

WCA October 17, 2006 Meeting:
Advanced Wireless Architectures to Facilitate Convergence of Services –
Part One

Alan J. Weissberger, WCA Volunteer

aweissberger@sbcglobal.net

Disclaimer:

All inferences, interpretations, and implications found in this report are the opinion of this author and do not in any way reflect a WCA position. The subjective statements by this author, if any, are expressed *in italics*.

Author's Notes clarify and provide background information on subject matter introduced by the speakers.

Introduction

Two very stimulating and enlightening presentations on advanced wireless architectures for metropolitan and wide area networks were the highlights of the Wireless Communications Alliance (WCA) October 17, 2006 meeting. Unknown to many industry professionals, new wireless backhaul architectures are being built with off the shelf WiFi components and modules. Big players, like Cisco, IBM, Motorola, and others are stepping up to bid on RFPs to build these new, municipal wireless networks that are based on "commodity" wireless parts.

Separately, a Radio over Fiber Ring architecture is being built and now in field trials. It combines the best of broadband wireless access networks with a high-speed fiber optic ring and backbone network. Both fixed and mobile wireless access might be offered in the future.

Once deployed, the new WiFi based backbone and the hybrid wireless/fiber architectures offer the potential to provide advanced multimedia services for voice, data and video services. Many of the new services (e.g. video and interactive gaming) require improved bandwidth, QOS, advanced control and management functions. Each of these two architectures were described and contrasted with alternative network implementations and technologies.

Presentations

WCA President Rick Ellinger opened the session and invited the new attendees to introduce themselves. There were newcomers from three service providers-SPRINT, AT&T, and Swiss Telecom in the audience. The two invited speakers were then introduced:

- **Dewayne Hendricks, CEO of the Dandin Group**, presented the **Sandoval Model for Broadband Municipal Wireless Networks** (the actual title of the talk was **"Municipal Wi-Fi aka Municipal Wireless"**}- a revolutionary implementation of a totally wireless network architecture based on off the shelf components and modules. The wireless backbone operates at 100M bps over a very wide geographical area. Described as a "commodity wireless network," the Sandoval County, NM municipal wireless network was said (by the Sandoval County Manager) to be the most advanced municipal wireless broadband network deployed in the United States.

- **Dr. Somnath Mukherjee, of the Arasor Corporation**, presented **Radio-over-Fiber Architecture** - a totally new concept for a multi-protocol distribution network to offer voice, data and video using a WiMAX (initially Fixed WiMAX- IEEE 802.15-2004) access network combined with a fiber optic ring and/or fiber backbone network. Performance examples from a real-life implementation were given.

1. Municipal Wi-Fi aka Municipal Wireless, Dewayne Hendricks, Dandin Group

Dewayne Hendricks could have been a motivational speaker. He was very passionate and dedicated to his belief that low cost municipal wireless networks are and will continue being built with commodity parts. While not fully IEEE 802.11 compliant, these networks offer extended range, sufficient broadband speeds, and QOS good enough to support triple play (voice, data, and video) services. Hendricks made three presentations: his own backgrounder on Municipal Wi-Fi, a description of the Sandoval, NM municipal Wireless network (prepared by Debbie Hayes- the Sandoval county manager), and a Summary and Recommendations/ Wrap Up.

a] Backgrounder on Municipal WiFi networks

WiFi enables low cost, anywhere, anytime communications. However, it has taken 10 years for unlicensed WiFi municipal networks to "kick into high gear." *The healthy growth in municipal wireless networks has occurred despite the failed attempts of a little known FCC subcommittee to stimulate municipal wireless network deployment.* In January 1997, the FCC created U-NII Band, which was intended for unlicensed wireless metropolitan area networks. Then in early 1998, the FCC formed a Technical Advisory Committee (TAC) to furnish technical expertise that would aid the committee in their decision making process for broadband wireless networks. Early TAC discussions were related to spectrum sharing, noise floor, spectrum measurement, and monitoring. Curiously, the FCC still does NOT monitor the frequency spectrum that it regulates, despite TAC recommendations to do.

Hendricks participated in the early TAC meetings and in April 2004 made a TAC Presentation entitled, "**Real World Issues, Practical Pitfalls and Opportunities.**" His main points were the following:

- Wireless networks can be built in a cooperative manner where the whole is greater than the sum of the parts (AKA synergy)
- Using spectrum as a commons can work through the use of simple rules
- Innovation occurs when driven by needs

The Wireless Broadband Access Task Force (**WBATF**) was created in 2004 to survey licensed and unlicensed wireless broadband networks. They made their final report in February 2005 (but dated March 8, 2005 on the FCC web site).

The report is quite illuminating and (in this authors opinion) right on target!

It may be accessed from: www.fcc.gov/wbatf

WBATF made the following recommendations in that final report:

- Promote voluntary frequency coordination
- Promote industry 'best practices'

- Work with WISPs on a pro-active basis
- Increase power limits in selected bands
- Consider annual WISP forum

Additionally, the WBATF final report made several observations about Municipal Wi-Fi status at that time:

- Covered city wide Wi-Fi in Grand Haven, MI
- Other municipal Wi-Fi discussions were WISP oriented
- Estimate of 6,000 WISPs at that time in U.S.

In July, 2005 TAC made a report, which basically echoed the findings of the WBATF final report referenced above. Yet the FCC took no action to promote or encourage the building of municipal WiFi networks, according to Hendricks.

In a spirited and energetic summary of municipal wireless networks, Hendricks *pounded the table to tell the audience it was happening in a big way*. One key message was that "**Reality still is under reported.**" According to Hendricks, this means that there is a lot of underground activity not reported. Hence, critical decisions are made with insufficient or even faulty information. **The reality in this case is that municipal wireless is extending beyond cities, to reach entire counties.** Yet this has not been widely publicized. For example, Rhode Island is the first state to be blanketed by a municipal wireless network. As of June 2006, there are 247 city/county wide wireless broadband networks in operation. Please refer to:

www.muniwireless.com/reports/docs/June-7-2006summary.pdf

Suffolk & Nassau Counties, NY has just issued a RFI/C this week to cover a 1200 square mile area that will reach 2.7 million people. Affordable or even free broadband access will be available to all residents of those counties. Please refer to: www.nassaucountyny.gov/wireless

Sandoval County, NM was offered as a case study, because Hendrick's Dandin Group is building the wireless backbone network. Reaching 110,000 people that are spread over 3700 square miles, this is one of the largest municipal wireless networks in the U.S. Said to be a "Commodity Wireless" implementation, Phase I is now complete. A 100 Mbps wireless backbone is now able to reach into rural areas within the County. National Lambda Rail (NLR) is used for peering and transit. New Mexico Governor Richardson recently allocated \$1M for the project. Please refer to: www.ollagrande.net

b] Sandoval County Manager Presentation on their Municipal Wireless Network

Said to be, "the most advanced municipal wireless broadband deployment in the United States," the Sandoval network will endeavor to "level the playing field in Healthcare, Education & Business."

The following key points were extracted from the first page of this presentation:

- Sandoval County has determined that access to high- speed telecommunications infrastructure should be available to every County resident.

- While some 380 municipal wireless projects are currently underway in the United States, none approach the amount of bandwidth, nor the size, diverse topography and rural nature of the Sandoval County project.
- Eliminating geographic access barriers to medical services, quality education and business/marketing opportunities will improve the quality of life for all New Mexicans.
- The most dramatic changes and the most incredible opportunities will, however, happen in rural New Mexico, by **bridging the digital divide**.

Hendricks stated that the Sandoval network would provide free Internet access to public agencies, e.g. emergency services, education/ schools, and medical (telehealth services) within the county. Internet services are not being offered to commercial end users.

The Summary presentation slide provides additional information about the network, structured in a Q and A format:

HOW MUCH (TOTAL) BANDWIDTH?

Currently 100 megabits; 400 megabits within a few months; goal is 1 gigabit.

Other municipal wireless projects in the US have a goal of 1 megabit

Japan, Korea and Hong Kong already have 1 gigabit available to their citizens (via FTTP rather than wireless access)

HOW MUCH DOES IT COST?

Far more than it does in Asia and Europe, somewhat more than many areas of the US, but much less than when the project was started.

WHERE WILL IT BE AVAILABLE?

All 3700 sq. miles of Sandoval County and replicable throughout the State of New Mexico.

WHAT IS BEING DONE WITH IT?

Not enough, but projects underway at Jemez Valley Schools, Jemez Pueblo Health Clinic and the Village of Cuba, NM.

WHAT DO WE WANT TO DO WITH IT?

Eliminate geographic barriers to health care and quality education.

Bring care to patients in their homes and communities no matter where they live.

Close the gap between citizens and the care and opportunities they deserve.

c} Conclusions and Recommendations

Summing up, Hendricks stated that innovation is driven by user needs. The fact that many vendors are now offering innovative products for the municipal wireless market reaffirms that user need. The major vendors cited are Cisco, IBM, AT&T, and Motorola. "Commodity

wireless” is now becoming a factor in the municipal and metro wireless market space, according to Hendricks. Here are the elements of a commodity wireless system he identified:

- Single Board Computer (SBC) - available from multiple vendors
- Mini PCI form factor radios - multiple vendors
- Operating System (OS) - multiple sources, both commercial and open source
- Enclosure and Antenna(s)- widely available

Ubiquity Wireless is using ‘Frequency Freedom’ technology aka **transverter**. It maps "commodity parts into anywhere in the frequency spectrum."

- So far 900 MHz, 3.5 GHz and 4.9 GHz
- 900 MHz radio retails at \$160
- 54 Mbps operation at 700 mw of power

Observation and Recommendations (by Hendricks):

- Unlicensed wireless is going to places where no one dreamed was ever possible
- Companies are developing Software Defined Radios using WiFi technology
- FCC should make an effort now to act on recommendations of WBATF (which have not been acted upon)
- FCC & TAC should consider a new task force on municipal wireless broadband

In the Q and A that followed, Hendricks reaffirmed that municipal WiFi networks are being designed using off the shelf components and modules, He indicated that distance limits could often exceed the specification and techniques were being developed to provide QOS in support of triple play services. When asked if the Sandoval municipal WiFi system was IEEE 802.11 compliant, he said it was not but didn't have to be since vendor interoperability was not required. He indicated that the wireless professionals in the audience had a lot of "catch up" learning to do, if we wanted to better understand what is going on now in municipal WiFi networks.

Addendum on WiFi range

There were several questions directed at the range of WiFi when it is used as a backbone technology (even with beam forming on a point- to- point link).

Stu Jeffery supplied the following url that describes a 72 Mile WiFi link, using 802.11b at 1 Mbps:

<http://www.computerworld.com/mobiletopics/mobile/story/0,10801,75830,00.html>

Stu states that "the data rate you can achieve is simply a factor of: power, path loss, noise figure of the receiver, miscellaneous cable loss, total antenna gain, fade margin, and required signal to noise."

"Airtegrity has a nice little tool that allows you to predict achievable bandwidth versus antenna gain for their equipment," says Jeffery. Please refer to:

<http://www.airtegrity.com/tools/index.shtml>

The second part of this article will feature a story on a potentially cost-effective and efficient technique for transporting wireless in its native RF format over fiber.