not answer directly, but stated: “NextWave Wireless holds spectrum licenses all over the world, including the U.S.” We were intrigued by this statement and searched the company’s web site for additional information. Here are results:

You will find NextWave Broadband at:

<http://www.nextwave.com/page.asp?prmID=79>

Their Network Solutions Group owns licensed spectrum all over the world. In Germany, their licensed spectrum is being touted for WiMAX use:

<http://www.nextwave.com/page.asp?prmID=433>

In the 2.3 GHz band (compatible with Mobile WiMAX):

<http://www.nextwave.com/page.asp?prmID=291>

In the AWS band elsewhere:

<http://www.nextwave.com/page.asp?prmID=436>

“Based in Henderson, NV, NextWave Broadband's Network Solutions Group (NSG) is developing end-to-end mobile WiMAX network solutions for service provider partners interested in offering advanced mobile broadband services to the market. NSG's 802.16e WiMAX compliant networks will be designed to operate on **NextWave's licensed spectrum**, will utilize network and device equipment that can incorporate WiMAXplus products and technologies, and will support mobile terminals that utilize the WiMAX plus chipsets currently under development.

The Network Solutions Group team has extensive experience in building and operating wireless networks for companies such as Airtouch, AT&T Wireless, McCaw, SPRINT PCS, and Nextel and has spent the last several years conducting field trials of numerous wireless broadband technologies, including 1xEV-DO, TD-CDMA, and OFDM. In addition, the team has extensive experience in developing advanced IP core networks and in developing back-office systems designed specifically to enable the delivery of differentiated mobile broadband network services.

NSG is currently deploying a WiMAX trial network in Henderson, NV, located just south of Las Vegas, which is expected to be operational in late 2006. This trial network will showcase NSG's advanced core network and back office system capabilities and will provide potential network partners an opportunity to evaluate the performance of mobile WiMAX technology.”

Separately, we talked to several **WISPs** at the conference and could not find a single one that planned to deploy (Fixed or Mobile) WiMAX. Even though some WISPs hold licenses in the AWS band (1.9 GHz- to- 2.1 GHz), the WiMAX Forum has not generated a profile for WiMAX used in the that band. Further, there are power, radiation, and other issues with using WiMAX at the AWS frequencies.

One other important application for WiMAX has emerged in the U.S. – high speed **wireless backhaul** for mesh WiFi metro networks. Most municipal wireless networks use mesh WiFi for access and are likely to use Fixed or Mobile WiMAX for (point to

point or point to multipoint) backhaul to a telco's central office. For example, Alvarion pre-WiMAX gear is being used for backhaul at 700 MHz by the Metro Connect team (Azulstar is the ISP), which is providing the Joint Venture Silicon Valley municipal wireless network.

Municipal Wireless Networks: Update, Lessons Learned, and Innovative Applications for

Progress reports from the Smart Valley Network (AKA Joint Venture Silicon Valley or JVSV network) and Google's Mt. View municipal network were provided along with perspectives of vendors, ISPs, and system integrators. Those two networks were the subjects of previous articles by this author. Municipal wireless networks in Manteca, Anaheim and Milpitas were also mentioned, but a huge (and so far unpublicized) municipal wireless project was the subject of great interest to session attendees.

-Executive Director John Ramos presented a report on the **Wireless Sacramento Regional project (WiSac)**– a large municipal network that will blanket nine counties and over 30 municipalities in the Sacramento area with wireless connectivity. The network will provide the telecommunication infrastructure for: VOIP, data and video streaming services. The network must be extremely robust and have a 24 x 7 x 365 availability criterion. The WiSac broadband network infrastructure project's coverage area will be 60% rural and 40% urban. The nine counties are: Butte, Sacramento, El Dorado, Nevada, Placer, Solano, Sutter, Yolo and Yuba. Applications will focus on public safety, education, and economic development, e.g. agriculture. Plan is to issue a RFP to potential participants in the first or second quarter of 2007, with the service provider and vendors to be selected one quarter later (hopefully by end of 2Q 2007).

For more information on this planned network, please go to:

<http://www.wisac.org/cm/>

-Larry Alder of **Google** provided an update and shared his company's experiences with the wireless network built for the city of Mt View. The network covers 12 square miles and serves a population of 70K people. IEEE 802.11 b/g (WiFi) signals are propagated through radio/routers mounted on city light poles. The users supply their own devices- laptops with built in WiFi can be used from 90% of the side walks in the city. Like most municipal wireless networks, it is intended for outdoor use. A WiFi modem is required for indoor use and Google does not offer support services for that. The service was launched in mid August 2006. It is a free service up to 1M b/sec and requires a Google account to log in. A single non-encrypted SSID is required to start a session. IEEE 802.1x based SSID (Secure Session ID) is being considered for future authentication purposes. There are additional SSIDs for public safety, library/ book mobile, and city hall. Google only offers email support – no telephone help desk- so an alternate means of Internet access must be used to report service problems or difficulties.

Alder stated that there were thousands of users each day and showed a slide on network usage density to illustrate that point. Ed Taulbee of Tropos (WiFi equipment supplier for the Mt. View network) remarked that the network offered higher speeds than a 3G network at 1/8th to 1/10th the cost to build and maintain. Alder commented that WiFi

CPE was improving rapidly and cited WiFi repeaters as an example. He cited **four lessons learned** from the Mt. View municipal wireless project:

- People want to use municipal wireless networks. Usage continues to trend upwards.
- Devices and technologies used (e.g. radios, mesh WiFi routers, gateways, base stations, etc) are still improving.
- It's important to work closely with the city to ensure successful project.
- Important to know where you can mount the WiFi radio/routers (mounting assets are often a scarce resource and are vital for network operation).

-Glenn Loo, CIO for the city of Palo Alto, CA, provided a perspective on how the Joint Venture Silicon Valley network might be used by the city. Glen mentioned that the mobility aspect was vitally important, as many employees were outside and moving about everywhere within the city. So the network technology must support services for mobile and nomadic workers. [Note that WiFi was originally intended for stationary, indoor use - not the mobile, outdoor use that cities require]. Glenn cited an emergency response application that would enable a mobile worker to access health records at the scene of an event, e.g. an accident or life-threatening emergency situation. That might have life saving potential, he said.

-Other speakers cited innovative new applications like education, economic development, community out-reach, tele-medicine, intelligent transportation, video surveillance, law enforcement, and public safety. Eric Dentler of Cisco (part of the Metro Connect team for JVSV network) hinted at location based ad services for mobile and nomadic municipal workers and commercial subscribers. Those services together with "advertising engines" were projected to be available by the end of 2007.

All participants agreed that municipalities must work with providers and vendors to ensure a sustainable business model to ensure long-term sustainability of the wireless network, the services and applications that are now being developed for use on those networks.

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