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**The Future of Motorola Canopy
Advantage... and Beyond To WiMAX**



On Wednesday, October 27, 2004 at WISPCON VI being held in Las Vegas, Nevada, Motorola's Canopy Wireless Broadband Group will unveil the next generation of Motorola Canopy systems – the Canopy Advantage Platform. In addition, Motorola will discuss for the first time their plans to address the evolution of Canopy towards WiMAX compatibility.

I was permitted an exclusive interview last week with Tom Hulsebosch, Senior Director of Sales and Marketing, and Tom Gruba, Director of Marketing and Customer Support, both with Motorola Canopy Wireless Broadband Group. Some of the material in this article is drawn from an earlier interview with Juan Santiago, Director of Strategy and Business Development, Motorola Canopy Wireless Broadband Group. The background information is drawn largely from my knowledge of the history of Canopy.

Background

In the more than two years since Canopy (unofficially) debuted at WISPCON I, Canopy has become a successful product for Motorola. It is selling well, and competes well against its competition. Its primary design goals are to operate reliably in license-exempt spectrum, relatively simple construction and resulting low price (depending on volume, potentially as low as \$200/unit), and be easy to deploy, including the option of user self-installation. Canopy has been well received by Broadband Wireless Internet Access (BWIA) Service Providers (SPs) because it does operate reliably in license-exempt spectrum using a robust modulation technique (Binary Frequency Shift Keying – BFSK; essentially “digital” Frequency Modulation – FM) and a relatively wide channel (33 MHz). Canopy systems are available for the 5.2 GHz (Canopy is one of the few outdoor systems for this band; a challenge because of very low allowable transmit power), 5.3, and 5.8 GHz bands, as well as new systems released earlier in 2004 for the 2.4 GHz and 902-928 MHz license-exempt bands.

But... all was not bliss. Canopy was reportedly developed for the white-hot China market and while it is being sold there, it hasn't gained the market share that Motorola once hoped for. Canopy was developed as a “science project” with little formal recognition of the product within Motorola. Tom Freeburg, then a Motorola Corporate Vice President / Director Of Canopy Technology reportedly had to “run interference” for Canopy within Motorola to avoid having Canopy killed before it could even emerge on the open market. Ironically, that Canopy performed *so* well and so reliably in the “junk bands” reportedly proved to be a minor embarrassment to Motorola lobbyists. I was told that in at least one case a Motorola lobbyist at the FCC advocating for additional licensed spectrum was told that the license-exempt approach to spectrum allocation seemed to be working pretty well, judging from the good reputation of the Motorola Canopy system.

Canopy did begin to sell well in the US, especially to larger BWIA Service Providers as well as the smaller Wireless Internet Service Providers (WISPs) that were the initial target market for Canopy. Motorola's internal support for Canopy has grown considerably as Broadband Internet Access has become a critical issue and received growing recognition not only at the Federal Communications Commission (FCC)... but the direct attention of the White House (US Presidential administration). When Canopy was initially released, Motorola was adamant that Canopy was not suitable for “critical” uses such as public safety (not surprising, given Motorola's high-margin mobile communications business). Yet barely eighteen months later, Canopy presentations at trade shows were showing just such “critical” applications for Canopy – Homeland Defense, public safety, municipal broadband wireless networks to name a few. In presentations at Broadband Wireless conferences, Motorola personnel stated that a Canopy system would be developed for mobile use.

The biggest challenge to Canopy was, again, Motorola itself as its chronic financial underperformance in a number of key business units such as cellular telephone handsets and network equipment, two way radio systems, and semiconductors were catalysts for major change to Motorola's direction. Against that tumult, Canopy could have easily been shut down simply as a cost-saving measure. (Several vendors told me in 2003 that

the Canopy Group was quietly offered for sale. When asked about this, Motorola personnel claimed that the possibility of a sale was an “internal valuation exercise”. My contacts at the other vendors dispute this as posturing; they remain convinced that if terms had been agreed upon, Motorola would have sold Canopy.)

Motorola’s management issues have been addressed by the hiring of well-respected former Sun Microsystems’ President / Chief Operating Officer Ed Zander as Chief Executive Officer (CEO). Zander, a professed hands-on techie, reportedly couldn’t pass up the challenge, and the considerable potential of turning around Motorola given how rapidly technology is shifting from wired to wireless communications. Upon Zander’s arrival at Motorola, all operations were put through a “Zander Test”. With this week’s announcement of Canopy Advantage, it’s apparent that Canopy has passed its “Zander Test” and thus now *has* a “foreseeable future.”

Canopy Advantage Differences

Canopy Advantage includes new hardware and software. The new software, Canopy Release 6, upgrades the performance of existing Canopy user radios and makes them compatible with Canopy Advantage Base Stations. This is possible because Canopy’s major components are a Field Programmable Gate Array (FPGA) and a processor rather than a built-to-purpose Application Specific Integrated Circuit (ASIC).

Latency - Average latency in a Canopy Advantage System is reduced from 20 mS to 5 mS. Latency is a critical issue for Voice Over Internet Protocol (VOIP) communications, which have become an important reason for customers to want Broadband Internet Access.

Speed – Average throughput in a Canopy Advantage System is increased from 4.2 Mbps to 7 Mbps (speeds on the 2.4 and 902-928 MHz Canopy systems are lower, but there is also a resulting speed improvement on those systems. The speed increases come at the cost of some decrease in range.

Quality Of Service – Canopy Advantage has the option of dynamic, packet-by-packet Committed Information Rate (CIR); earlier versions of Canopy “hard” reserved a portion of the overall bandwidth to insure adequate QOS. Motorola has also implemented a Virtual Local Area Network (VLAN) feature at the request of Service Providers.

Backwards Compatibility – Tom Gruba states that a key requirement with Canopy Advantage is to “*Leave no CPE behind!*” [CPE - Customer Premise Equipment] Note that the *CPE* are not being left behind; but to make use of Canopy Advantage, upgrade (physical change-out of the radios) of the base station is required. Once that is done, Canopy Advantage user radios (available in 1Q05), and older Canopy user radios (must be software upgraded to Release 6) can both access a Canopy Advantage base station. The Canopy Advantage user radios will achieve better speeds than the software-upgraded older radios. To preserve at least some of the service provider’s investment, Motorola offers software that converts old base station radios to Release 6 user radios so that the base station radios can be returned to revenue service.

Setting The Stage For WiMAX

In considering the future of Canopy, passing the “Zander Test” was only the first hurdle. The second, steeper hurdle is “What To Do About WiMAX?” With WiMAX being hyped into a media, analyst, and investor frenzy, *every* Broadband Wireless Internet Access system vendor is facing this question... from existing customers, from analysts, from potential customers, from investors. Some of the smallest and most specialized vendors intend to essentially ignore WiMAX and continue to sell only their existing product lines. Some are merely adding a WiMAX product to their current offerings. Some intend to offer WiMAX/legacy-proprietary hybrid systems. A (very) few are... stalling, not being able to invest in WiMAX and hoping, but not really knowing if they will have a market for their products once WiMAX is actually shipping.

The vast majority of WiMAX activity to date is directed at developing systems for the very popular licensed 3.5 GHz band (but not available in the US because it is used by the US Department of Defense). Development of WiMAX systems for the license-exempt 5.8 GHz band are distinctly secondary; 3.5 GHz systems are typically deployed in large, revenue deployments, and thus have the BWIA system vendor’s immediate attention.

Motorola and other large BWIA system vendors are driven to signal their intentions on issues such as WiMAX compatibility earlier than later to give their customers time to adjust. Motorola’s immediate WiMAX strategy (previously announced) is to develop a 3.5 GHz WiMAX version of Canopy. Because 3.5 GHz is licensed (interference is managed by regulation, not technical means), and WiMAX interoperability requirements dictate the use of Orthogonal Frequency Division Multiplexing (OFDM), Motorola will not use BFSK modulation in this product. From all accounts, Motorola’s 3.5 GHz WiMAX system will make use of its innovative and highly-competitive user radio form factor.

Motorola sees considerable ongoing opportunity for systems in the license-exempt 5 GHz bands... and has very good reason to do so.

- The cost of licensed spectrum remains high and going higher as the wireless telephony market consolidates into a handful of players. Wireless telephony “3G” data systems will require more spectrum to operate effectively, and thus there will be little unused spectrum in the 800 MHz and 1.9 GHz wireless telephony bands.
- Motorola’s BFSK technology is particularly well-suited for the rigors of license-exempt spectrum. The fact that its “efficiency” as measured in spectrum/data hertz/bit is not as high as other systems is nicely offset by...
- More than 500 MHz of license-exempt spectrum available in the various 5 GHz license-exempt bands (once the 5.4 GHz band is finally released for use... a long story indeed).

Canopy WiMAX Platform

In 2006, Motorola plans to release the Canopy WiMAX Platform, whose key feature is that it will seamlessly interoperate with WiMAX systems (in the same spectrum). Canopy

WiMAX base stations will optionally transmit separate time slots for Canopy Advantage user radios and WiMAX radios. (Note- this would appear to be the only effective Canopy/WiMAX coordination possible; in a “contest”, Canopy’s robust BFSK modulation will work in the presence of a WiMAX system, but the reverse is not true... one of the reasons the WiMAX Forum intends to address “Regulatory Issues” in coming years.) Canopy WiMAX user radios will communicate with either Canopy WiMAX base stations, or other vendor’s WiMAX base stations.

Not only does this approach offer investment protection for current Canopy deployments and equipment to be purchased in the coming year, but also it offers a measure of “spectrum insurance”. Arguably, WiMAX has few mechanisms for dealing with interference in license-exempt spectrum, having been designed operate mostly in licensed spectrum.

For service providers intending to make use of the 5 GHz bands, deploying Canopy WiMAX base stations insure that a service provider can take advantage of the hoped-for economies of scale that will (supposedly) drive costs of WiMAX user radios rapidly toward the “Magic \$100 per” price point. (To hear Intel tell it, WiMAX will rapidly be embedded into every laptop with an Intel CPU and chipset.) If spectrum conditions “get rough” in the 5 GHz band, Canopy user radios can be used in BFSK mode to deal with interference.

Using Canopy WiMAX user radios makes a lot of sense also. Apart from the “insurance” aspects of having access to robust BFSK mode to overcome potential interference, there are few BWIA system vendors who have done as good a job of integration and packaging of their user radios as Motorola has done with Canopy. A Canopy user radio is a one-piece unit, encased in injection-molded plastic, and designed to be mounted outdoors. A (outdoor rated) 10baseT cable is plugged in to the exterior-mounted radio and routed indoors (considerably easier less expensive than routing thick, stiff coaxial cable between and indoor radio and an exterior antenna, where it’s connected to a small Power Over Ethernet (POE) module and the customer’s computer (or router). When building such user radios, it’s tough to balance performance, reliability, and packaging with cost. Motorola has overcome these issues and already has such production underway in considerable volume, so it’s reasonable to expect that Canopy WiMAX user radios could be more cost-competitive than similar first generation products from other system vendors. (For example, in its 3.5 GHz WiMAX system, implements WiMAX as a mode of its Advantage hardware; as such delays, deficiencies, pricing, or availability of Intel’s Rosedale WiMAX chipset does not affect it.)

Motorola Says Go! Deploy! Don’t Wait For WiMAX!

By offering a credible roadmap for future WiMAX interoperability, and investment protection of existing and near-future Canopy purchases, Motorola’s message with Canopy Advantage is “Go Deploy. Now! (Please?)”

One of the reasons that Canopy did survive the “Zander Test” is that it is a good fit for Motorola’s new corporate vision – Seamless Broadband Mobility; delivering broadband

services to the user wherever they are. Canopy, capable of being deployed flexibly using license-exempt spectrum, is a key enabler of the Seamless Broadband Mobility vision.

Motorola states that it will continue to evolve Canopy in directions such as “Canopy Hotzone”, where Canopy systems supply backhaul bandwidth to Tropos Wi-Fi systems to create a Wi-Fi HotZone not dependent on wireline backhaul. Although Motorola has now backed away from its tepid commitment to offer a mobile Canopy system (addressed, somewhat, in the “connectorized” 900 MHz Canopy system which apparently can “roam” to some extent), Motorola now plans to tackle Canopy mobility by evolving Canopy into compliance with 802.16e broadband mobility standard and the corresponding WiMAX interoperability specification.

Conclusion

Evolving Canopy into WiMAX compatibility is something like corporate tightrope-walking. There’s a considerable installed base to be protected and given a migration path... and the (if the most optimistic projections are to be believed) huge pent-up demand for WiMAX systems.

At minimum, Motorola has fixed the nagging latency issue with Canopy, and has increased Canopy’s speeds to be more competitive. Assuming that Motorola delivers the Canopy Advantage systems as promised, that bolsters the current value proposition for Canopy. 2005 will likely not see a widespread emergence of license-exempt WiMAX systems – most of vendors will put their energies into 3.5 GHz licensed WiMAX for overseas markets. Understandably, Motorola has its hands a bit full with its own 3.5 GHz licensed WiMAX system and getting Canopy Advantage in production. But waiting until 2006 when the bulk of the license-exempt WiMAX competition arrives would seem to be giving up a considerable tactical advantage.

In coming issues, I’ll have more to say about Canopy as I learn more from Motorola at WISPCON VI and have a chance to talk to BWIA SPs and WISPs that have deployed, or are considering deploying Canopy systems.

FOCUS On Broadband Wireless Internet Access

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FOCUS On Broadband Wireless Internet Access is founded upon the following tenets:

1. Internet technology is becoming the foundation for nearly all communications, commerce, and entertainment services;
2. For Internet access to be truly usable, always-on Broadband Internet access is required;
3. By the end of the first decade of the 21st century, Internet access will be ubiquitous;
4. In the “last mile”, wireline-based technologies and systems will generally prove to be insufficient or not cost-effective to provide ubiquitous, always-on, Broadband Internet to most homes and businesses;
5. In the near term, Broadband Wireless Internet Access in all its forms – Sub 11 GHz, Above 11 GHz, Free Space Optics, Ultra Wideband, Licensed, License-exempt has emerged as the most likely technology to provide cost-effective, ubiquitous, always-on Broadband Internet Access.

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