



Independent, original, in-depth coverage of the trends and technologies shaping the BWIA industry

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Clearwire's Looming Competition

In writing about trends, it's often useful to highlight a particular company as representative of an industry. Doing so makes the comparisons a bit more manageable and it's somewhat easier to illustrate particular points. Mostly for that reason, but also as some followup to the **FOCUS** Special Issue earlier this year, I'll use Clearwire to illustrate some of the trends, opportunities, and challenges in Broadband Wireless Internet Access (BWIA) that I see emerging in the next eighteen months. Although I'll discuss some specifics of Clearwire, this discussion is meant to encompass companies such as AT&T, Covad, and Nextel, and many others who now offer, or have announced their intention to provide Broadband Wireless Internet Access service.

Clearwire emerged from stealth mode with great fanfare in June, 2004 in Craig McCaw's high-profile keynote at the Wireless Communications Association trade show in Washington DC. As I predicted, press whose only previous exposure to BWIA was Intel's aggressive WiMAX public relations campaign took note that "Craig (McCaw) is back (in the wireless business)". In short, Clearwire took maximum advantage of McCaw's "star power"... and who could blame them? It was instructive that most press didn't know what to make of the fact that Clearwire would begin deployment without waiting for WiMAX-certified equipment to become available; they simply could not grasp that the capabilities advertised for WiMAX have been widely used for some time.

In late August 2004, Clearwire (re) commenced service in its inaugural market, Jacksonville, Florida. (The previous incarnation of Clearwire commenced BWIA service in early 2003 using systems by IP Wireless to offer a similar "scope" of service – "DSL" speeds, an external radio, but modest coverage using four base stations.) Clearwire's

initial BWIA service offering is compelling – consumer pricing are \$25/month/512 Kbps, \$30/month/768 Kbps, and \$35/month/1.5 Mbps.

The Consumer Broadband Installation Experience

Under ideal circumstances, DSL and cable modems are now user-installable... once the respective line is pre-activated, which requires a call to the sales department or the equivalent on a web page, an irritating question and answer session, and then an indeterminate wait, not only for the equipment to be shipped (cable modems can now be purchased over the counter in some markets), but for the provisioning. Once the wait is complete, theoretically one can plug in the pre-purchased, or shipped-upon-sale modem into the line, the modem handshakes with the Operation and Support System (OSS), and Internet access is available.

Non-ideally... such as if the needed line isn't near where the modem would be ideally located, a service/installation technician visit must be scheduled, and in the last several years, I haven't heard any good service/installation technician stories... including my experience with IDSL (a new dedicated line had to be installed) and cable modem (my house didn't previously have a cable television line). In my case, the technicians were pleasant and competent, but it took two or three appointment attempts before the service/installation could be completed.

Clearwire's Installation Difference

The Clearwire experience could... and *should* be different. Typically, a Clearwire modem (radio) will be purchased over the counter and brought home. Once plugged into to power and the computer, the modem will help the user through alignment (the antenna is directional) and connect. There will be a web page redirect, and the Clearwire signup page will display. If you've gotten that far, the customer has good connectivity with a Clearwire base station, and all that is left is to make payment arrangements. Note that there shouldn't be any of the frustrating uncertainty and appointments; it will either work or it won't – you'll know within a few hours (total *elapsed* time) of bringing the Clearwire modem home. This is well within consumer expectations; if it doesn't work, the modem can be returned and a refund arranged. In reality, there will be some cases where Clearwire too will require an installation of an outdoor radio/antenna unit, such as when a customer is in a fringe coverage area or desires a higher/faster grade of service than what the self-installed unit is capable of.

Consumers have heard enough word of mouth “horror stories” about cable modem and DSL installations gone wrong that Clearwire may well be able to leverage it's ‘cleaner install’ as an advantage that a customer can quickly grasp. (However, mentioning the “ease” of “cell phone installation” is tempting... but fraught with peril because that would all-but-invite comparisons with cell phone quality issues – dropped calls, bad audio, billing mistakes, etc.

In the end, consumers have proven that they generally don't care about particular technologies, only 1) Price, 2) Price, 3) Price, 4) Features, 5) Ease of Use, 6) Quality of Service, and 7) Quality of Customer Support. Clearwire should attract consumer's

attention if they can effectively leverage their ability to offer Broadband Always-on Internet Access at a lower price than the competition, and quickly follow with additional features such as (my prediction, but not realized to date) Telephony Over Internet Protocol (TOIP) service (equivalent to integrating Vonage-like analog telephony interface in the Clearwire modem).

Two Trends in Consumer Wireless – Bad News For Clearwire

While Clearwire offers some significant differentiation from wireline Broadband Internet Access services, it's not a given that Clearwire's approach is the best way to exploit wireless in competition for Broadband Internet Access customers. There are two trends in BWIA that by themselves are potent threats to Clearwire's plans... as well as service providers in general whose model is a one-on-one relationship with each individual user (or "user unit", such as a household, and a corresponding monthly payment.) By themselves, the two trends - "Municipal Wireless Networks" and Self-forming Dynamic Wireless Mesh Networks are potent threats to the service provider business model. If the two trends merge... the threat to service providers is exponentially greater. Both trends are driven by politics and technology; the former mostly politics and enabled by technology... the latter mostly technology enabled by politics.

Trend One - Municipal Wireless Networks

Often referred to as "Citywide Wi-Fi Networks", such as the City of Philadelphia proposing a City-Wide Wi-Fi network, what's most notable about the trend is that the goal of such governmental agencies is to offer as a free or relatively low cost amenity. Many governmental organizations, especially smaller entities and those in rural areas, have been severely frustrated that telephone and cable companies have not seen fit to offer DSL and cable modem service to their constituents. They have come to... have been *driven* (by their constituents) to regard Broadband Internet Access as basic economic development issue. If a city, county, or even neighborhood doesn't have Broadband Internet Access, it cannot attract... and more critically, *retain* businesses and the attendant jobs, or even be seen as a desirable location for homeowners that increasingly require Broadband Internet Access. Governments are coming to view reasonably-priced, reasonable performance (generally excluding satellite due to latency issues and attendant inability to use Telephony Over Internet Protocol – TOIP) no differently than they view providing roads, water, power, garbage; essential services that sometimes the private sector can't or doesn't want to do. (Note: I hope the distinction is clear that I'm not I'm not discussing the "Community Wireless Networks" such as Personal Telco in Portland, Austin Wireless City, and other volunteer-based, not-for-profit groups, though there is some crossover between such groups and Municipal Wireless Networks at times.)

When looking at Municipal Wireless Network, it's important not to focus too narrowly that many, or most, Municipal Wireless Networks are using 802.11/Wi-Fi as the wireless technology. While Wi-Fi has certainly "caught on" in the public's imagination as cool technology, it's not at all the case that Wi-Fi is the only type of BWIA being deployed for Municipal Wireless Networks. Most vendors of proprietary BWIA equipment are selling equipment to government entities to help build private and public, low-profile or high-

profile Municipal Networks. Two of the most successful vendors that I'm aware of that are used for public-access Municipal BWIA networks are Alvarion and WaveRider, both selling systems that are purpose-built for BWIA (with no inherent Wi-Fi compatibility.) I make this point to illustrate that there's no basis for belief that "Municipal Wireless Networks won't work because Wi-Fi can't scale; it's not always Wi-Fi that's being used for such networks.

That said... to dismiss 802.11/Wi-Fi as being completely unsuited and unusable for Municipal Wireless Networks would also be a mistake. Technology demonstrably does exist for such "saturation" Wi-Fi coverage. A number of vendors such as RoamAD (Auckland, New Zealand) and Tropos Networks (Cerritos, California) have convincingly demonstrated equipment that can overcome the limitations of Wi-Fi as used as Municipal Wireless Networks. There are other technological "tricks" just now beginning to be exploited: mesh networking, which I'll examine below; Multiple Input Multiple Output (MIMO) – active beamforming applied to Wi-Fi; relatively simple compact, electronically-switched multi-sector antennas; and other technologies that weren't practical (and, in fairness, weren't really needed when using Wi-Fi as "merely" as a Wireless Local Area Network (WLAN) until Wi-Fi has achieved critical mass.

In conclusion, Municipal Wireless Networks will emerge because they are needed, they are politically attractive, and the technology exists to implement them. Because they are not driven by a pure profit motive, they can and will be built in situations where there's little potential for profit... such as a friend's childhood hometown of Kevin, Montana, population 177 (2003 estimate).

If you wish to learn more, and actively track developments in Municipal Wireless Networks, I recommend www.muniwireless.com. MuniWireless Editor Esme Vos follows the field very closely, and is often called to write and consult on the subject.

Trend Two – Self-forming Dynamic Wireless Mesh Networks

Many... arguably most... of those with experience in the BWIA industry have confused the near-infinite potential for Self-forming Dynamic Wireless Mesh Networks (the phrase "wireless mesh" will be used from this point forward) with the limitations inherent in implementations to date. This myopia is even more extreme in the conventional telecom industry, where every (save one – David Isenberg) telecom expert is convinced that wireless mesh networks *cannot* work reliably, *cannot* offer consistent performance, and *cannot* scale.

It's not overstating the case to say that wireless mesh is a nexus of three enormous technological, and now social trends – Moore's Law (processor power), Wi-Fi (inexpensive, license-exempt wireless products driven by consumer volumes)... and the Internet. Implementations of wireless mesh to date have suffered from factors such as sufficient memory to retain extensive routing tables being expensive; cost of final unit dictating that a single radio has to be used for user access and backhaul; previous generation processors not being powerful enough to do sophisticated, dynamic path

qualification... etc. Moore's law has "fixed" the processor issues, and volume in the Wi-Fi market has "fixed" the expensive radio issues.

As a result, wireless mesh will... inevitably... become ubiquitous. The Institute of Electrical and Electronics Engineers (IEEE) has convened 802.11s – which is chartered to develop a new extension of 802.11/Wi-Fi to add mesh functionality (the 802.11s logo says, "Free the APs") to 802.11 base functionality. Wireless mesh is already appearing as an overlay to Wi-Fi usage – just load the software on your laptop. Wireless mesh has been ported to Linux, and thus can be run on single-board computers, including those used in building inexpensive Wi-Fi-based BWIA systems. In short, Wireless Mesh is a force that cannot be stopped, and likely cannot be co-opted since much of the seminal intellectual property was developed as the result of public research, such as Defense Advanced Research Projects Agency (DARPA) who wanted to develop wireless mesh as a survivable battlefield communications system.

"Ubiquitous" will eventually result in something I've come to call a "House Node", a small wireless mesh device that will allow me to communicate with my immediate physical neighbors for the purpose of exchanging TCP/IP packets... of any kind. File sharing packets. Telephony Over Internet Protocol (TOIP) packets. Packets bound to and from the Internet... or other neighbors two or three "hops" away. This could be as simple as a device that combines Wi-Fi hub and Wi-Fi client into a single device capable of doing both jobs simultaneously. The point is that once such a device emerges, it will fundamentally alter the balance between Broadband Internet Access service providers and their potential customers. Many will simply say "I can call my neighbors free and talk as long as I want without paying anyone, anything... so tell me again why I should subscribe to your expensive Internet access service?" Many, many others will be content to take advantage of the kindness of neighbors willing to buy Broadband Internet Access and share it at very low or no cost (assuming appropriate service provider Terms Of Service, such as Speakeasy).

As the house node / neighborhood wireless mesh networking trend emerges, there will be less and less justification for the traditional role of telephony and Broadband Wireless service providers... increasingly they'll end up selling their services not to individual customers, but rather neighborhood and condominium associations... devolving their offering to "bulk bandwidth" because the neighbors (and, to a large extent, the wireless mesh technology) take care of the details such as distribution, technical support, etc. that have traditionally been the purview of a service provider.

Merging The Two Trends...

It's entirely feasible that Municipal Wireless Networks will combine with user-owned/built/maintained Wireless Mesh systems. The former will provide the raw bandwidth, much like water, sewer, power and other services, with the portion of the distribution system that is on the user's premises left to the responsibility of the user. This is feasible given municipal government's typical rights of way and facilities – roads, streetlights, water towers, etc. Municipal governments and related organizations have

many other facilities available; for example, in Woodinville and Bothell Washington, the Northshore School District was able to pass a technology levy that allowed it to construct a private fiber loop that extended to its headquarters building, all schools, and its other major facilities. Like most urban/suburban school districts, the schools are relatively evenly distributed throughout the service area. What could be done if small towers to distribute inexpensive Broadband Wireless Internet Access throughout each neighborhood? The School District would only be providing “excess capacity” (once “on-fiber”, each school will be receiving 100 Mbps Intranet/Internet access... quite a leap from leased 1.544 Mbps lines... but nowhere near saturation for the fiber system, especially in the evenings and weekends when demands at the school would be lowest.) Fire Stations are also typically geographically distributed to reduce response times; they could also be used as Municipal Wireless distribution hubs.

With Wireless Mesh... the user portion of the network is not a “demand” on the municipal government; it effectively isolates the user support costs because the user’s portion of the BWIA network is largely user-funded, user-constructed, and user-maintained.

The Big Question

Clearwire views its competition as cable television and telephone companies. But, even with the advantage of being a focused entrepreneurial venture, and the advantages inherent in using wireless as a transport medium for Broadband Internet Access, Clearwire and its ilk are largely unprepared for the competition for customers against Municipal Wireless Networks in the short term, and Wireless Mesh in the longer term. A phrase from the computing industry in the heyday of mainframes seems appropriate to mention: “IBM (municipal wireless / wireless mesh) isn’t the competition... it’s the *environment!*”

The only way to effectively compete with the two trends is to provide a service that is *overwhelmingly* compelling – ubiquitous and cheap/free, or greater speed for the same price as the alternative. Clearwire’s on the right track - \$25/month for always-on Broadband Internet Access is an aggressive starting price point. But what about when it comes into a market with an existing Municipal Wireless system?

Two recent announcements are ample illustration. San Francisco’s Mayor, Gavin Newsom wants to provide free wireless Internet to all its citizens. During the annual State Of The City speech, he stated, “We will not stop until every San Franciscan has access to free wireless Internet service. These technologies will connect our residents to the skills and the jobs of the new economy.” The second was an announcement by VeriLAN, a BWIA Service Provider in Portland, OR apparently understands the threat. At a conference this week, its announcement that it will allow free access to its extensive Wi-Fi network in the Portland area at 56 Kbps was apparently calculated to give pause to a growing movement for Portland to implement a municipal wireless network. VeriLAN’s offer gives pause to the municipal wireless movement because 1) It allows free access (albeit at speeds that many consider inadequate), 2) It already exists, and 3) It’s

ubiquitous (enough). In such a case, a municipal network would be redundant and unnecessary – the goals have been achieved.

Another way to effectively compete is to offer an overwhelmingly compelling value proposition. Yes, it's hard to get a customer to part with \$35/month when you can get Internet access for free or cheaper... but it's much easier get that \$35/month when you can offer Internet Access speeds that are simply unachievable by competing systems. A number of BWIA systems shipping now offer reliable delivery of 5 Mbps or faster, with equipment price points comparable to lower-speed systems. TowerStream uses just this approach in its newest markets with its "5 for 5" service – Internet Access burstable to 5 Mbps for \$500/month. TowerStream's reportedly suffering no shortage of customers willing to pay \$500/month. It's telling that its newest market is Los Angeles... with many existing BWIA Service Providers.

Wither Clearwire?

As I espoused in the FOCUS Clearwire Special Issue, Clearwire has considerable potential if it can execute, and do so rapidly to stay ahead of its direct competition, but the looming threats posed by Municipal Wireless and Wireless Mesh. Clearwire needs to deploy rapidly into a number of cities for its service to be gain sufficient "mindshare" to be considered a credible competitor for Broadband Internet Access (the "Earthlink Test").

Clearwire also needs to rapidly differentiate itself to gain mindshare. For example, if Clearwire were to offer integrated (telephone jack on the user equipment) telephony service at current prices, the "overwhelmingly compelling" test will have been met.

Lastly, Clearwire also needs to understand, like cable and DSL modem vendors, that Wi-Fi is now expected by users and service providers, and needs to be included with Ethernet and USB ports. This would let the Clearwire modem be placed conveniently, for maximum coverage, and Wi-Fi reduces the hassle of Ethernet cabling.

Conclusion

Ubiquitous, reasonably-priced Broadband Internet Access, like telephony a century earlier, has become sufficiently compelling that it is now a political issue. The rapidly-improving technology of Broadband Wireless Internet Access makes it possible for municipal entities... and soon enough, the users themselves, to provide Broadband Internet Access at low prices (if not free). BWIA Service Providers simply won't be able to avoid these trends; they can only "ride it" to offer potential customers an overwhelmingly compelling service at attractive prices.

Breaking News! *FOCUS* Exclusive! Motorola To Disclose New Canopy Product, WiMAX Migration Strategy at WISPCON VI

Late last week, I was gratified to be given an exclusive briefing on a new Canopy product from Motorola that will be announced next week at WISPCON VI in Las Vegas, NV. As part of that briefing, Motorola for the first time has disclosed its direction for the Canopy

product line in the face of what has become the “WiMAX juggernaut”. Motorola’s announcement will occur on Wednesday, October 27th, but on Monday, October 25th, (with Motorola’s concurrence), I will publish another *FOCUS* Special Issue based on what I learned at the Motorola briefing. I’m told that no other media will receive a similar briefing before the Wednesday announcement. In a word, I’m impressed at Motorola’s direction for Canopy, and I look forward to explaining it to you in *FOCUS*.

Steve Stroh At WISPCON VI Las Vegas, October 27-29, 2004

I will be attending WISPCON VI in Las Vegas this coming week. Unlike past WISPCONs, I have no (pre-planned) speaking, nor any interviews scheduled other than to do my Wireless Tech Radio co-host duties as usual on Wednesday morning from 10:00 – 11:00 AM Eastern. That leaves me free to monitor the pulse of the small-to-medium Wireless Internet Service Provider (WISP) portion of the Broadband Wireless Internet Access (BWIA) industry through the lens of WISPCON. WISPCON VI is notable that it is the sixth such event in three years, despite significant encroachment into its subject matter from other larger and better-funded events. Although I wasn’t able to attend WISPCON V, WISPCON VI is a “must-attend” event for me, for in holding it in Las Vegas, it brings true (at least partially) a prediction I made at (what’s become known as) WISPCON I; that the WISP industry was on a growth trajectory, and WISPCON with it, such that WISPCON would be big enough and successful enough to be held in one of the large convention centers in Las Vegas within five years. WISPCON director Michael Anderson laughed uproariously at that prediction at the time... Evidence of just how far WISPCON has come is that WISPCON VI’s Keynote Speaker is none other than FCC Chairman Michael Powell, who has been made acutely aware of the presence of WISPs over the last few years in testimony at FCC hearings, personal visits to the FCC by WISPs, personal visits to WISPs by FCC personnel, and conferences such as WISPCON.

I mention this because unlike past trade shows, I am in an ideal position to “report live” from WISPCON VI. That is due, entirely, to having moved my computing environment from a poorly-coordinated desktop / laptop PC combination to working entirely from an Apple (15”) PowerBook G4 laptop. The PowerBook is sufficiently powerful to become my entire writing environment... and unlike all the PC laptops I’ve used to date, efficient enough to be left in sleep mode and wake up immediately as needed, have sufficient battery life, and be physically small enough to be useable during the entire travel cycle (not merely transportable enough to use out a hotel room, but not toted around with me at an event.) For example, I rarely resort to taking notes on paper any more but instead record notes directly onto the PowerBook, which makes it far more efficient to transcribe my notes into coherent text for reading by others.

At a minimum, I will attempt to transmit a daily summary email message of what I saw of interest at WISPCON VI to *FOCUS* Subscribers. If things work out as well as I hope – connectivity permitting, I may transmit single-subject messages such as salient points of FCC Chairman Powell’s keynote speech.

Special Note Of Thanks

As part of the changes I have made to resume regular publication of *FOCUS*, I consulted several people, and critically studied several newsletters of similar scope to *FOCUS*. One person in particular offered me tremendous wisdom and encouragement on how to fix *FOCUS* – Dana Blankenhorn. Dana publishes A-Clue (www.a-clue.com), a widely-read and widely respected newsletter that's been in publication for a very long (Internet) time – on a very regular schedule. Dana's suggestions and observations were tremendously useful to me in getting *FOCUS* restarted. Thanks *very* much, Dana!

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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