Focus

On Broadband Wireless Internet Access

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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From The Editor

The Best Of Times, The Worst Of Times…

With the announcements in late 2001 of Sprint Broadband Direct's "holding action", and AT&T Wireless Services' termination of its "Project Angel" Fixed Wireless system, it didn't take much good news to lift my spirits.

But good news was to be found in the Broadband Wireless Internet Industry, if one dug a bit deeper than the typical sound bites that pass for "tech news" in this era.

The good news is that new companies offering Broadband Wireless systems such as Navini Networks, Sustream Wireless, and Caly Networks (and a number of others) continue to emerge into what is supposed to be a dead market. Small-to-medium service providers employing Broadband Wireless technology are emerging, surviving, and even expanding, especially in second and third tier markets. Some existing companies are attracting new funding and are achieving significant deployments. Still other companies have gone out of business only to be resurrected, such as Metricom's Ricochet network, Adaptive Broadband, and ADC Broadband.

In "internal news" with ***Focus***, I have bowed to reality and the tyranny of summer and holiday schedules, and have changed the publication schedule to 9 issues during the year. ***Focus*** will be published monthly, with combined June/July, August/September, and November/December issues. All current subscribers will have their subscriptions extended to include 12 issues.

As always, I would like to take a moment to ask that, if you find ***Focus*** to be useful and insightful, please take a moment to recommend it to colleagues. A subscription form is located on the last page of this issue for ease of printing and copying.

Thanks!
Steve

***Focus On Broadband Wireless Internet Access*:**

www.strohpub.com/focus.htm

Starting A Wireless Internet Service Provider

As a result of articles I've written in various publications, I'm occasionally asked about the basics of starting up a Wireless Internet Service Provider (WISP). I've been formulating a lot of the points I'll make here for some time, and a recent lunchtime chat with a potential WISP, combined with a discussion on the Wireless ISP mailing list (www.isp-wireless.com) gave rise to this article. An in-depth version of this article will appear as a chapter in my upcoming book on Broadband Wireless Internet Access.

Opportunity Abounds

The good news is that there is plenty of opportunity for WISPs. Broadband demand is increasing, especially in the critical small office / small business segment (and this includes professionals that are working out of home offices). The competition – cable modems and DSL, are slowing their deployments and/or increasing prices, and Broadband Wireless Internet Access equipment is becoming more capable and cost-effective by the month. This market segment has a clear need for reasonable-speed Internet access, and can afford to pay for equipment installation and access fees that are higher than typical consumer broadband prices. For that premium, such customers expect good support and high-quality, fast Internet access, along with "premium" features such as multiple static (routable) IP addresses upon request.

Don't Overlook ISP Issues

In dealing with the challenges of becoming a *Wireless* Internet Service Provider, it's easy to overlook that, in the end, a WISP is very much an *Internet Service Provider*. In common with all other ISPs, WISPs need skills in networking, system administration, customer support, and general business issues such as billing and, of course, financing. Personnel with experience (and, more importantly, the mindset) to effectively manage security issues are especially critical. It's a crucial differentiation that System Administrators do not equate with "Linux User". Though typical Linux users are far more familiar with such technical issues, the task of System Administrator encompasses far more than the mundane technical issues – being a System Administrator is more of a mindset, of being willing to manage the mundane because it really does make a difference in the long run; for example, examining log files of critical systems. Recommendation – be willing to pay the money needed to attract an experienced SysAdmin.

The Best Markets

The best markets for WISPs appear to be in second / third tier cities and rural areas, where wireline broadband solutions typically don't exist, especially considering that DSL and cable modems are technologies more suited for dense urban deployments where customers are relatively concentrated. There is certainly a market for Broadband Wireless Internet Access in urban areas, but the business environment is much tougher – sites for wireless hubs on towers and buildings are much more expensive, and it's tough to differentiate Broadband Wireless from wireline broadband services.

Consider 5 GHz Spectrum

If your target market is an urban area, you should seriously consider making use of 5 GHz spectrum for your hub-to-user links because there is, at the moment, far less usage there compared to 2.4 GHz. Link lengths are necessarily shorter, and this necessitates more hub sites. Because there is more spectrum at 5 GHz, speeds are somewhat faster. A number of very promising new equipment vendors now offer equipment for 5 GHz, and are worthy of serious consideration. Such equipment could offer a critical performance and cost-effectiveness difference.

Interference, Legal Issues

There is a lot of fear, uncertainty, and doubt (FUD) "sprayed around" about the issue of "interference" between two license-exempt systems. The relevant Federal Communications Commission (FCC) regulations – Part 15.247 (Part 15), do not give any preference to the WISP who is "first to deploy" in a given area. Many WISPs take comfort in the "Must not cause harmful interference" clause in Part 15, and do not realize that the term "harmful interference" has a *very* specific meaning within the FCC rules. *Harmful interference* refers, *very* specifically, to interference caused to a licensed service in the FCC rules. It was a bad shock to many WISPs in early 2001 when a large WISP's deployment to an apartment complex was shut down for harmful interference to an Amateur Radio television repeater. Amateur Radio is a licensed service and is shares some spectrum in the 2.4 GHz band with Part 15 operations. Attempts by the affected Amateur Radio Operators to work with the offending WISP were met with indifference on the part of the WISP… until the FCC issued a "show cause" order that effectively shut down the WISP's offending system. WISPs that plan to make use of Part 15 equipment should understand thoroughly the implications of the FCC's Part 15.247, and Unlicensed National Information Infrastructure (UNII) rules.

That said, potential WISPs should be aware that in our highly litigious society (that includes business), if you are a new WISP and cause interference to an incumbent WISP, you could easily be sued by the incumbent

WISP, likely for "interference to trade" or language to that effect. That such a suit has little or no *technical* merit (again, there is *no* protection, stated or implied, in the FCC Part 15 rules for those who are first to deploy Part 15 equipment) may, or may not, be considered relevant in the eyes of the court. At that point, it's a civil matter, and technical issues may not hold much sway with a local judge. If you have sufficient resources to appeal a bad judgment and can employ legal representation that has experience in communications law, likely you could prevail.

There is a critical, fundamental difference of *intent* if a Part 15 interference case is taken to trial in a local court. If it can be shown that the "new" WISP in a market had a deliberate intent to interfere (such as documented statements from the newcomer like "our [better] equipment will shut your equipment down", etc. could probably be considered evidence that interference was a primary motive. On the other hand, formal statements (such as registered letters) offering technical explanations for interference issues (such as "Frequency Hopping Spread Spectrum systems, by FCC regulation, must make use of the entire 2.4 GHz spectrum, and therefore some interference to Direct Sequence Spread Spectrum systems is unavoidable) would be very helpful in keeping the discussion focused on technical aspects.

It makes sense for WISPs to cooperate, at least minimally, if at all possible. An ideal solution would be for competing WISPs in a market to cooperate at least minimally to insure that their systems don't (excessively) interfere with each other. In some cases, the "other" WISP simply *won't* see reason, or will have deployed a technically inferior system that is all-too-easily interfered with, and reasonable discussion isn't an option. In such cases, legal maneuvering aside, the most robust technology, assuming a reasonably-well engineered system, tends to continue to work reliably, and older technology in marginally-engineered systems tend to fail.

RF Knowledge *Is* Necessary

There was a time when WISPs had the luxury of "learning on the job" about RF issues, but that time has, unfortunately, passed. There is simply more at stake in the current economic environment. Mistakes made in equipment selection or system design can cost dearly – sometimes fatally. Taking too long to resolve a service outage can rapidly result in lost customers. By the time a WISP commences revenue service, they must either possess considerable knowledge of RF, or be willing to grow that expertise by sending personnel to classes, or hire the needed expertise (and be prepared to pay the going rate).

At a minimum, a WISP should take maximum advantage of training offered by WISP equipment vendors. Whether or not a particular vendor offers factory training should be a given considerable weight in deciding between vendors.

Impartial training should be strongly considered. Unfortunately, trade shows, despite their claims of offering valuable training and seminars, have allowed their "seminars" to degenerate into thinly-veiled marketing pitches. This isn't to say that trade shows aren't useful for seeing different types of equipment and getting some feel for which vendor's equipment is an appropriate fit for a particular WISP, but trade show training should not be relied upon solely.

Sources of independent training:

- Wireless Nets, Ltd. – www.wireless-nets.com/
- Wireless InfoNet, Inc. – www.ask-wi.com/

Beware The Consultants

There are many "consultants" who will offer "surveys" of potential WISP markets. A common problem with consultants is that their "survey" addresses only potential interference from well-known Part 15 systems such as 802.11b Wireless Local Area Networks (LANs) which are widely deployed in large businesses and increasingly in public spaces such as hotels, coffee shops and convention centers (as well as WISP systems). Other consultants will use inexpensive "site survey" kits by wireless LAN vendors, which offer, at best, only a very general idea of existing activity. Surveys by very experienced companies are costly. Survey companies should readily offer references, and such references should be checked. The survey company's written report should state the methodology of the survey and references to the instrumentation that was used. For example, if a "peak-reading" or "sample and hold" Spectrum Analyzer is not among the equipment used in a survey, it's unlikely that Frequency Hopping Spread Spectrum (FHSS) Part 15 systems, if present, will be detected.

As part of doing business, a WISP should invest in appropriate RF test and monitoring equipment such as spectrum analyzers, and more importantly, knowing how to use one. Alternatively, a local business that has such equipment, such as a two-way radio repair business, may be an appropriate resource when problems occur. The critical issue here is to have the ability to troubleshoot RF problems rapidly so that service outages can be kept to an absolute minimum. Service outages do not inspire confidence in customers, especially when it takes days to resolve problems because test equipment could not be procured rapidly.

It should be noted that there are numerous "uncommon" sources of interference. For example, in a coastal area, military communications and electronic warfare systems (such as advanced radar) could be experienced. Part 15 spectrum is shared with "Industrial, Scientific, Medical" devices such as microwave ovens (household and industrial), plywood dryers, medical diathermy, RF-driven lighting systems, etc. Numerous new communications systems are being developed that have unusual RF characteristics, such as Orthogonal Frequency Division Multiplexing (OFDM) and numerous proprietary modulation schemes that may not have been encountered previously; another reason to employ experienced firms and personnel.

Licensed *and* Unlicensed Spectrum

There is an old saying that applies here: "When the only tool you have is a hammer, everything looks like a nail." Most WISPs find reasonable success using license-exempt spectrum, and make the assumption that licensed spectrum is unavailable or too expensive. It's a surprise to many WISPs that licensed spectrum is often available, especially in second and third-tier markets. There are numerous allocations of spectrum, especially in the point-to-point microwave services, that are available upon (qualified) request. An RF and terrain survey is typically required, and with reasonably certainty that no interference to existing systems will result, obtaining a license is relatively routine. For example, it may well be more cost-effective and reliable to use a licensed point-to-point 6 GHz microwave link to service a high-revenue customer than to deploy an equivalent link with equipment that uses license-exempt spectrum… and the license-exempt spectrum remains available for use in the WISPs network. There are numerous allocations of spectrum that often go unused in particular second and third tier markets that may be available for WISP use upon some reasonable investigation.

Part 15 Compliant, and Purpose Built

Some ISPs consider the cost of the Customer Premise Equipment (CPE) to be the paramount factor in their success as a WISP – they cannot afford to subsidize or finance a $500-$1000 CPE and installation and customers (especially residential) customers balk at such charges (having read of low or no-cost equipment in DSL and cable modem Internet access).

The most common way to achieve very low-cost CPE is to make use of equipment intended for use in Wireless LANs, such as 802.11 and 802.11b equipment. I suggest that this approach be studied very carefully as there are numerous pitfalls. For example, 802.11b uses a 22 MHz "channel" in the 2.4 GHz, and there are only three such channels that don't overlap. 802.11b equipment is becoming ubiquitous in offices, and if your WISP equipment is on the roof of a three story building, and the office on the 4th floor of the building next door begins using an 802.11b Wireless LAN, there's a good chance that interference will occur. There are pitfalls too numerous to discuss in this article; just be sure to do your homework and understand the critical issues about using equipment for purposes not originally intended (no matter *how* many "rave reviews" it's getting on a mailing list).

All equipment certified for Part 15 use is certified as a system. That's a fact little-understood by most WISPs. The FCC's intent is that a Part 15 device be sold as integrated and matched system so as to comply fully with Part 15 rules. But, the language in Part 15 is less than clear in places, and there is mention of "professional installers". The result is that most Wireless ISPs consider themselves, and their personnel, to be "professional installers" and therefore allowed to "mix and match" radios, antennas, coaxial cable, and even amplifiers (which the FCC attempts to discourage).

At its mildest, the "mix and match" can take the form of simply obtaining a particular antenna that is certified by the radio manufacturer from an alternate source, saving the cost of the radio vendor's markup.

At worst, "mix and match" can result in systems that transmit far more power than intended in the rules, thereby "polluting" 2.4 GHz spectrum for other users in the immediate area.

Largely, the blame falls on the FCC for lack of enforcement on Part 15 issues when it comes to the Wireless ISP industry. The FCC has simply chosen not to respond to numerous, well-documented deviations from Part 15 compliance in Wireless ISPs, and articles on illegal modification of consumer Wireless LAN equipment, such as "Pringles can antennas" being mated to 802.11b access point equipment. In the long term, adhering to Part 15 rules is a sensible, conservative approach to building a system that will be reliable, scalable, and maintainable.

Purpose-built Wireless ISP equipment is typically more expensive than Wireless LAN equipment, but far better suited for the unique requirements of Wireless Internet service. For one, it's typically more robust. An example is that three purpose-build WISP systems – Alvarion (formerly BreezeCOM), Cirronet, and WIMAN Systems all use Frequency Hopping Spread Spectrum (FHSS) because it is (arguably) a more robust modulation technique. All three company's products are specifically designed for outdoor use, and include manageability and other features to minimize the need

to revisit an installation except in the case of major failure.

The Dreaded "Truck Roll"

Installation of antenna and radio equipment (Customer Premise Equipment – CPE), and the ability (or perceived lack of ability) to collect direct payment for same is a key factor in the economics of wireless Internet access. Smaller WISPs especially feel that installation can be economized, and "shortcuts" taken. In many cases, this is a false economy.

Mounting the antenna on a roof or pole is an exacting task, requiring that numerous factors be taken into account. For example, the installation must be capable of standing up to the maximum winds expected in the area. Numerous WISPs learn this the hard way after a hard wind alters CPE antenna aiming just enough to lower signal strength to marginal or worse; the resulting customer irritation and site visits to re-aim and "tighten the bolts another notch" are expensive lessons.

Mounting antennas and routing feedline through roofs, especially flat roofs, are best avoided if at all possible. A building owner's claim for water leaks (allegedly) caused by a WISP antenna installation can easily offset many months of profit. Good quality mounting systems, experience (and/or training) in roof or pole mounting, and carrying adequate bonding and insurance are simply costs of doing business of a WISP. Another approach is to simply contract such installations to a qualified, experienced, and (most importantly) bonded contractor, such as a local two-way radio dealer.

Because of the additional cost, some WISPs consider lightning protection to be optional in a CPE installation. Largely, lightning protection is a question of potential liability. A lightning strike that enters via a WISP antenna can easily damage far more than just the wireless equipment. The nature of the CPE is to be coupled into a home or business' local area network (LAN), and so a lightning strike could damage not only network equipment (routers, hubs, etc.) but also any computer connected to the LAN including servers. The major expense in recovering from such damage is not in replacing the hardware, but the loss of productivity until the equipment is replaced, and the potential loss of data. For such reasons, lightning protection should not be considered optional. Note that a number of wireless systems include integral lightning protection, and this should be a factor in the choice of wireless equipment.

Tower Work – Professionals Only

While it's debatable whether rooftop work should be done by WISP personnel, there is very little debate about whether WISP personnel should perform tower work. With very few exceptions, the answer is No. Tower work should be contracted to personnel that specialize in tower work. A minor mistake while performing tower work can *easily* be fatal; the law of gravity from tower heights is absolute – and totally unforgiving of mistakes. During tower work, there are literally *dozens* of factors to keep track of in order to remain safe. In a typical WISP system, tower work will be required infrequently enough that caution and careful procedures won't be exercised often enough to become ingrained to habit.

Scalability – Often Overlooked

Inability to scale up to meet demand for Broadband Wireless Internet Access services is as fundamental a problem as lack of financing, ineffective marketing, etc. In short, WISPs face a delicate balancing act between building in scalability, and not dangerously overspending. Some suggestions on cost-effective scalability:

- The time to negotiate for good base station sites is long before they're required. In your business plan, you should already have a good idea where, geographically, your customers will be, and some minimal surveys of appropriate sites to service those areas. Link ranges – especially when using 5 GHz spectrum, are critical. Begin discussion with the site owner(s) before you need to begin construction on a base station. The more site options you have, the greater your leverage in the negotiations.
- When building or renting facilities, leave extra room for expansion – additional space in the rack, room for additional racks, etc. It's often not necessary to pay extra for "keeping the floor space next to mine open" as long as that's requested up front (with the understanding that you'll be offered the space first as the facility begins to fill).
- Scaling the management of the radios. Networks of less than 100 customers are relatively easy to manage. Networks of 1000 customers are, at times, nightmarish to manage. Selecting equipment that lets you automatically monitor the functioning of your network, although initially more expensive, will likely pay for itself several times over as your network grows and you are able to manage it effectively. No level of detail is too small; how easy is it to determine that the customer's Ethernet cable became unplugged and you can check that remotely and advise the customer to re-insert the Ethernet plug – instead of sending a technician to investigate the problem?

Visit Other WISPS

There's little "secret sauce" in the Broadband Wireless Internet Access industry. Many WISPs are willing to share "secrets", many in person. I suggest identifying a WISP of the same size and general market (if rural, find another rural WISP) as your intended operation in a different part of the country, and make arrangements to visit in person. Because you will not likely be a direct competitor, the "host" WISP is more likely to agree to a meeting. It's reasonable to offer to pay the "host" for their time to show you around – their time, like yours, is valuable.

Don't Ignore Home Office Market

Many WISPs choose not to offer services to residential customers, and that's understandable. However, be careful not to overlook the market for those operating a business out of their homes. Those operating their own business, whether home-based or not, typically understand the value of fast, always-on Internet access and are willing to pay higher rates than "recreational" residential users. Being able to accomplish more online, in less time, is a value proposition especially to small business owners, for whom time is an extremely precious resource. In markets where there is no DSL or cable modem service, the local telco often markets Integrated Services Digital Network (ISDN) access as "fast Internet". ISDN works and is faster than dialup modems, often it doesn't work very well, resulting in a generally frustrating experience for users. Advertising specifically to "frustrated ISDN customers" may result in a number of conversions to WISP service.

Thoughts On Financing

A popular perception is that it's impossible to get financing for ISPs in the current financial climate. That's somewhat true, but certainly not an absolute. It's only possible to be earning interest or appreciating when money is "out there, working".

Local bankers are an often-overlooked resource. Many WISPs (and ISPs) have had bad experiences with local bankers, and often the source of the difficulties is poor preparation on the part of the (W)ISP. In addition to the usual burdens of a small business requesting financing such as demonstrating a sound business model, revenue, and good prospects for payback, WISPs have a special burden – bankers might able to understand an ISP business (they probably use the Internet, and have a modem and understand [generally] how it works), but wireless, to a banker or most others outside the industry, means a cell phone. WISPs need to be prepared to walk a banker or other investor through the basics of Wireless ISP service. There's a special burden on those planning to use license-exempt spectrum – in a word, hearing the word "unlicensed" will generally scare them out of having anything to do with your business. You have to be prepared to educate them that license-exempt does not mean unregulated. It will help greatly if you are able to detail the steps you have taken to gain competency in RF. List, in agonizing detail how much training you've attended, the consultants you've engaged, the site surveys you've had done, etc. Don't try to overwhelm them with detail… but be prepared to educate them to the point to which they wish to learn about all there is to being a WISP. One of the critical pieces of such a documentation package is your plans which equipment you plan to use, and any relevant white papers from the vendor. Alvarion (BreezeCOM, for example, offers an extensive library of white papers on their web page).

Resources

- The isp-wireless mailing list is a popular place to ask for help on all manner of issues relating to being a WISP. Although much help is available, you'll get a much better response to your questions if you don't ask the same tired questions (though they're new questions to you) that have been posted numerous times. If you post a question and there are few or no replies, this is typically a sign that yours is a question that's been asked many times. The isp-wireless mailing list has an archive available (though problematic at times) and browsing through the archives, time consuming though it may be, will yield valuable information. You should be aware that isp-wireless has a very high volume of postings – June of 2001 had more than 5400 messages. I suggest setting up a filter on your mail program and automatically sort isp-wireless postings into their own folder. If feasible, create a separate email account and subscribe to isp-wireless from *that* account. Doing so will allow your main email account to remain uncrowded, and you'll be able to search for items of interest at hard-disk speeds instead of the occasionally agonizing slowness of the isp-wireless archive. www.isp-wireless.com
- The Broadband Wireless Exchange is an excellent way to keep on top of what is happening in the Broadband Wireless industry. Press releases from multiple companies are posted here, and there is an extensive set of links to various other resources such as analyst reports. Broadband Wireless Exchange is has become a primary reference site for all things Broadband Wireless, and it will accept "homegrown" press releases of any significant news relating to Broadband Wireless..

The site also has an extensive, likely the most comprehensive index of Wireless Internet Service Providers in North America. www.bbwexchange.com

- I can wholeheartedly recommend the Wireless Communications Association International (WCA) as a worthy organization to affiliate with. WCA offers two trade shows relating specifically to Broadband Wireless, a very informative and to-the-point weekly newsletter, and most importantly, representation of Broadband Wireless issues in Washington DC with extensive presence both in Congress and the Federal Communications Commission (FCC). Although the WCA is sometimes criticized as primarily licensed spectrum holders and equipment manufacturers, the reality is that the license-exempt spectrum holders and equipment manufacturers have a substantial, and growing influence. Evidence of this is the recent formation of two subgroups- the License Exempt Alliance (LEA) and the Free Space Optics (FSO) Alliance to provide a focus on those industry and spectrum segments. A Wireless ISP's primary resource is spectrum, and decisions on spectrum are made in Congress and the FCC, and it's a prudent investment to be well-connected (through the WCA) with what is happening in Washington DC.

In many areas of the country, DSL and cable modems aren't available, and won't be for the foreseeable future. In such areas, Broadband wireless is likely the only way that broadband services can be made available at a reasonable cost.

Sprint Freezes Fixed Wireless Deployments

On October 17, Sprint announced the termination of its Integrated On-demand Network (ION) project. As part of the same announcement, Sprint announced that it was "… ending customer acquisition…" for its Sprint Broadband Direct (fixed wireless) service. Current customers would continue to receive service and maintenance, but no new customers would be acquired.

The "general interest" press has reported Sprint's actions as "killing" their wireless Internet access business. As you might expect, my take on this development differs considerably.

A Quick Review

Sprint's Broadband Direct fixed wireless Internet access service makes use of licensed Multichannel Multipoint Distribution Service (MMDS) spectrum at 2.5 to 2.7 GHz. Through participation in FCC auction and acquisitions, Sprint acquired licenses for MMDS spectrum in a number of markets. (Worldcom did the same, and Sprint and Worldcom generally divide the MMDS licenses for major US markets between them.) "Co-habiting" 2.5 – 2.7 GHz is Instructional Fixed Television Service (ITFS - *not* a typo). The 2.5 – 2.7 GHz band is divided into 6 MHz channels. The original use of 2.5 – 2.7 GHz was for "private" television broadcasting; originally instructional programming from educational institutions, and later "private wireless cable". The market for the latter largely evaporated with the emergence of Digital Broadcast Satellite (DBS) providers such as Dish Network and DirecTV, which offered a better selection of television programming for lower cost, anywhere on the continent.

Between a Rock And A Hard Place

Generally, Sprint was between the proverbial "rock and a hard place" with its deployment of fixed wireless services. To date, Sprint has only deployed "supercell" (a high, central site) systems in each of its markets. Each customer must have a clear line of sight to the hub, thus an external antenna mounted high on a house or pole was required. Thus, each installation required an installation visit to not only install an antenna, but also to hook the system up to the customer's computers. Installation could take as much as an entire day for a complicated installation, and there were often complications from (what turned out to be) marginal RF paths and computer installation complications (installing a network card in some PCs can sometimes be more art than science).

The "rock" was that as Sprint continued to add customers, the systems became saturated, causing slow speeds and frustrated customers. Sprint could expand capacity by adding additional sectors to existing hubs, adding more hubs, or begin using additional MMDS channels.

The "hard place" was that Sprint was pinning its hopes on next-generation MMDS technology. Sprint had a long list of requirements including:

- Self-installation by users, both for the radio link and attaching it to the user's computer
- Ability to provide higher Quality Of Service (QOS) for users wishing to have faster speeds or better than "best effort" service
- Ability to offer "toll quality" (equivalent to wireline) voice services
- Significantly lower prices of Customer Premise Equipment (CPE)

Altogether there were perhaps six major requirements, and six lesser requirements. Although Sprint representatives have stated that Sprint would buy and

deploy equipment from whatever vendor could best satisfy its stated requirements, to date it has not done so, despite a number of compelling next generation MMDS systems having emerged that appear to satisfy the majority of Sprint's requirements. Some glaring examples:

- NextNet Wireless developed Expedience – a system whose CPE device can sit on a desk and work through walls, allowing new customers to buy the CPE off the shelf at a retailer.
- Raze Technologies developed SkyFire, which delivers both data and toll quality voice services. Raze went to great pains (for example, the CPE has a battery so that voice services, especially 911, to continue to function in the event of a power failure) to make the voice portion "life safety" quality so that it could be the primary "phone line" for a household.

Vendors such as NextNet Wireless, Raze Technologies, and a number of others have offered Sprint the advances in MMDS systems that it claims to need and want. Yet, Sprint has not endorsed *any* of these next generation systems. Some of the reports I've received indicate that Sprint is not currently testing any next-generation MMDS systems.

Waiting For Standards

Sprint may well have tired of waiting for a non-proprietary Broadband Wireless standard to emerge so that it would theoretically be able to buy interoperable systems from multiple vendors. Sprint's corporate (and engineering) culture is in the telecommunications industry, in which widely accepted non-proprietary standards are the rule. It likely frustrates Sprint that most *next generation* Broadband Wireless equipment vendors have embraced the "computing and networking industry standards process" (such as it is) in which a few proprietary standards become dominant, then become de facto industry standards, and eventually formalized non-proprietary standards.

Telecommunications industry standards are driven by consensus and sometimes take as long as a decade to coalesce to the point of being usable. In comparison, the computing and networking industry's proprietary/de facto/formalized standards process has repeatedly demonstrated much more rapid evolution- simply because it's driven by market acceptance.

The Institute of Electrical and Electronics Engineers (IEEE) has developed the highly successful 802.11, 802.11b and 802.11a Wireless Local Area Network (WLAN) standards, and has had a parallel effort underway for Wireless Metropolitan Area Networks (WMAN). In late 2001, 802.16 finally emerged after several years of intense effort. However, 802.16 is a specification for systems operating above 11 GHz. 802.16***a*** is the WMAN standard in work for below 11 GHz. Because of polarization within the 802.16a committee over issues relating to the license-exempt 5 GHz band, it may be several more years before 802.16a is completed.

Financial Issues

Underlying the current state of affairs with Sprint Broadband Direct is Sprint's financial problems as a result of the telecomm downturn. Simply, Sprint may not be able to muster the capital required to go forward with additional deployments using next generation MMDS technology.

MMDS Mobile Use Now Permitted

Another significant factor in Sprint's stance on its MMDS spectrum holdings is aftermath of the FCC's decision that although 2.5 – 2.7 GHz spectrum would *not* be converted to "3G" spectrum for the mobile telephony industry, the FCC (at Sprint and Worldcom's request) amended the "permitted usage" of 2.5 – 2.7 GHz spectrum to allow "mobile" uses in addition to the current "fixed" uses. With that one change in permitted usage, Sprint (and Worldcom) may be in possession of spectrum worth (extrapolating from the NextWave auction/re-auction debacle) tens of billions of dollars.

But not right away…

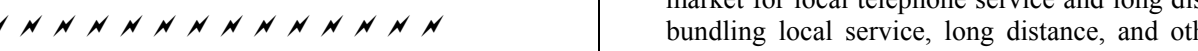
- 2.5 – 2.7 GHz is heavily encumbered, with many of the (6 MHz) channels currently in use by ITFS users- typically educational video links, especially in metropolitan areas. Such existing usage will be highly protected, or will have to be relocated / equivalent services provided.
- 2.5 – 2.7 is not used for mobile services anywhere else, and equipment for mobile use would have to be developed and purpose-built (not insurmountable; it took a few years, but equipment eventually became available for the Wireless Communications Service (WCS) band at 2.3 GHz which is unique to the US).

Not pursuing Business customers

It is somewhat curious that Sprint did not initially focus on, or even redirect their Broadband Wireless activities on providing small businesses with Internet access via wireless. One reason may be that Sprint may not have done so is that it is a major player in the T-1 market; T-1's are tarriffed services, and highly lucrative. Making use of broadband wireless to provide Internet services to small businesses may well have caused an internal turf war in Sprint; one in which the existing, high-margin service business apparently won. But Sprint may have to learn the lesson that many high tech companies learn the hard way – obsolete your own

products… before the competition does it and puts your company out of business.

But at least for the moment, Sprint remains in the Broadband Wireless Internet Access business.



RIP, Project Angel
ATTWS Exits Fixed Wireless

I began my professional writing career (defined as being paid for my writing for the first time) in April, 1997. The venue was Boardwatch Magazine and the start of my five year column, Wireless Data Developments. That first column was titled *Technologies to Provide Wireless Internet Access* and largely discussed AT&T's recently announced "Project Angel" Fixed Broadband Wireless system.

On November 23, 2001, in a news release discussing third-quarter revenues, AT&T Wireless Services (ATTWS) announced that it would terminate its AT&T Digital Broadband fixed wireless service within six months, and cease all development work. AT&T Wireless Services will attempt to transition its Digital Broadband customers to other broadband providers and find a buyer for the intellectual property of the system.

Some History

In order to understand this development in its proper context, it's necessary to briefly review the history of "Project Angel" (PA). PA began as a small research project of what was then McCaw Cellular. The goal of PA was to make some use of "nighttime" cellular system capacity by offering household customers a cheaper alternative to landline telephone service. Originally PA was envisioned as a voice-only system.

AT&T did not know of PA until after the purchase was complete – McCaw Cellular considered PA such a "secret weapon" that, if the purchase by AT&T fell through, did not want AT&T to know of PA.

When AT&T did finally learn of PA, management largely dismissed it, but before killing the project, decided to submit it to a perfunctory audit by Bell Labs personnel. To management's great surprise, the Bell Labs personnel agreed that the PA's technology was innovative and, given sufficient development resources, could evolve into a full-fledged wireline replacement system for both high(er) speed Internet access and primary-line telephone service.

PA was given the funding it needed to develop the system. PA was designed to use relatively narrow blocks of spectrum, primarily the less-desirable (for mobile use) narrow (10 MHz) blocks of spectrum, and later Wireless Communications Service (WCS) spectrum at 2.3 GHz. Only after ATTWS bid for, and got the spectrum it needed to deploy PA did it reveal PA's existence.

AT&T's corporate strategy, driven by its new CEO Michael Armstrong, was to "retake" the consumer market for local telephone service and long distance by bundling local service, long distance, and other high-margin services. It was having little success in leasing copper lines from Incumbent Local Exchange Carriers (ILECs). Because of their monopoly position in the marketplace, ILECs were able to price their wholesale rates for copper lines far above rates AT&T needed to pay in order to generate profits from customers.

AT&T's "one / two punch" for the "retake" strategy was to use cable television lines (from purchases of Telecommunications, Inc. – TCI and other cable television companies) and Project Angel to bypass the need for leasing ILEC's copper lines. In markets where AT&T Broadband (the new name for the cable television properties) had systems, AT&T would offer voice services over cable. In markets where AT&T Broadband wasn't present, Project Angel would be deployed. Both systems would "drive minutes" to AT&T Long Distance services, which was AT&T's most profitable (by far) service offering.

AT&T's strategy was a huge gamble on a number of fronts. The purchase of TCI was an enormous cost, with AT&T taking on a huge debt. To accommodate voice services and Internet access, almost all of the TCI cable systems had to be largely rebuilt.

AT&T began running into very significant challenges, any one of which could probably have been overcome, but when combined, doomed Armstrong's strategy. Revenues from long distance didn't decline slowly as projected, but declined precipitously, depriving AT&T of much-needed revenue to maintain its famous stock dividends and fund its debt payments and capital requirements. Revenue from cable television subscribers began to decline as digital satellite systems began offering better pricing and more selections than AT&T Broadband aging cable systems.

AT&T, under intense pressure from shareholders to grow revenues (such growth had been largely absent during the short-lived, but intense telecom boom from 1996-2000), reluctantly concluded that the only way to offer shareholders a reasonable return was to divide the company yet again into four units – Wireless, Broadband (cable), Business (which would retain the AT&T corporate name), and consumer (long distance, dialup Internet access). The breakup plan effectively announced that AT&T's "retake the consumer" strategy was well and truly dead since the units, once independent, could begin competing with each other as well as other competitors in their respective markets.

Under ATTWS

Once independent, AT&T Wireless Services wasted little time in setting challenging milestones for Project Angel. From all accounts, the position of PA within the newly-independent ATTWS could best be described as a barely-tolerated "stepchild". PA was seen as by ATTWS as competing for resources with ATTWS' primary line of business – mobile telephony and eventually mobile data / Internet access. The most severe competition was for capital, as ATTWS has a daunting challenge ahead of it migrates its existing systems to "next generations" of mobile wireless technology, including wireless Internet access. (Whether ATTWS will migrate its mobile wireless network to the widely accepted definitions of "3G" technology is yet to be determined given the growing influence of part owner NTT DoCoMo and its i-mode technology).

PA had previously deployed two generations of customer premise equipment (CPE), and had begun deployment of a 3rd generation CPE. There were significant problems with the first and second generation equipment that generated many user complaints and was beginning to tarnish PA's reputation in some of its markets (it didn't help that PA personnel apparently weren't very candid to customers about the well-known problems). It appeared that the 3rd generation CPE was performing well and resulting in markedly fewer complaints.

It appears that ATTWS decided to discontinue PA primarily because of the costs for expanded deployment that would be necessary to achieve sufficient scale to become revenue positive… with a host of contributing factors.

Contributing Factors

A major contributing factor in the demise of PA was that Project Angel was AT&T's *only* development project – unique in all of AT&T (post-spinout of Lucent Technologies) and especially unique within ATTWS. ATTWS management was used to managing system and network integration, the technical details and majority of the skilled labor of which was subcontracted to vendors.

After ATTWS' independence, PA was something of a product in search of a mission. The vast majority of management at AT&T Wireless Services saw the mission of ATTWS to sell *mobile* wireless voice services and Internet access, and to them, PA was an aberration.

There were other factors as well:

- Problems with installations; one humorous installation story was that a PA customer complained that their system had worked fine when installed, but several months later had ceased to function. A supervisor was puzzled when line of sight between the customer and the base station was blocked by a new house. The initial installer had aimed the antenna *through* the frame of the house under construction. When the siding, and finishing was added, the signal was blocked almost completely.
- Overselling PA services; despite caution from engineering personnel urging slow rollouts, PA advertising promised the same quality and reliability as wireline, and traded heavily on AT&T's reputation
- Significant interference issues; Although ATTWS had originally obtained 1.9 GHz Personal Communications Service (PCS) spectrum for PA, ATTWS mobile services eventually grew to require that spectrum. PA was then directed to use 2.3 GHz Wireless Communications Services (WCS) spectrum, which now suffers from interference from adjacent services such as terrestrial repeaters for the new Digital Audio Broadcasting (DAB) satellite radio service
- Interfacing with the ILECS; dealing with the various Incumbent Local Exchange Carriers (ILECs) was an ongoing problem, especially over the issue of local number portability (LNP). The idea is that customers (especially businesses) should not be required to change telephone numbers when moving within an area or changing telephone companies. From accounts, ATTWS spent an inordinate amount of time and legal effort to get the ILECs to transfer customer's phone numbers from ILEC (wireline) service to PA service in a reasonable time. (Ironically, ATTWS straddled this issue; lawyers representing PA argued *for* LNP in court… and ATTWS lawyers representing the mobile business argued *against* LNP, that it was too difficult and expensive to implement). To the ILECs, this was normal procedure – stall anything that smacked of serious competition until forced to comply. This was especially evident in the Texas markets; ATTWS as a Competitive Local Exchange Carrier (CLEC) could offer bundled long-distance. Many Texas customers converted to PA simply because ATTWS offered free in-state long distance.

Aftermath

AT&T Wireless Services' decision to kill Project Angel program has had a chilling effect on the Broadband Wireless Industry. It is widely cited in industry articles, in conjunction with the failures of

Winstar, Teligent, ART, Metricom, and Sprint's freezing of its Broadband Wireless activities.

In the aftermath of the termination decision, it's became clear that AT&T Wireless Services never fully embraced PA. In fact, PA may well have become perceived as a threat to some of the most potentially lucrative aspects of future ATTWS offerings such as "advanced" wireless Internet services such as NTT DoCoMo's (an investor in ATTWS) i-mode services that are wildly popular in Japan.

Project Angel's technology clearly worked. Though early PA systems indisputably had glitches and resulted in poor service, by third generation being deployed at the time of the shutdown decision, the technical glitches had been almost completely overcome, and the development thrust at the time of the shutdown decision was to aggressively continue cost-reductions.

Consumer acceptance was clearly there, especially in the areas where there was a distinct lack of broadband services; fast-growing areas where wired telecommunications infrastructure had not kept pace with demand, and areas where the Incumbent Local Exchange Carrier (ILEC) could not justify deployment wire-based broadband services.

Sources have indicated that ATTWS has offered the PA technology for sale, and that there is at least one bidder seriously considering purchase of the PA technology, so it may be yet be the case that "reports of Project Angel's death are greatly exaggerated".

Adaptive Broadband Resurfaces As Axxcelera

On July 26, 2001 Adaptive Broadband declared Chapter 11 bankruptcy, not long after a proposed merger with competitor Western Multiplex was scrapped. Like so many other companies, Adaptive Broadband's market largely evaporated in the brutal telecomm downturn in 2000 and 2001.

By many accounts, Adaptive Broadband's products worked reasonably well and a number of customers have deployed A-B products. A-B's AB-Access was a point-multipoint (PMP) Wireless Internet Access system that offered speeds of up to 25 Mbps. A-B was one of the first systems to make effective use of the 5 GHz license-exempt band for "outdoor" PMP systems. (One of the strengths of the proposed AB/WM merger was that the company's respective product lines were highly complementary; WM had a popular Point to Point (P-P) product line, and AB had AB-Access). But a number of anticipated (and announced, with great fanfare) large orders never materialized for AB as the telecomm downturn deepened, and with Western Multiplex merger abandoned, A-B had little choice but Chapter 11.

On November 2, 2001, Adaptive Broadband re-emerged as Axxcelera Broadband Wireless, a unit of Moseley (www.moseleyb.com). Moseley is a manufacturer of specialized wireless communications systems, mostly targeted at the broadcasting industry.

With sufficient capital behind it, Axxcelera should be able to restart sales of AB-Access, and perhaps reduce the price (high, which limited its popularity) taking advantage of rapidly-declining prices for 5 GHz components as 5 GHz systems, especially 802.11a, become more popular.

A Modest Proposal – My Last Boardwatch Column

[The following column was submitted as my final Wireless Data Developments column in Boardwatch Magazine, and was slated to appear in November, 2001. Boardwatch, like all other Internet and telecomm industry magazines has suffered a severe erosion in the number of advertising pages, and eliminating columns was part of an editorial change of direction. This column finally appeared (severely abbreviated) in the Technology section of the January, 2002 issue of Boardwatch, on page 23. It was retitled "Wireless Smart Radio, Heavy Lobbying Would Bring Wireless ISP Band". Boardwatch Magazine is online as part of ISP World – www.ispworld.com. Since the column was written, I've discussed the idea of a WISP Smart Radio with personnel from several radio manufacturers, and they agree that, in principle, such a radio could realistically be built with reasonable performance and price. A more thorough treatment (the column was limited to 750 words) of the WISP Smart Radio idea is scheduled for the February, 2002 issue of ***Focus***.]

A Modest Proposal For The Wireless ISP Industry – A "WISP Smart Radio"

Abstract / Summary:

Many Wireless ISPs are facing increasing challenges in their use of the 2.4 GHz band. Some WISPs have speculated about the creation of a "WISP Band". In this column, Steve outlines how a "WISP band" could actually happen.

In my self-defined career as an Independent Technology Writer specializing in Broadband Wireless Internet Access, I monitor a lot of different sources of information, including a number of mailing lists. A topic that surfaces regularly on wireless internet access

lists is that the operating in the 2.4 GHz band can be a difficult challenge for many ISPs because of interference issues. An oft-mentioned "cure" for such problems is "reserved spectrum" for Wireless ISP use.

The idea of a "WISP band" has merit, and is actually achievable, especially in the context of local, entrepreneurial ISPs providing a cost effective, quick-to-deploy solution to the "Digital Divide" issue in non-metropolitan areas. The basic idea is to share, *strictly on a non-interference basis*, unused television broadcasting channels 14-59. Each television broadcasting channel is 6 MHz wide. Channel 14 is 470-476 MHz. Channel 59 is 740-746 MHz. 470 – 746 MHz is 276 MHz of contiguous spectrum reserved for television broadcasting. (Channels 2-13 and Channels 60-69 are already slated for reallocation.) In contrast, the 2.4 GHz band is "only" 83.5 MHz.

Such a sharing scheme would only be possible with the emergence of a new type of radio - a Smart Radio. A "WISP" Smart Radio (WSR), is programmed to (powerup and at regular intervals) "survey" the 470-746 MHz spectrum. On any television channel where transmissions are heard, that channel is automatically "locked out" from being used by the radio. In that way, interference from a WSR to nearby television broadcasting is all but impossible- without the necessity of costly and time-consuming manual "coordination". A Smart Radio can make such a "decision" (whether or not there is a potential interference problem on a channel) *in milliseconds*, versus humans making the same decision in weeks… months, or (all too painfully often) years.

One of the prime reasons for trying to make use of 470-746 MHz is that it has good "penetration" characteristics (trees don't stop signals at this frequency). Reasonable transmission power levels at 470 – 746 MHz are possible, with reasonable safety. A maximum power limit of 10 watts (perhaps with automatic power control) should be very, *very* ample.

The technology to build a WSR certainly exists. Frequency Hopping Spread Spectrum (FHSS) modulation seems most applicable to WSR, as it can simply "hop over" television broadcast channels that are in use. I further propose that WSR be designed as a consortium, mostly for non-technical (any one manufacturer will be less of a "target" (see below), and standardization between manufacturers would insure interoperability and drive down costs.

There is a very real expectation that any new use of spectrum must generate some "income" for the government. (If no revenue is generated, the "positioning" for WSR is weakened considerably.) A revenue generation approach that seems applicable to WSR is for a one-time "spectrum tax" (perhaps, say, $30) be applied to the final purchase price of each WSR. The more "use" is made of spectrum (the more units are sold), the more government revenue is generated. The expense is directly proportional to "use", and the expense is incurred only after the additional business is generated.

The main obstacle in developing WSR… and it's a huge one, is not technical. Television broadcasters and their industry organization, the National Association of Broadcasters (NAB) are one of the most powerful forces in Washington DC. Any non-broadcasting use of television broadcasting spectrum will be fiercely and effectively resisted.

Wireless ISPs could overcome this obstacle, huge though it is, only with *effective* representation in Washington DC and at the FCC. To accomplish the WISP Smart Radio (WSR) will require time, sustained effort, financial support, and experienced lawyers. The Wireless Communications Association International (WCA) fulfils many of those requirements, and is an established, effective presence in Washington DC representing wireless Broadband service providers and equipment manufacturers. The WCA certainly doesn't currently have budget to tackle a project as ambitious as WSR, nor the mandate. But if there was a groundswell of Wireless ISPs joining WCA (and committing additional funds for the WSR project), then WSR *could* happen. But make no mistake… a "grass roots" (low budget) approach could not realistically accomplish WSR- the forces arrayed against WSR will be *very* formidable.

One last suggestion: Manufacturers… could you build in the capability for WSR to work at 420-450 MHz with some reasonable substitution of components… with instructions on such a modification available *only* upon presentation of a valid Amateur Radio license? I, and my fellow 682,218 US Amateur Radio operators would *greatly* appreciate it!

(Apologies, but once again, space doesn't permit a Wireless ISP of the Month profile this month.)

Cisco Quietly Exits The Broadband Wireless Market

On November 13, 2001, Cisco "stealth" announced that it was exiting the Fixed Broadband Wireless market by posting an End of Sale / End of Life Announcement (www.cisco.com/warp/public/cc/pd/witc/wt2700/1579_pp.htm) for the WT-2700 product line on its web site. Current customers of the WT-2700 product line have until February 12, 2002 to purchase

additional equipment from Cisco, at which point it will be discontinued. All engineering support for the WT-2700 product line will be terminated on November 12, 2006.

Cisco's withdrawal from the market had been indicated months prior when news leaked out that the vast majority of the Broadband Wireless team had been reassigned within Cisco. At the time, Cisco sources insisted that the staffing for the unit was indeed being cut back severely, but that the unit was not being shut down. Confirmation of sorts of this status came at the Wireless Communications Association International (WCA) show in June, 2001 when a large booth for Cisco was shown on some show material, but at show time Cisco's space was occupied by other vendors.

A query to the Broadband Wireless Internet Forum (BWIF), a trade group of suppliers formed around Cisco's Vector Orthogonal Frequency Division Multiplexing (VOFDM) technology embodied in the WT-2700, resulted in a noncommittal response that Cisco "plans to remain a member of BWIF" and that BWIF members will continue to offer VOFDM products even without Cisco's presence in the market. BWIF's web page appears frozen in mid-October, 2001, with no mention is made of Cisco's withdrawal.

In reality, Cisco's withdrawal effectively terminates the market for BWIF/VOFDM products. Cisco's VOFDM product was a radio (technically, the output was Intermediate Frequency – IF) card for its Universal Broadband Router (UBR) product line. No other vendor offers such a card; no other vendor *could* offer such a card. For the card to work requires special code in Cisco's Internet Operating System (IOS), generally regarded as the "crown jewels" of Cisco. Cisco is loath to allow other companies such intimate access to IOS.

Sources claim that Cisco's withdrawal of the WT-2700 product line is a direct result of the lack of spending by Sprint and Worldcom on next generation systems for Broadband Wireless Internet Access. Cisco entered the market (with the acquisition of Clarity Wireless) specifically with the expectation of significant business from both Sprint and Worldcom, and after that business did not appear after several years, Cisco's withdrawal was foregone.

The main cause for Cisco's exit, in my opinion, was a severe case of hubris. In an early interview unveiling the WT-2700 product line, Cisco personnel exhibited an astounding ignorance of the basics of RF technology. Cisco appeared to believe that significant numbers of customers were simply waiting for Cisco to "legitimize" the Broadband Wireless market. It was telling that Cisco did not build a "radio" and instead built a "router blade" for its highest-end router family. A statement from one of the Cisco reps present at the interview remains burned into my mind: "To Cisco, wireless is just another piece of wire, to be connected to the UBR and managed by IOS".

Note – Cisco's termination of its VOFDM does not appear to have any bearing on its Wireless Local Area Networks (WLAN) business – formerly Aironet, which remains a thriving business.

Letters

Because ***Focus*** *on Broadband Wireless Internet Access*, is a relatively new publication, we don't have any letters yet specifically directed at the contents of ***Focus***.

I'd like to explain what my policy, and hopes, are for letters. A number of other newsletters that I admire have made the reader's letters, and the editor's responses, a significant part of the content of those newsletters. This serves several purposes: 1) It makes the newsletter more interesting to read, 2) It provides something of a reality check on what's written in the newsletter, 3) the readers likely know of things that the editor doesn't.

So, Letters and Editor's replies will be an integral part of Focus. Initially, while readership is relatively low, this will be a pretty intimate exchange of ideas and points of view. As ***Focus*** grows, it may not be possible to include all letters that are submitted… but we'll do our best.

Here are the initial guidelines for Letters to ***Focus*** *on Broadband Wireless Internet Access*:

- All editorial commentary letters (including email) to ***Focus*** *on Broadband Wireless Internet Access* will be considered to be submitted for inclusion in the Letters section of ***Focus*** *unless otherwise stated*.
- Letters may be edited for space and relevance (and such edits will be noted)
- If you do not wish for your letter to be included in the Letters section of ***Focus*** *on Broadband Wireless Internet Access*, please state that in the letter.
- If you prefer to remain anonymous, but have your letter included in the Letters section of ***Focus*** *on Broadband Wireless Internet Access*, please state that in the letter and the request will be honored.
- All letters must include contact information; no anonymous communications will be published.

So, Please write! I very much look forward to exchanging ideas with ***Focus*** readers!

Focus On Broadband Wireless Internet Access
Companies To Watch

"Companies To Watch" highlights companies that I consider to be particularly innovative and therefore worthy of watching. A number of companies will be added each month, and the list will be cumulative – and dynamic. Company names in *italics* denote being added in this issue.

In future issues, each addition to Companies To Watch will be preceded by an in-depth article explaining their addition to the list. This first group of companies will be profiled together in a future article in ***Focus***.

Equipment Suppliers:

- Alvarion – www.alvarion.com
  Largest supplier of equipment to Wireless Internet Service Provider (WISP) market, formed by the merger of BreezeCOM and Floware Wireless Systems.
- Aperto Networks – www.apertonet.com
  Aperto began their design with a clean sheet of paper and effectively integrated a number of disparate wireless technologies to develop PacketWave. PacketWave is notable as one of the first to offer Non Line Of Sight (NLOS) and effective Quality Of Service (QOS) resulting in a highly effective system.
- *Cirronet* – www.cirronet.com
  One of only a few purpose-built Wireless ISP systems intended for consumers; low price point and truly self-installable.*
- Time Domain – www.timedomain.com
  Primary proponent of Ultra Wideband RF technology.
- *fSona Communications* – www.fsona.com
  fSona is one of the leading vendors of Free Space Optics equipment. fSona's SONAbeam products are making significant inroads into the high-bandwidth, short-haul wireless links market previously reserved for high-bandwidth RF technologies.

Service Providers:

- *Aerie Networks* – www.aerienetworks.com
  Bought Metricom Ricochet technology out of bankruptcy; attempting to re-establish, and eventually grow Ricochet service at lower price points.*
- hereUare Communications www.hereuare.com
  hereUare provides "back end" billing services for independent operators of Public Wireless Access Points (PWAPs); a notable partner is Boingo Wireless.
- *BroadLink Communications* www.broadlink.com
  BroadLink has adapted 802.11b technology to provide Small Office / Home Office (SOHO) wireless Internet access. BroadLink recently entered into a market trial with Earthlink in Atlanta.
- *Tachyon, Inc.* – www.tachyon.net
  Tachyon began by asking a fundamental question about current-generation geosynchronous satellite transponders: how much could be accomplished if a number of disparate technologies were "thrown at the problem"? Tachyon succeeded in developing a system that allows far more users and far higher speeds per transponder than were previously thought possible.

Events Of Interest To The Broadband Wireless Internet Industry

Please let me know of events that will be of interest to those in the Broadband Wireless Internet Access industry, and they will be featured as space permits. If I plan to attend a particular Event, it is noted.

- November 27-28, 2001 (rescheduled), Santa Clara, CA – 802.11 Planet Conference and Expo, Fall 2001.
  seminars.internet.com/80211/la01/index.html
  (I plan to attend this event.)
- November 28, 2001, Portland, OR – Alvarion Wireless ISP Seminar
  www.alvarion.com/CorpInf_30210.asp?tNodeParam=1
  (I plan to attend this event.)
- December 4-5, 2001, Dallas, TX – Private and Wireless Broadband Show
  www.privatebroadband.com
- December 12-14, 2001, Sarasota, FL – Wireless Training Class, Wave Wireless Networking
  www.wavewireless.com/whatsnew/
- January 14-16, 2002, San Jose, CA – WCA Technical Symposium
  www.wcai.com/events.htm
  (I plan to attend this event.)
- January 21-25, 2002, Levi, Finland – IEEE 802.16 Working Group Session 17
  grouper.ieee.org/groups/802/16/meetings/mtg17/index.html

- January 29-31, 2002, Santa Clara, CA – Wireless LAN Workshop
  www.wireless-nets.com/ws_overview.htm
- February 12-14, 2002, Anaheim, CA – Broadband Wireless World Forum
  www.scievents.com/bwwf02/default.asp
  (I plan to attend this event.)
- February 18-21, 2002, Tempe, Arizona – National ITFS Association (NIA) 2002 Conference
  www.itfs.org
- March 11-15, 2002, St. Louis, MO – IEEE 802.16 Working Group Session 18
  grouper.ieee.org/groups/802/16/calendar.html
- March 13-15, 2002, Chicago, IL – 2002 Chicago WISP Conference
  www.primedirective.com/seminar/main.htm
- March 18-20, 2002, Orlando, FL – Wireless 2002 (CTIA)
  www.wow-com.com/events
- March 22, 2002, West Hills (Los Angeles), CA - Deploying License-Free Wireless Internet Access in the Real World
  www.ask-wi.com/2002workshops.html
- May, 2002, Date and Place To Be Determined – IEEE 802.16 Working Group Session 19
  grouper.ieee.org/groups/802/16/calendar.html
- June 2-6, 2002, Atlanta, GA – SUPERCOMM
  www.supercomm2002.com
- June 10-12, 2002, Philadelphia, PA – 802.11 Planet Convention and Expo
  seminars.internet.com/80211/spring02/index.html
- June 24-27, 2002, Boston, MA – Wireless Communications Association International (WCA) Annual Conference
  www.wcai.com/events.htm
- July 8-12, 2002, Vancouver, BC – IEEE 802.16 Working Group Session 20
  grouper.ieee.org/groups/802/16/calendar.html
- September, 2002, Date and Place To Be Determined – 802.16 Working Group Session 21
  grouper.ieee.org/groups/802/16/calendar.html
- October 16-18, 2002, Orlando, FL – CTIA Wireless I.T. and Internet 2002
  www.wow-com.com/events

With Thanks To…

As an *Independent* Technology Writer, I don't have access to the resources of large news and publishing organizations. What I do have are a number of people I've found over the years that offer high quality information that is highly relevant to the content of ***Focus***, at no cost. Such "free" content providers don't get thanked nearly often enough, and, as part of ***Focus***, I'd like to acknowledge their efforts.

- David Farber – Interesting-People List
  www.interesting-people.org
- Glenn Fleischman – 802.11b Networking News
  80211b.weblogger.com
- Jim Geier – Wireless Nets Newsletter
  www.wireless-nets.com
- Jeff Harrow – Harrow Technology Report (formerly Rapidly Changing Face Of Technology newsletter)
  www.theharrowgroup.com
- David Isenberg – The SMART List
  www.isen.com
- Dewayne Hendricks – Dewayne-Net Technology List
  www.warpspeed.com
- Robert Hoskins – Broadband Wireless Exchange Magazine
  www.bbwexchange.com
- Ed Mitchell – Ham Radio Online: Common Sense Views On Technology
  www.hamradio-online.com

Other paid membership / advertising-supported resources include: Broadband Wireless Business Magazine, Cellular Telephony and Internet Association's (CTIA) Daily News, Slashdot, San Jose Mercury News' Good Morning Silicon Valley, Strategic News Service, Wall Street Journal Interactive, Wireless Communications Association International… and, of course, the many companies and organizations that contact me directly with relevant news.

Focus

On Broadband Wireless Internet Access

Steve Stroh, Editor

www.strohpub.com/focus.htm

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