



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

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Steve Stroh, Editor

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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.

FOCUS on Broadband Wireless Internet Access is written in an informal, easy-to-read style, with an emphasis on clear explanations of why a particular company, product, or development in the Broadband Wireless Internet Access industry is significant. Each issue contains a number of *original*, in-depth articles and news stories. *FOCUS* is a just-in-time, short-lead-time publication, using Adobe Acrobat (.pdf) format, and email distribution. *FOCUS On Broadband Wireless Internet Access* is published by:

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Broadband Wireless Internet Access and Voice Over Internet Protocol

The Dawning Of A Truly Next Generation Telecommunications System

At WISPCON I, way back in the dusty recesses of history (nearly two years ago now), I was asked to make a few remarks to the assembled group. I've forgotten much of what I said at that time, but I do clearly remember making a prediction that probably sounded totally ludicrous to most of the Wireless Internet Service Providers (WISPs) that were there.

The prediction I made in March, 2001 was that WISPs are the next generation telecommunications industry.

The problem with that prediction was that, while I believe it wholeheartedly, and the broad trend was very clear to me... I had no idea *How?*... or *When?*... it was actually going to come to pass.

Nineteen months later at WISPCON IV, sitting in Brian Capouch's session titled "VoIP - Policies, Procedures and Guidelines", I learned the missing piece I needed to answer the *How?* and *When?* of my WISPCON I prediction.

How will WISPs become the next generation telecommunications industry? *By deploying Voice Over IP services.*

When will WISPs become the next generation telecommunications industry? *It's already happening!*

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Those statements probably sound pretty “plain vanilla”... but believe me – this is profound. Let me expound and explain a bit more.

What Capouch spent most of his time talking about in his WISPCON IV session was Asterisk (www.asterisk.org) – software that implements all the features of a telephony Private Branch Exchange (PBX; a small telephone switch). Three key features about Asterisk take it from being “interesting” to *electrifying*:

- Asterisk doesn’t just implement PBX / telephone switch functionality, but it’s based on Voice Over IP; in short, it processes and routes packetized voice.

- Asterisk can accommodate nearly any legacy telephony interface through well-supported drivers and interface cards, so it’s by no means “limited” to VOIP. Asterisk runs on Linux, runs well on a typical PC.

- Asterisk is Open Source Software... free to use however one sees fit, and free to modify, expand and change to accomplish nearly anything related to Voice Over IP or legacy telephony. For those that don’t want to do Asterisk the hard way, the primary author of Asterisk formed Digium (www.digium.com), which fully supports... and exploits... all that Asterisk is capable of, including offering hardware integration, interface boards, technical support, etc.

At this point, please permit me a brief context switch away from WISPs. Voice Over IP in the telecommunications industry is a very, very big deal beginning in 2003 when it became clear to the Incumbent Local Exchange Carriers (ILECs) that VOIP service providers such as Vonage, Packet8, and dozens (literally) of others are poised to begin stealing significant (for the first time) market share of local voice services... the most profitable segment of the ILEC’s business. This is happening at the same time they’re already losing significant market share to wireless telephony (which, even though the ILECs are in the wireless telephony business, the

profit margins for that business are much lower than providing local voice services). The ILECs, and state Public Utility Commissions (PUCs) are now exerting enormous pressure on the FCC to “shut down these VOIP parasites before we go out of business”.

That VOIP industry is, to me, “tinkering at the margins” of the current telecommunications industry. It’s a competitive frenzy revolving around the minutiae of how a telephone call will be originated, transported, and completed. In short it’s more of the same, with some new competitors like Vonage and Packet8 seeing a new technology (with associated regulatory and taxation uncertainties) as entry into the market for competitive local telephone service that was completely inaccessible to competition from small companies. On *that* basis... there’s not much uncertainty about how this will ultimately come out. Telephony services (which I define as coupling into the Public Switched Telephone Network for the purpose of originating or terminating voice telephony) will be regulated and taxed similarly, regardless of the particular technologies that are used to originate, transport, or terminate the call.

This “more of the same” is why I had not been actively following the emergence of VOIP.

OK, context switch back to WISPs. What Capouch demonstrated during his session at WISPCON IV was the involvement of at least four Asterisk boxes that he had built, installed, and programmed to do exactly the functions that *he* wanted them to do. His extended Asterisk system encompassed interface to the PSTN (somewhere... it really didn’t *matter* where, physically, that interface was), transport over the Internet, transport over wireless, and did so opportunistically and transparently. In short, Brian had complete control over his telephony services to take advantage of whatever telecommunications services he wanted/needed/could afford, wherever they happened to be located... delivered to him via the Internet. In the end, it’s a phone call, but *he*,

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not an ILEC had the control over how his phone calls get to him.

What Capouch showed was that 1) telephony services aren't rocket science any more; anyone who's smart enough to be an ISP is smart enough to handle telephony services. 2) By building *IP* networks where they're needed, WISPs are now, effectively, building *telephony* networks wherever they're needed.

This is *profound!* It's never been possible to build telephony infrastructure so cost-effectively... where it's needed... as fast as it's needed... as what WISPs can do in providing IP services. Now it's possible for WISPs to begin offering telephony services. Of course, they always "could" offer telephony services, but that was just transport for another company's VOIP emulation of PSTN services such as Vonage.

With Asterisk, WISPs can now offer their own VOIP services... and the possibilities are endless. WISPs can offer their customers free, unlimited calls to other customers. To answer an obvious question – that customers can do this now with no involvement from the ISP, the answer is Yes, they can... but it's possible for the ISP to add enormous value by offering, for example, a directory of customers and their "extension" VOIP numbers. A WISP's Asterisk system can route incoming calls simultaneously to two or more destinations simultaneously. An Asterisk system can "transcode" – translate between two different codecs (coder/decoder) when that's necessary for interoperability. There are possibilities too numerous to mention.

What I'm discussing in the above paragraph is not... yet... full replacement for PSTN services. In an example from the wireless telephony industry, what I'm describing in the above paragraph is an equivalent of "Nextel Push-To-Talk" service that does not yet transition to the PSTN. Initially... such a service is only of limited value if the only ones you can "talk to" are other WISP customers. But... Asterisk and VOIP are certainly not that limited.

A next step for a WISP offering VOIP services could be to develop a very low-cost Internet access service that's designed strictly for VOIP

service. There are some amazing codecs out there that accomplish good-quality voice using very little bandwidth, with the resulting low impact on a WISP's network. Perhaps all of the non-ILEC ISPs in a town begin to collaborate on implementing compatible Asterisk systems, with a common numbering scheme and unlimited "talk" time between systems. At that point, such a VOIP service is not merely a science project... it's a very serious productivity tool, with serious uses.

What I learned at WISPCON IV is that some WISPs are already pretty far along the path I've described above. There are other, somewhat related projects and products. For example, Alvarion has a version of their BreezeAccess II CPE designed for mobile use, that has a voice option (though not VOIP)... put in a VOIP gateway at the base station and you have the equivalent of mobile telephony. There are a number of Voice Over IP over 802.11b (VOIP/Wi-Fi) handheld telephones about to emerge such as Jeff Pulver's WiSIP phone (www.pulverinnovations.com/wisip.html). All of these products don't depend on the PSTN, except where that's convenient or needed. If it's too expensive, or regulated, or taxed... PSTN interface will be avoided and another way found.

Projecting forward just a bit... At WISPCON IV I saw a number of very impressive, and amazingly low-cost radio/router combinations designed for WISP use. The routers already run Linux on an X86-based single board computer (SBC). To me... it's not much of a leap to implement Asterisk on a second SBC... and eventually when the SBCs are a bit more powerful, run Asterisk on the same SBC as the router... which will also be busy managing Mesh Network routing. Imagine... a neighborhood of license-exempt wireless mesh-network nodes, with high speed "data" Internet access supplied optionally to any customer that wants it, with a separate service offering of low speed "voice" Internet access. Want to be able to stay in contact with your neighbors? Put up a mesh node, plug in a phone and a laptop. Want to be able to make legacy phone calls (a few of your relatives are

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really old-fashioned and still have dial phones) – buy phone service from a WISP.

The telecommunications industry as a whole simply does not... *can not*... grasp that their industry has changed so radically in such a short time. They think that they are reacting by offering VOIP services, but again, those are “tinkering at the margins”. A good example of too little, too late are the numerous announcements ILECs will offer VOIP over their DSL service... and as soon as the VOIP packets arrive at the ILEC’s DSLAM... they’re immediately converted back into PSTN format for transport over the legacy ILEC network.

There are very, very few that have grasped the opportunity to fully combine VOIP and Broadband Wireless Internet Access as a build-as-needed voice infrastructure! The emerging VOIP industry can’t see it; the feeling there is “we’ll use any broadband pipe that happens to exist”. They haven’t grasped the power of being able to *cost-effectively create new infrastructure purely (if necessary) to provide VOIP services.* The telecommunications industry can’t see it; it’s just waking up to the threat that VOIP is *very actively killing circuit-switched services* and rendering obsolete entire tiers of switching equipment (expensed, or not). The Broadband Wireless Internet Access industry (largely; there’s *some* dawning recognition) can’t see it either; they don’t see the very rapid evolution possible in offering VOIP services that can be initially differentiated, and as needed be in full competition with Incumbent Local Exchange Carrier’s voice services.

How will the US achieve a truly competitive, cost-effective, next generation voice and Broadband Internet infrastructure? I believe that it will come about very rapidly by the introduction of VOIP services over Broadband Wireless Internet Access systems that were previously used only for Internet access. Such systems can be introduced far more rapidly and cost-effectively than almost wireline (or wireless telephony) service.

Verizon’s Broadband Wireless Internet Access Announcement

On January 8, 2003 Verizon Communications CEO Ivan Seidenberg announced at the Consumer Electronics Show (CES) that Verizon will deploy a nationwide (US) Broadband Wireless Internet Access (BWIA) service during the coming year. The name of this new service is BroadbandAccess.

There’s quite a bit “under the surface” of the announcement of BroadbandAccess. First, BroadbandAccess is actually being deployed by Verizon Wireless, a separate company that is a joint venture between Verizon Communications and Vodafone Group. That Seidenberg made the announcement instead of Verizon Wireless CEO Dennis Strigl was apparently a deliberate blurring of the respective roles and services of Verizon Communications and Verizon Wireless. The language and manner of the announcement at CES was likely calculated to convey the impression that Verizon Communications is now deploying wireless broadband services.

Second, it’s instructive that BroadbandAccess is not the long-awaited announcement of the deployment of “fixed” Broadband Wireless Internet Access by Verizon, offering DSL-replacement service in areas where DSL is unavailable, infeasible, or not cost-effective, using its licensed Wireless Communications Service (WCS) spectrum at 2.3 GHz. Instead, BroadbandAccess is the “3G” enhanced data standard 1xEV-DO, in existing cellular spectrum, and pitched at mobility usage.

In short, Verizon has made a US\$1B punt on “fixed” Broadband Wireless Internet Access and decided to go with a more conventional service that offers marginal performance with ubiquitous coverage.

Despite the apparent ringing dismissal of “fixed” Broadband Wireless Internet Access, the Verizon announcement has a number of positive aspects for the overall BWIA industry.

1) BWIA will now be an established product of the dominant wireless telephony service provider

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in the US. That will firmly establish BWIA as a distinct product category in the minds of consumers and businesses. This should help enormously in the quest to explain BWIA service to consumers and businesses, instead of saying “just like DSL... only without the wires.” Instead of providing a comparison to a dissimilar technology, now a BWIA Service Provider can contrast their service directly against Verizon Wireless’ BWIA service.

2) Verizon Wireless’ BWIA service will be offered nationally and uniformly. The same product, at the same price, will be available nationally. Lack of national availability is something that has, and will continue to handicap BWIA service providers in the minds of journalists, analysts, and investors.

3) Verizon Wireless’ BWIA service establishes price and performance benchmarks for BWIA services. Verizon Wireless’ BWIA service offers “full portability” (use it anywhere within our coverage area – no hunting for Wireless HotSpots), 300-500 Kbps download (claimed; 200-250 actual), 40-60 Kbps upload, for \$79/month unlimited use, with PCMCIA cards costing typically \$200-\$250.

4) It’s very instructive that the wireless telephony industry, and by extension the large telephony service providers apparently won’t be won’t be turned from their evolutionary standards. The wireless telephony service providers such as Verizon remain fully committed to 3G evolution, with no real tolerance for “alternative” technologies. The exception seems to be small telephony service providers, who are adopting such “alternative” BWIA systems for providing incremental broadband services rather than rebuilding their entire wireline infrastructure to be broadband-capable.

5) Likely BroadbandAccess is a somewhat preemptive strike against the possible/likely emergence of new BWIA services that use the 2.5-2.7 GHz MMDS/ITFS bands. Hints have begun to emerge that Nextel’s purchase of Worldcom’s MMDS spectrum licenses is not, as I’ve previously speculated, purely a hedging bet,

but rather part of an active plan to develop a new BWIA service, likely including mobility.

The good news is that Verizon Wireless’ pricing is relatively high, but not excessively so. For BWIA service providers that do/hope to charge more, they can point to the fact that Verizon Wireless has huge economies of scale, and that they can cross-subsidize their BWIA service from their wireless telephony business and huge number of existing customers – “I’m a small guy and I have to pay full price for my equipment – I can’t match Verizon’s prices.” On the other hand, it’s often the case that BWIA service is priced substantially less; a number of BWIA service providers price their service the same as dialup - \$25/month and that’s a bragging point. “Verizon Wireless’ BroadbandAccess service is twice what we charge, and ours has better performance, and we’re local.”

The bad news for BWIA service providers is that other aspects of BroadbandAccess will be harder to explain away– national (urban) footprint, ubiquitous coverage in a service area, no need for an external antenna (or an external radio unit; Broadband Access “CPE” are PCMCIA cards), and mobility. Taken together, these features are powerful arguments with potential customers. In areas which have Verizon Wireless (direct – not affiliate) service, these features will be a strong draw, particularly to those using their laptop as their primary computer. To compete, WISPs will have to more aggressively begin to deploy Non-Line-Of-Sight (NLOS) systems that offer truly ubiquitous coverage in their service areas and begin to offer mobility services (as some already do). BroadbandAccess should also provide incentive to a number of BWIA equipment vendors to “finish the job” and begin to offer mobility-enabled versions of their “fixed” systems.

The ultimate irony is that the other part of Seidenberg’s announcements was that Verizon will be putting US\$2B into deploying Voice Over IP (VOIP) capability on its existing wireline network. Left unsaid, or more likely, nervously ignored is that Verizon’s BroadbandAccess BWIA service would be a

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good basis for using customers to use VOIP, assuming that the highly variable latency issues exhibited in earlier telephony data services can be corrected.

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TiVo Done Right

(From the "I Just Don't *Get* It" Department)

In my research reading this month, a brief mention of Kreatel (www.kreatel.com) who makes IP settop boxes caused another round of exasperation that the consumer electronics industry is just completely missing the boat in not seeing the possibilities of a combination of Digital Video Recorder (DVR) like TiVo (www.tivo.com) and a IP settop box like Kreatel's. The problem with TiVo is that the content is required to arrive at the TiVo in realtime and in analog (or digital cable) format. It's then digitized/converted/compressed and stored on a hard disk to await viewing at a convenient time. With an IP settop box, the input is at least digital and IP, but it's still being transmitted and viewed in only in realtime.

What *I Just Don't Get*TM is why bother with realtime delivery of content for content that's not inherently best viewed in realtime (such as breaking news stories?) Or... at least... now that it's possible (current TiVo's have a USB jack that can support USB/Wi-Fi adapters, and there's some limited interoperability with other household devices) why not offer the *option* of non-realtime delivery of content? If the content is just going to be "TiVo'ed" anyway... doesn't it make sense to deliver the content pre-digitized, and using a broadband connection when it's not being otherwise used to get it to the individual TiVo? Especially now that hard disks are at 250 GB which can hold more reasonable-quality video content than it seems reasonable to contemplate watching?

In the Broadband Internet age... the local Blockbuster store is an abomination. *Driving* to a store to rent *bits on discs*???. And then you have them for a limited time and have to return them?

Even more absurd is the idea behind Netflix, where the bits on discs are *snail-mailed* to you from elsewhere in the country!!! This isn't to say that Blockbuster or Netflix aren't popular, profitable, or fulfilling a useful purpose. It's just that we ought to be able to do better. For one... On those rare occasions that I sit down and actively want to watch some television, I want to select from *my viewing choices*, not the thousand or so titles that Blockbuster has chosen to stock, or the few "theme" channels and this month's endlessly-repeated movies on cable and satellite. In short, I want to Google for some interesting-looking content, download it for a small fee (perhaps prepaid) into my settop box, viewed comfortably on my television, viewed whenever I find it convenient to do so.

Note... I am aware that there are at least a few services much as I describe that allow content to be downloaded, stored, and played back as desired... on your PC running Windows Media Player or other lame, proprietary player, on a small screen, tying up the resources of a computer to do so (which... admittedly... have gotten to "appliance" levels of cheap-enough-to-devote-to-a-single-purpose such as video playback.) No... what I really want is a simple box(es) that can go on any television in the household and plug into the household LAN and retrieve the non-realtime content for their viewer, and swap it / play it over the LAN from whichever box happens to be storing it at the moment. TiVo does this one function with its newest units, but again – no ability to retrieve content from the Internet for later playing.

There's also Disney's MovieBeam service now in trials that does some of what I describe, only the content is distributed via television broadcast stations, in non-realtime, assembled onto a hard disk-based player, with the customer having a choice from those movies transmitted to all MovieBeam units during the previous four weeks. Disney's mostly there... it's puzzling why it didn't decide to create a parallel

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distribution channel for the units via Broadband Internet connections?

Someone is going to get this right - a settop box that will retrieve non-realtime, pre-digitized content from a server on the Internet via a reasonable (DSL-equivalent) broadband connection for direct display on a television screen. With some reasonable, minimal, unobtrusive copy protection (akin to what TiVo is doing about the content that is recorded into its devices), content that stays "locked away" in the unit (and, to be clear, deleted only on the command of the owner) should be good enough protection for the content owners. This is simply too good an idea to bypass all of the purpose-built video content distribution networks of the world- satellite, terrestrial broadcasting, and especially wireline cable television.

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Short Packets – BWIA Industry News

Airspan acquires yet another BWIA product line – Continuing a string of acquisitions that allow it to offer combined Internet and circuit-switched voice services compatible with wireline telephony infrastructure, Airspan has acquired the Northern Telecom Proximity fixed wireless product line for US\$12.9M. Proximity is designed to operate in the international 3.4-3.6 GHz bands.

Trango Broadband Wireless begins shipping 900 MHz product – Trango is now shipping its previously announced M900S system. Using the 900 MHz band (available largely only in North America), the M900S achieves up to 3 Mbps at a range of 3 miles. The primary attraction of 900 MHz is that such "lower" portions of the electromagnetic spectrum can, at comparable power levels, penetrate foliage far better than typical 2.4 or 5 GHz systems. With the M900S, Trango enters an increasingly crowded market for 900 MHz equipment. In addition to WaveRider Communications, whose LMS system has been successfully deployed in numerous markets and shipping for several years, Alvarion, Airspan, Motorola, and Cirronet

have all announced or are shipping 900 MHz systems.

Motorola quietly enters WLAN/Wi-Fi market, one of the first to integrate "smart antenna" technology into consumer WLAN equipment – The week before January's Consumer Electronics Show, I stopped in at an area Radio Shack store, and was very surprised to see Motorola-branded WLAN/Wi-Fi equipment on display. From appearances and brief research, Motorola appears to have skipped 802.11b entirely, opting for 802.11g in these first WLAN products. Motorola officially announced the WLAN product line at CES. In a separate announcement, Motia announced that Motorola would be incorporating its "smart antenna" technology into future versions of Motorola WLAN systems to increase coverage effectiveness. Speculatively, there may be some interesting synergy ahead for Motorola's consumer products – it has products for all three major uses of the 2.4 GHz band – cordless phones, Wireless LANs, and Broadband Wireless Internet Access. Motorola is, of course, also a major force in wireless telephony. Perhaps we'll see an integration of Voice Over IP over WLAN – cordless phones that use Wi-Fi and VOIP like the Pulver Innovations SIPPhone, using Motorola WLAN Access Points (APs) instead of cordless phone docking stations, all cooperatively sharing 2.4 GHz spectrum with Canopy 2.4 GHz equipment. Perhaps with Motorola's new, more Internet-savvy CEO... it *could* happen.

Household WLAN content distribution is the main story at CES - Another Consumer Electronics Show (CES) has come and gone, and we're left wondering which of the wonderful gadgets that were profiled will actually come to pass. What was abundantly clear was that the distribution method of broadband digital content choice within the home has become Wireless LAN. In 2004 that will be 802.11b/a/g (thus realizing a prediction I made some years ago in my Boardwatch Magazine Wireless Data Developments column that wireless – not cable television cabling, not phone lines, not power

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lines would be the dominant transmission medium for content distribution.)

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Letters To FOCUS – WISP Best Practices?

I found this recent exchange particularly engaging, and I think **FOCUS** readers will find it equally so. The exchange teases out a few points in my worldview that I hadn't explored very thoroughly to date. My correspondent, who is a broad-based technologist at a Fortune 50 company who I met at a small conference last Fall, makes some excellent observations, especially in the wrap-up. He/She requested that that his/her name and affiliation not be attributed.

Round 1:

Letter to Steve: I bought a farm in [a rural area] and, in trying to find broadband connectivity here I started thinking about the WISPs that you watch and write about. Is there one model that is emerging as the "best practice" for running a rural WISP? A particular WISP that you think is head and shoulders above the rest? I'm thinking of planting a few seeds among the more entrepreneurial types I've met around here, if only to get some decent connectivity for myself!!

Steve replies: There's no "best" model, and that's the strength of WISPs. What would/should work best is to fit the system/technology/model to the local conditions. Hilly or flat? Trees or no trees? Lots of high points like grain silos / water towers, or have to build your own towers? Clustered population or dispersed? Entrenched wireline or no? Acutely price sensitive, or less so? Other WISPs present / pollution of 2.4 GHz from other sources, or no? Access to patient capital, or pure bootstrap? There are solutions for all of these, or any combination, they all need to be factored in.

Round 2:

Letter to Steve: I can see exactly what you mean about no "one size fits all" - that's one of the sources of vitality in the unlicensed wireless "industry" isn't it? And one of the things that

makes it somewhat impenetrable and puzzling to the bellhead mentality, where there is definitely one size (big) and it will fit you! Or else!

Steve replies: Agreed - the choice of technologies / techniques / reliability versus cost tradeoffs is indeed the strength of the WISP industry and why I'm such an advocate. It can be made to work anywhere for nearly any situation, as cost-effectively as required... which gives the telcos fits. It's really instructive that Verizon's recent announcement of "Broadband Wireless" was merely deployment of 1xEV-DO; it's all they can figure out how to make work. They don't have the ability to support multiple technologies / systems that are close fits for individual market conditions. So, it falls to the small guys - and the result will be classic "disruptive technology".

Round 3:

Letter to Steve: As for the telcos - OK, so we agree the big guys can't support multiple technologies and niche markets - so what does it look like when an entire sector stumbles? Who wins and who loses? That's what is mystifying me. Clearly the little WISPs can't scale up to serve the entire country - technically it might be possible with ad hoc networking, but socially we just aren't there yet. Do the big brand names end up being aggregators of network service that is actually provided by hundreds of little network operators? Does there end up being 1-2 dominant players in each viable technology, horizontally deployed across the country? Or do we end up with regional networks that interoperate, sort of like the power grid?

Steve replies: I'm not being flip when I say Yes - All of the models you name, simultaneously.

We'll see rollups of the small WISPs, we'll see continuous evolution of new small WISPs, we'll see startups of regional WISPs, we'll see associations of WISPs that will essentially be franchises, as well as municipal WISPs, private WISPs, co-op WISPs, free WISPs, Wireless HotZones, etc. I just don't see any indication of the Broadband Wireless Internet Access industry

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"coalescing" into a single or a few dominant models, because the business case and the technology (especially the use of license-exempt spectrum) can accommodate all those models simultaneously.

The carriers are somewhat flummoxed; they can't figure out a way to stop it. They can't buy up license-exempt spectrum, they can't intimidate the equipment vendors into making life rough for the startups, they can't effectively compete with subsidized services (WISPs often provide service where the telcos simply AREN'T), and they can't cause technical problems for them because WISPs generally don't use any wireline facilities like DSL ISPs do (and those few wireline services that WISPs do use are tariffed services like T-1's, and all ISPs are experts at sic'ing the statue PUCOs on the telco for any foolishness about manipulating reliability of T-1 lines.)

Wrap-up:

Letter to Steve: It's very interesting that you don't see a pattern emerging that will shape this into something that conforms with the traditional view of "industry." Of course, it felt as though the 5000+ ISPs in mid-nineties weren't going away anytime soon either. Though of course your argument that the technology and the spectrum don't allow for the rapid, massive consolidation that was experienced in the late 'nineties...

I'm actually developing a theory of a shift from our current services-based economy to something else as services are commoditized and moved off-shore just as manufacturing was before it. What that "something else" is I am not really sure at this point, but it seems more and more likely to me that there will be many many more firms of a much smaller average size than that to which we are accustomed. It makes sense that telecommunications would enter that phase first, being the leading edge of the services industry in the first place. Next up, media and entertainment...

Planned For Next Issue:

- Notes From the WCA Technical Symposium – four days of total immersion in Broadband Wireless Internet Access. A number of seminal announcements are expected.
- New members of the BWIA Deadpool
- The *FOCUS On Broadband Wireless Internet Access* Comprehensive List Of BWIA Vendors
- More Short Packets
- Updated BWIA-related Events Of Note

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Publishing Note:

The **New Products**, **BWIA In Other Media**, and **BWIA-related Events Of Note**, and **BWIA Deadpool** sections will all return in future issues of *FOCUS On Broadband Wireless Internet Access*. They were omitted from this issue as part of an intense effort to restore the publication of *FOCUS* to a regular schedule in 2004, for which twenty (20) regular issues, and several bonus issues are planned.

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David Isenberg, SMART Letter #71

Independent technology writer Steve Stroh again provided his unique blend of comprehensive and informative insights in his newsletter "FOCUS On Broadband Wireless Internet Access.". The newsletter continues to provide personal interpretations on industry developments that are worth knowing – and supporting.

Andrew Kreig, President Wireless Communications Association International, WCAI Bulletin April 11, 2002

Clued-in is Steve Stroh , whose understanding of the technical issues involving wireless broadband is first- rate and fine-grained.

Dana Blankenhorn, A-Clue.com, February 25, 2002

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Glenn Fleishman, 802.11b Networking News, February 13, 2002

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Robert X. Cringely, PBS.com Technology columnist, I Cringely June 6, 2002

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Dave Hughes, Principal Investigator, National Science Foundation Wireless Field Tests

Some Background On *FOCUS*

Since beginning my professional writing career, I have specialized in the emergence of Broadband Wireless Internet Access. Many readers have repeatedly told me how valuable my articles and columns in Boardwatch Magazine, CLEC Magazine, Broadband Wireless Business Magazine, and other publications have been to them in understanding the companies and technologies of the Broadband Wireless Internet Access industry. I've been asked many times if there was any way to read more of what I have written about Broadband Wireless Internet Access. In answer to those readers, in June, 2001 I began publication of a newsletter- ***FOCUS On Broadband Wireless Internet Access***.

FOCUS is founded upon the following tenets:

- Internet technology is becoming the foundation for nearly all communications, commerce, and entertainment services;
- For Internet access to be truly usable, always-on Broadband Internet access is required;
- By the end of the first decade of the 21st century, Internet access will be ubiquitous;
- 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;
- 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.

FOCUS on Broadband Wireless Internet Access is written in an informal, easy-to-read style, with an emphasis on clear explanations of why a particular company, product, or development in the Broadband Wireless Internet Access industry is significant. ***FOCUS*** is not an investment newsletter, merely recommending or highlighting particular companies for their investment potential. Each issue contains a number of original, in-depth articles and news stories. ***FOCUS*** is a just-in-time, short-lead-time publication, using Adobe Acrobat (.pdf) format, and email distribution

In every issue, ***FOCUS on Broadband Wireless Internet Access*** will profile the companies, technologies, and developments that are creating the Broadband Wireless Internet Access industry. ***FOCUS***' coverage is independent and accepts no advertising; ***FOCUS*** is entirely reader-supported. Key events such as Broadband Wireless World Forum and Wireless Communications Association International's Summer Tradeshow and Winter Technical Symposium, and other significant wireless and Internet events will receive extensive coverage in ***FOCUS On Broadband Wireless Internet Access*** will be in a state of continuous evolution. My promise to readers is that ***FOCUS*** will be relevant, honest, and interesting.