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Clearwire – New Craig McCaw Venture Poised To Ignite BWIA Industry In 2004

I've predicted that 2004 would be a watershed year for the Broadband Wireless Internet Access(BWIA) industry. In 2004 there is a unique confluence of demand, technology, opportunity, regulatory cooperation on spectrum issues, and market uncertainty in the face of an impending technical standard (WiMAX) that many predict will totally commoditize BWIA. In uncertainty, there is opportunity, and no one understands that lesson so well as "billionaire wireless entrepreneur" Craig McCaw.

There are a number of disparate pieces to this story that only form a complete picture if you know where to look. In the preparation of this story over the last six weeks, I've seen no evidence that anyone else has developed a complete picture of what McCaw is planning. So, in typical *FOCUS* fashion, I'll stitch together a number of disparate pieces of the story of McCaw's new venture, which is called

Craig McCaw (In McCaw Cellular days)

FOCUS On Broadband Wireless Internet Access

Clearwire, and offer what I consider to be a very compelling story. Clearwire… led by McCaw… is the *I'll know it when I see it* development that I believe will launch Broadband Wireless Internet Access from a perennial "niche" method of providing Broadband Internet Access to "mainstream" and quite possibly, dominant method of deploying Broadband Internet Access… If… and it's a *major* if… McCaw acts quickly enough, it's likely that he'll be able to rout rival companies and Broadband Internet Access technologies who had planned on a far more leisurely adoption/upgrade cycle to Broadband competition than what McCaw has in mind for Clearwire.

It Begins The genesis of this story was an email message from a person who prefers not to be named for publication. Their initial message was "*Do you know anything about a rumor I am hearing about a McCaw backed company launching a 4G network in Florida (and 30 more cities soon to follow)?*" Over the next few days we exchanged emails and insights, and once I was alerted to this story, a more comprehensive picture of what McCaw may be attempting with Flux U.S. began to emerge. I'm indebted to my correspondent for alerting me to this development.

When you need to hide something in plain sight… how do you do it? Stage magicians perform their "magic" in full view of an audience by providing a distraction. In the US business press, you can't get a much better distraction than the week before the Christmas holiday, when most businesses begin to wind down in preparation for relaxed holiday operations, and the hot business news is how retailers are faring in the critical Christmas sales season. So, purely in hindsight, it seems natural that the earliest hint of news of Craig McCaw's newest venture - to provide Broadband Wireless Internet Access services would begin to emerge in the week before Christmas 2003.

Since before that article, and continuing to the present (likely the primary reason for "stealth mode") McCaw has been quietly assembling all the needed assets to create a compelling new class of services that combine the hottest elements of Internet and Telecommunications:

- Wireless; completely bypasses the increasingly antiquated infrastructure and anti-competitive practices of the incumbent telephone companies
- Broadband; making use of new generations of wireless equipment to offer Internet access at speeds in excess of DSL and cellular telephone "3G" next generation data/Internet services
- Mobility; the technology of Broadband Wireless systems to offer full mobility has quietly emerged; the label "Fixed Wireless" doesn't necessarily apply any longer
- Voice Over Internet Protocol (VOIP) telephony; the ability to offer telephony services for a fraction of the cost of conventional telephony by using VOIP technology, over wireless

Finding The Sweet Spot of Telecom The "Sweet Spot" of Telecom is an inability to service the majority of potential customers with new-generation, more cost-effective telecom services such as those emerging in countries such as Korea… and Mexico.

The Sweet Spot of Telecom is bordered by wireline telephony, wireless telephony, and current Broadband Wireless Internet Access service providers. Their respective inabilities to satisfy the demand for lower cost, higher-performance, telecommunications services and scale such services offers a huge opportunity. In other countries, notably Korea, the Sweet Spot of Telecom has been filled by inexpensive, high-performance DSL. In Mexico, it has been filled by reasonably-priced, medium-performance Broadband Wireless Internet Access. In Sweden, it has been filled with municipally-funded FTTP deployments.

In the US, wireline telephony companies haven't, and by all reliable estimates *cannot* (financially) and will not (no effective

competitive threat, little regulatory pressure) deploy fiber-to-the-premises (FTTP) or indeed "FAC" (Fiber *Anywhere* Close). There will be small demonstration projects, and the occasional new development, and some municipal government FTTP deployment, but in the main, FTTP won't happen in the near term, and perhaps not the long term. Note… FTTP is no longer a question of technology, but rather it is a question of willingness to deploy in the near term. Absent such willingness to deploy FTTH in the near term, a void is created.

Wireless "telephony" companies are unable to offer effective competition for the lack of FTTP deployments; their networks, systems, and standards are optimized entirely for voice, with grudging accommodation of moderately higher (than dialup) Internet access speeds. They prize standardization of systems above all and are loathe to make use of new generations of wireless equipment to be able to offer broadband speeds. To them, voice is the "killer app", the one service that they know how to make money on.

Broadband Wireless Internet Access service providers who are successfully exploiting Broadband Wireless technology are small and the best of them are funded and organized only for regional expansion; none to date has a credible plan to "go national" or has established anything like a dominant brand or identity in the minds of prospective customers. (To some extent, the "stay regional" focus may well be a protective measure, given the high-profile failures of national Broadband Wireless rollouts to date such as Metricom, Sprint Broadband Wireless, Advanced Radio Telecom, Teligent, Winstar, AT&T 's Project Angel… the list goes on.)

So the "Sweet Spot of Telecom" is exploiting the deficiencies of wireline, using better wireless technology than the wireless telephony companies are prepared to use… and with better management and financial resources "get big, go national" quickly and establish economies of scale.

I believe that McCaw has correctly identified the Sweet Spot of Telecom and is prepared to exploit it with his new venture, now named Clearwire, and will use Broadband Wireless Internet Access do so.

Assembling The Pieces McCaw's brilliance in forming Clearwire is not so much in identifying the opportunity, or deciding that "Broadband Wireless is the way to go", but rather in quietly assembling the pieces and the strategy to effectively and *rapidly* exploit the opportunity. Here is a summary of the "pieces" of Clearwire that have been assembled, and then each piece will be examined in depth.

- **Spectrum** Several years ago, McCaw created Fixed Wireless Ventures to opportunistically acquire spectrum that became available; at the time it was felt that McCaw had no specific use in mind for the acquired spectrum. Last year McCaw formed Flux U.S. to buy individual MMDS/ITFS licenses in the 2.5 – 2.69 GHz band wherever possible. This year McCaw bought Clearwire, an existing BWIA service provider which has developed an exclusive arrangement with "The ITFS Alliance", a consortium of ITFS licensees. *Note: From this point forward in the article, for the purpose of brevity I'll use the term "MMDS" to refer to the entire (USA) 2.50 - 2.69 GHz band, inclusive of the Instructional Fixed Television System (ITFS) and Multichannel Multipoint Distribution Service (MMDS) allocations in each market, which are interleaved throughout the 2.50 - 2.69 GHz band. – Ed.*

- **Equipment** McCaw bought a minority stake in NextNet Wireless whose Expedience system is designed for MMDS and "Non-Line-Of-Sight" (NLOS), customer-installable Customer Premise Equipment (CPE). McCaw has now acquired NextNet in its entirety.

- **Talent** Many of McCaw's most trusted and experienced lieutenants from previous ventures have come onboard Clearwire.
- **Financing** One cannot imagine, with McCaw's impressive history of "creative" financing beginning with McCaw Cellular, that arranging financing for a credible Broadband Wireless Internet Access service provider would be an issue.
- **Branding** In Clearwire, McCaw found a sustainable brand that "implies" wireless, but doesn't lapse into "techie-speak". A uniform brand for deploying service nationwide will be critical. Branding is especially critical for effective retailing, both in trying to sell the service, and in such things as getting retailers to carry the CPE devices for local sale.
- **Target Markets** The major markets of the US are hotly contested for telecom services. McCaw has apparently chosen to focus on "Tier II" or smaller market cities, where competition from established telecommunications players has is less intense – Daytona, Florida as opposed to Miami, Florida.
- **Base Stations, Backhaul, and Internet Bandwidth** Having founded XO Communications and although he failed to retain control of it post-bankruptcy, XO's capabilities and Clearwire's requirements fit together very well. For example, XO has extensive fiber deployments (especially after its recent acquisition of Allegiance Telecom) and vastly underutilized 28 GHz spectrum licenses that would be ideal for providing backhaul connectivity to Clearwire's network of base stations. XO is a Tier I Internet backbone provider (peers with MCI, Sprint, AT&T, etc.) While XO offers some notable advantages, Clearwire won't be beholden to XO; such services could be provided by XO competitors.

- **Mobility** It's not widely known that the NextNet Expedience system is now capable of supporting vehicular mobility (but not "laptop portability") at the same data rates of "fixed" service.
- **Voice Over Internet Protocol (VOIP)** It's also not widely known that the NextNet Expedience system includes (optional) prioritization for VOIP. This gives Clearwire the option of offering their own branded VOIP telephony service; since Clearwire owns the equipment vendor, the CPE could evolve to have an "RJ-11" (telephone) jack on the side and integrate the current standalone box that Vonage and others use to offer VOIP telephony services. XO Communications, in its role as a Competitive Local Exchange Carrier (CLEC) could easily provide the back-end telephony services for Clearwire.
- **Timing** There are numerous ways that McCaw's timing is very, very good to begin Clearwire in the Summer of 2004. One example is that there are a number of high-profile "municipal wireless networks" being constructed as a reaction to affordable (home, small business pricing) not being available in smaller markets. Another example is the difficulties (which *can* be managed) resulting from the use of license-exempt spectrum, such as interference issues with "metro-scale" Wi-Fi systems.
- **Integration / Consolidation** Many a company has gone down to failure in part due to their inability to integrate and consolidate disparate, geographically separated companies. McCaw has already aggressively addressed this by consolidating all management and operational employees in Kirkland, Washington, a suburb of Seattle. Clearwire is being wholly relocated from Dallas, Texas and operational and

management functions of NextNet Wireless are being relocated from Minneapolis, Minnesota to Kirkland. In addition, Clearwire's strong management talent will be able to effectively meld the acquisitions rather quickly, as they have worked together before.

- **Market Positioning** It's not yet "clear" what Clearwire's business model will be. The current web page suggests that it will operate as both "retailer" and "carrier", but an emerging model is for ISPs such as Earthlink, AOL, and MSN to operate on overlays using "commodity" Broadband Internet connectivity.

- **Lessons Learned** The first major deployment of NextNet Wireless's Expedience system was in Mexico. There, MVSNet operates as "carrier" – constructs the network of base stations and backhauls, and a number of "retailers" actually procure the customer using their own marketing, branding, and back-end services such as web hosting, email, etc. MVSNet simply provides the wireless connectivity and transports each individual customer's "bits" to and from each retailer's network. While Mexico is obviously not the US, there are sufficient lessons learned from NextNet's experience that Clearwire's learning curve will be significantly flatter than such a new venture would otherwise suggest.

- **The "McCaw Factor"** The "star power" of Craig McCaw is a significant factor that cannot be underestimated. McCaw's now-legendary sale of McCaw Cellular to AT&T Wireless is the stuff of Wall Street legend, and McCaw's moves have a huge following. Apart from "star power", McCaw is well-known for "thinking outside the box" and the formation of this newest venture is an excellent example.

Details – Spectrum, Part 1 – Background

Though many would argue the issue (it's *property*, and all that implies – speculation,

appreciation, leasing, etc.), spectrum is intrinsically worthless. Spectrum is only of any value whatsoever when it is *used*. By that measure, the vast majority of the MMDS band in the US is worthless because it is currently unused.

While many would, again, argue the point, spectrum is inherently, generally agnostic as to use – any portion of spectrum can be used to do anything that is possible to do with spectrum. There are broad portions of spectrum that are somewhat *more* suited for *specific* purposes using *current* technologies… but there is no overarching "best" or "completely unsuitable" use of spectrum, including MMDS at 2.50 - 2.69 GHz. The chief values of the MMDS band are:

- It's licensed; it can be bought, sold, access made exclusive, and "interference" can be "controlled" to a great degree

- It's 190 MHz of contiguous spectrum (in contrast, consider that the original 800 MHz cellular spectrum allocation was "merely" 50 MHz, and the 1.9 GHz PCS spectrum allocation was 120 MHz.)

- It's well within the capabilities of current technology to produce and deploy reasonably priced and reasonably functional equipment and systems, especially considering that "just underneath" is the very popular 2.4 GHz license-exempt band, with a volume of millions of devices shipping monthly.

- It's well within the accepted limits (6 GHz is considered the absolute limit) for cost-effective mobility services.

- The history (see below) of the band is sufficiently murky and convoluted that non-savvy potential investors shy away from MMDS.

- The potential for continued use for private television broadcasting and the associated technical requirements to insure non-interference with television broadcasting "scares away" many, especially the larger, potential service providers.

- It's *not* the 1.9 GHz PCS wireless telephony band or other bands that are allocated

worldwide by most other national government for "3G" wireless telephony "broadband" services. This factor alone eliminates interest from an entire class of vendors and service providers for whom the entire universe is wireless telephony spectrum allocations and standards.

It helps to understand that McCaw's experience at McCaw Cellular was that spectrum licenses not just a necessary evil in order to provide wireless services, but are also a tangible asset that can be aggressively leveraged. With this background, McCaw would feel that any wireless venture such as Clearwire would need licensed spectrum… relatively cheap licensed spectrum, and even if Clearwire didn't come to fruition, the investment in spectrum licenses would not be wasted. McCaw's recognized that the vastly-underutilized 2.50 – 2.69 GHz band could be used to launch next generation services.

Details – Spectrum, Part 2 – History Even an abbreviated history of the 2.50 – 2.69 GHz MMDS/ITFS band would consume many pages, so I'll skip the customary "30,000 foot" view and offer a "view from space" highly-condensed summary of MMDS. I do this because a basic understanding of the convoluted history of the 2.5-2.69 GHz band is necessary to understand why McCaw has targeted this portion of spectrum.

The 2.50 – 2.69 GHz band was originally allocated for Instructional Fixed Television Service (ITFS), essentially private television broadcasting for use by educational and not-for-profit entities. An example of the intended use is for a school district to transmit daily lessons from a single Latin instructor to all schools in the district, with each school having only a handful of students interested in Latin, thus not justifying the expense of a Latin instructor at each school, or even traveling to each school on a schedule. There were some very useful ITFS systems built that were highly effective… but not many.

The Multichannel Multipoint Distribution Service (MMDS) was created in the 2.5 – 2.69 GHz band. Instead of educational/not-for-profit use, MMDS was for commercial use – so called "Wireless Cable" (television.) MMDS got started – systems were deployed… but the rapid rise of digital cable television (many more channels could be transmitted on the same infrastructure) and direct broadcast satellite television (what is now DirecTV and DISH Network) offering far more channels with digital quality ultimately doomed MMDS television broadcasting.

In the wreck of "Wireless Cable" in the mid-1990's, commercial, "civilian" access to the Internet was beginning its meteoric rise, and MMDS spectrum owners thought that they could repurpose MMDS from "Wireless Cable" to Wireless Internet Access (reflected by the name change of the Wireless Cable Association, International to the Wireless *Communications* Association, International). A few MMDS spectrum owners installed first generation MMDS Wireless Internet Access equipment from vendors such as Vyyo and Hybrid Networks – initially one-way with dialup uplink, but eventually two-way wireless. Such systems worked reasonably well, but user stations had to be installed professionally, the base station equipment was costly (it was, essentially, modified television broadcast equipment), and the systems could not scale cost-effectively to more than a few hundred users.

In the Summer of 1999, flush with Internet-bubble cash, Sprint and Worldcom acquired the numerous small companies that owned MMDS licenses for US "Tier 1" cities. By mid-2000, each of them had acquired 45-50% of the MMDS licenses in major US markets, ultimately paying approximately US$1B each. At that time, Broadband Wireless was envisioned as "then next big thing in telecom" because DSL and cable modems would take many years to satisfy the rapidly-growing demand for Broadband Internet Access. With venture capital plentiful, a wave of Broadband Wireless Internet Access startups were launched to aim for "the big

payoff" of a contract with Sprint or Worldcom, or "designed for acquisition by Cisco".

Sprint launched Sprint Broadband Direct (SBD), a credible service offering to consumers to offer "DSL-like" service in areas where DSL was unavailable. SBD was expensive because a truck roll was required, and the first generation equipment being used could not scale effectively without requiring the use of (precious) multiple MMDS channels. Ultimately Sprint added too many customers to existing systems, coinciding with the Internet bubble causing Sprint severe financial pain, and Sprint placed SBD in "suspended mode"; existing customers were allowed to stay on the system, but new customers were not accepted, and almost all service and support personnel were laid off.

Worldcom launched their equivalent to SBD, but targeted at businesses and was thus able to more easily withstand the costly customer installs and scaling issues. Ultimately, Worldcom's BWIA service was at most a minor experiment for them, done mostly in response to their primary rival, Sprint. Ironically, in the proposed, but ultimately disallowed Sprint/Worldcom merger, the combined MMDS spectrum licenses that would cover most US markets, was mentioned prominently as a significant factor in seeking the merger.

Sprint retains its MMDS licenses and occasionally makes presentations at trade shows stating phrases like "Sprint has active plans for MMDS", and has continued to conduct trials with new generations of BWIA equipment suitable for MMDS use. The prevailing wisdom in the BWIA industry is that Sprint, with the very significant challenges in its wireline telephony business and the ongoing financial demands of its Sprint PCS wireless telephony business simply does not have the financial resources to make significant use of its MMDS licenses, and is likely holding on to them for future, hopefully lucrative, sale or lease.

Once Worldcom's financial shenanigans became public and new management appointed, "Wireless" was quickly declared to be "a non-core business" for Worldcom and the various

wireless businesses such as Skytel and the MMDS operations offered up for sale via bankruptcy court auction. To the great surprise of almost industry observers, the winner of the bankruptcy auction for Worldcom's MMDS spectrum was Nextel, paying US$144M. (So much for Sprint's hope for a killing in selling *its* MMDS licenses.)

It's instructive to note at this point that Nextel's purchase of the Worldcom MMDS spectrum came during, or immediately after Craig McCaw's time on the Nextel Board of Directors. McCaw certainly had inside knowledge of Nextel's plans to bid on the Worldcom MMDS spectrum.

After the successful purchase of Worldcom's MMDS spectrum, Nextel bought the assets, including MMDS spectrum licenses, of Nucentrix, a distant-third MMDS spectrum-holder which was also in bankruptcy.

There has been much speculation as to Nextel's motivations for buying the MMDS spectrum. While Nextel has tried to posture, notably through a keynote speech at the January WCA Technical Symposium, that Nextel is prepared to "be disruptive" in Broadband Wireless Internet Access as it has been in wireless telephony by offering a highly differentiated service, just as it has done with DirectConnect.

The most likely scenario for Nextel's purchase of MMDS is that it is largely a fallback in case its "Consensus Plan" for relocating from the 800 MHz band (where some Nextel systems cause interference to public safety radio systems) to a nationwide, contiguous 10 MHz band near 1.9 GHz. This plan is, to say the least, controversial within the wireless telephony industry, despite the US$800M+ that Nextel is willing to commit to help "realign" public safety radio systems to make use of the vacated Nextel 800 MHz spectrum. For Nextel, spending a "mere" US$144M on spectrum, and a few tens of millions more for trials of BWIA systems would seem to be a prudent investment.

There is an effort underway by a number of MMDS/ITFS under the aegis of the Wireless Communications Association (WCA) to

completely revamp the more onerous regulations that apply to MMDS/ITFS, especially the onerous application process necessary to put a new system on the air. This is a legacy of this spectrum being used for broadcasting, and the "no hurry" slow, deliberative process that was felt necessary to minimize interference to broadcasting operations in adjacent areas when a change was made or a new system was constructed. The WCA proposal also includes a new "band plan" which would accommodate both legacy television broadcasting operations (centered around 2.60 GHz) and new types of services towards the low end and high end of the band. The "new services" portions of the band would be "de-channelized" (currently the entire band is partitioned into 6 MHz channels). The WCA plan has been proposed to the FCC and is being studied.

Details – Spectrum, Part 3 – Present Several years ago, McCaw created Fixed Wireless Ventures to opportunistically acquire spectrum licenses that became available; at the time it was felt that McCaw had no specific use in mind for the acquired spectrum. Reportedly, McCaw acquired licenses in several different portions of the spectrum and thus had little chance of actually using it efficiently. Very little is known about Fixed Wireless Ventures. In a December 20, 2003 article in the Seattle Post-Intelligencer by Miles Weiss of Bloomberg News, a regulatory filing revealed that McCaw had formed **Flux U.S.** in October for the purpose of acquiring MMDS spectrum licenses, including licenses for the cities of Jacksonville and Daytona, Florida. Near the end of 2003, McCaw resigned from Nextel saying, in effect, his work there was done. McCaw had begun quietly buying ITFS and MMDS licenses as he was able, through newly-formed Flux U.S.

In mid-April, 2004 it was disclosed that McCaw had acquired **Clearwire Technologies / Clearwire Holdings** of Dallas, Texas. (Dallas) Clearwire's primary asset is an exclusive agreement with the ITFS Alliance, a consortium of organizations that have ITFS spectrum licenses such as colleges, school systems, public television stations, and not-for-profit organizations. (Dallas) Clearwire had "first rights" to lease ITFS spectrum in use by IFTS Alliance members. (Dallas) Clearwire also had deployed its initial BWIA system in Jacksonville, Florida, using IP Wireless equipment (to great fanfare, by all reports the Jacksonville system performed well. The acquisition of (Dallas) Clearwire is the "spectrum centerpiece" of present-day (Kirkland) Clearwire's available spectrum. It should be noted that the ITFS Alliance did not represent all ITFS licensees. It is very difficult to work through the public and FCC records to see just how much ITFS spectrum (Kirkland) Clearwire has "title" to. Due to new FCC policies that specifically allow leasing of spectrum by current licensees (done to promote the spectrum actually being put to use, instead of being "warehoused" which is so often the case), that it may well fit (Kirkland) Clearwire's purposes to merely lease ITFS (and MMDS) licenses rather than buying them outright, in which case there's no record at the FCC of the ownership change of an MMDS/ITFS license.

Immediately "below" MMDS/ITFS, the license-exempt 2.4 GHz band, best known for "Wi-Fi" wireless local area network equipment, has become an "incubator" for entirely new generations of BWIA services such as:

- A mobile broadband Int*ra*net system installed in each San Diego County (California) Sheriff's Department patrol cars
- Prairie inet, based in Iowa, which provides Broadband Internet Access in numerous communities throughout the Midwest
- A growing number of "Metro Wi-Fi" deployments such as the town of Cerritos, California that provide "saturation" coverage of Wi-Fi signals through the city
- A proposed system in Newark, New Jersey by IDT to use Wi-Fi and Voice Over

Internet Protocol (VOIP) Wi-Fi phones to provide a very low-cost wireless telephony service

Such highly successful uses of 2.4 GHz, despite fears of interference, overcrowding, and competing uses, have begun to be noticed – by legislators… regulators (after a number of hearings to learn more about Wireless Internet Service Providers, especially those in rural areas)… press… and increasingly, investors.

The intense usage of 2.4 GHz… and the stark contrast of the nearly unoccupied 190 MHz of spectrum "just above" 2.4 GHz has given rise to a movement to "reclaim" 2.5 – 2.69 GHz or at least allow low-power, license-exempt operations in 2.5 – 2.69 GHz. It is being pointed out that a number of "Wi-Fi" cards that normally operate from 2.40 – 2.4835 GHz (the US 2.4 GHz band) can be simply reprogrammed to also operate from 2.40 – 2.70 GHz. In fact, such reprogrammed "Wi-Fi" cards are used in other countries for small, by small Wireless ISPs. Of course, the FCC strongly discourages such "grass roots" discussions of permitting the use of such reprogrammed devices, but there seems little that they can do to effectively stop it other than onerous rules and regulatory actions to prohibit and punish the use of such "mod" software.

I have publicly proposed an even more radical change for 2.5 – 2.69 GHz, that the US Government buy it back from the current licensees at fair market value, allowing current licensees a return on their investment. The US government would then allow low-power license-exempt use of 2.50 – 2.69 GHz much like 2.4 GHz. If innovation is flourishing in 83 MHz of spectrum where baby monitors compete with cordless phones which compete with "saturation" enterprise wireless LANs, which compete with Amateur Radio high-power television repeaters which compete with Wireless ISPs which compete with public safety agencies… and all of which is working surprising well reasonably well… it stands to reason that expanding the band from 83.5 MHz to 290 MHz (if 2.4835 to 2.4990 GHz is included, which has already been proposed) will create even more economic activity, which has largely been the single area of growth throughout the Internet downturn.

Details – Equipment

A formative lesson that McCaw learned during his time on the Nextel board was the dampening effect that Motorola has had on Nextel because Nextel did not have a choice of suppliers for iDEN technology, which is proprietary to Motorola. While iDEN met all of Nextel's functional requirements (which are unique within the wireless telephony industry), Nextel could not truly able to "drive" Motorola to decrease their prices, and add new features and even create new device form factors without Motorola deciding to allocate the necessary resources. As Motorola has grown increasingly troubled, it is problematic for Nextel to get Motorola to update iDEN as competition demands; Motorola doesn't "have to" – Nextel cannot go to any other company for iDEN systems.

Projecting forward, in the BWIA industry, the various proposed and ratified IEEE 802.16 standards, and WiMAX-certified interoperability will cure the "Nextel/iDEN problem", but interoperable WiMAX-certified systems are, at best, several years. With his purchase of NextNet Wireless, McCaw has apparently decided not to wait for WiMAX systems to emerge.

McCaw's equipment plans center around NextNet Wireless, Inc. headquartered in Minneapolis, MN. NextNet's Expedience system was designed around the stated requirements of Sprint and Worldcom, primary owners of MMDS spectrum in the US, for a Broadband Wireless Internet Access system that would not require a "truck roll" to install. A truck roll is when professional installation of an antenna and/or radio is installed, typically on a pole or on the

NextNet Wireless
Expedience CPE

side of a building so that the antenna is pointed in the right direction towards a base station and is positioned "up and in the clear". Mounting is trick enough, but there is also the issue of routing the cable between the antenna (more often the actual radio is mounted directly behind the antenna) and the indoor unit, and other issues such as proper grounding for lightning protection. Having to do truck rolls is hugely expensive – labor, rolling stock, inventory tied up in trucks, etc. and are a major consideration of the economics of a BWIA system. Many analysts posit that to succeed in direct competition with cable modem and DSL service providers (which are now largely user-installable), BWIA systems will have to be also have to be user-installable.

NextNet elected to achieve "no truck roll" by designing its CPE to use higher allowable transmit power limits (compared to license-exempt spectrum), along with an efficient antenna design and one of the first production uses of Orthogonal Frequency Division Multiplexing (OFDM). OFDM is a much more robust modulation technique than previous BWIA systems such as Frequency Hopping Spread Spectrum (FHSS) and Direct Sequence Spread Spectrum (DSSS). The higher power and better antenna "delivered the signal" and the use of OFDM "made sure the signal could be understood". NextNet optimized Expedience for MMDS; there was no "fallback plan" for other spectrum bands if MMDS didn't "take off". MMDS did not, in fact, take off in the US and NextNet barely survived long enough to supply a few small systems in the US. Just in time for NextNet, MVSNet in Mexico decided to use Expedience in a pilot deployment in Mexico City and Expedience was proven to live up to NextNet Wireless' claims for "self-installable", scalability, and overall performance. It was this demonstrated ability to scale with the MVSNet deployment that likely convinced McCaw to base Clearwire on NextNet Expedience, at least for system deployments for the next several years as WiMAX ultimately achieves

interoperability and cost-reduction targets as well as a certifying a WiMAX "profile" for MMDS.

Because the core technology behind Expedience is OFDM, NextNet will likely be able to migrate Expedience to WiMAX compatibility with a minimum of issues; certainly no more so than any other vendor with existing BWIA hardware. Not widely understood is that WiMAX is not a "technology" per se, but rather a certification of interoperability and an accompanying branding campaign for systems that achieve WiMAX interoperability certification. Current WiMAX activities are centered around achieving interoperability certification for systems that operate in 3.5 GHz bands that are used extensively overseas (in the US, the 3.5 GHz band is in use by the Department of Defense). A strong second in priority is WiMAX interoperability certification for license-exempt 5.8 GHz operation, which is heavily used in the US. In every WiMAX presentation I have seen, achieving WiMAX interoperability for MMDS is a distant third in priority… mostly because that band is owned by a relative handful of companies, such as in the US, Nextel, Sprint, and now Clearwire.

This means that WiMAX-certified MMDS systems likely will not emerge for several years, and whenever they do emerge, it will take several years for full interoperability (there are *always* glitches that are missed by the formal processes) and "commoditization" price declines to occur.

One "wildcard" in this timetable is Intel, which claims that their proposed WiMAX chipset, intended for use in laptops, will support all three "WiMAX bands" – MMDS, 3.5, and 5.8 GHz. Intel's "bet" on WiMAX is that the "WiMAX" bands will be used for "metro" services such as Clearwire's to provide ubiquitous and mobile coverage. One problem with that view is that companies such as Tropos Networks and RoamAD appear to have developed highly-effective "metro Wi-Fi" systems… that don't require WiMAX but instead leverage the huge

installed base of Wi-Fi systems. More to the point with Clearwire, much of the usability of NextNet Expedience comes from the use of the larger antenna and higher transmit power (with corresponding electrical power requirements) from the CPE; it will take another round of technology evolution before the usability of Expedience can be easily integrated into a laptop form factor.

Because McCaw now exerts direct control over both a Service Provider in Clearwire, and a system vendor in NextNet Wireless, McCaw can quickly drive features into the NextNet hardware that Clearwire identifies as requirements to better sell Clearwire service. One example is Voice Over Internet Protocol (VOIP) telephony, which is growing very rapidly. While the Expedience system "accommodates" VOIP very well (VOIP is recognized as a special type of data and prioritized so that VOIP calls to not "suffer" from being used on an Expedience system), VOIP is not integrated. For example, Vonage users are required to install a router to bridge between the Internet connection and conventional telephone equipment that's already found in the household and businesses. It would seem logical to integrate the "Vonage router" into an Expedience CPE, but a vendor would have to be convinced that there was sufficient market for such a product before committing to build it. In the case of NextNet and Clearwire, that cycle can be accelerated. When Clearwire decides that a new feature or upgrade is needed, presumably those requirements will be highly prioritized.

It remains to be seen if NextNet Wireless will continue to be the system of choice of other Service Providers now that the company is owned by a competitor. The "knee jerk reaction" is that such companies would cease buying from NextNet in favor of a vendor whose ownership is not a direct competitor. But those companies have a significant investment in Clearwire systems, and there is nothing on the market that provides the features of Clearwire… especially in the MMDS band.

For a service provider to build their own proprietary technology is attractive on the surface, for all the reasons discussed above. The downside of such a decision is when the service provider gets "comfortable" with its proprietary technology and does not feel driven to keep pace with other vendor's technology… and with every proprietary system installed, there is more and more "built-in" resistance to changing systems or technologies. The most recent example of this is Metricom Ricochet, whose technology was very good, but ultimately rendered irrelevant by 802.11/Wi-Fi (which is considered by most to be technologically inferior to Ricochet). *[I'm not trying to imply that Metricom's choice of technology is what caused its failure. –Ed.]*

This "rest on your technological laurels" problem does not seem likely for Clearwire or NextNet Wireless under McCaw because of the looming emergence of WiMAX; that threat is keenly felt at NextNet Wireless, as evidenced by their joining WiMAX as a Principal Member.

Overall, McCaw's purchase of NextNet Wireless is a sound decision. NextNet's Expedience system demonstrably works well, it is available now, at reasonable price points allowing Clearwire to begin revenue operations immediately. Going forward, assuming that NextNet is given sufficient resources, Expedience will achieve WiMAX compatibility with its corresponding interoperability and commodity-driven price reductions.

Details – Talent Analyzing executive pedigrees is not a strong point of *FOCUS*, so here I'll rely heavily on reports from other news sources. The primary point… above and beyond the experience and qualifications of each individual is that McCaw has assembled an unusually well-qualified team for Clearwire. This indicates strongly that Clearwire will be able to quickly and effectively integrate the acquisitions, get systems up and running, and scale the company and its operations. These are traits which few companies have in the formative stages. The depth of talent that McCaw has recruited for Clearwire clearly indicates that Clearwire will not be using a "take it slow and

easy" approach. Here is at least a partial talent lineup, from the Dallas Business Journal, *Fixed wireless play*, April 16, 2004:

- President Gerard Salemme, former AT&T and McCaw lobbyist
- Board member James Mansour, former CEO, (Dallas) Clearwire Technologies
- Nicholas Kauser, former Chief Technology Officer, AT&T Wireless
- Robert Mechaley, former "Technical Guru, AT&T Wireless and Founder and Chairman of RadioFrame
- Clark Peterson, former General Manager, Nextlink (now XO Communications)

In addition to the "star" talent, Clearwire will have little trouble finding well-qualified staff locally with little need to recruit nationally. That's because, once again, McCaw's timing is excellent; due to the impending acquisition of AT&T Wireless in nearby Redmond, and the shutdown of Bellevue's Monet Mobile Networks, there is ample talent available for nearly any required position in a Broadband Wireless Internet Access venture – Wireless Engineering, National Deployment, Tower Procurement, Information Technology, National Marketing, Corporate Sales, Customer Service… all that talent is currently available for reasonable prices as AT&T Wireless drags itself along towards the culmination of the merger at the end of the year, leaving ample time for employees to polish their resumes.

But AT&T Wireless isn't the only "wireless" talent pool to draw upon in the Seattle area. While it's lesser-known that Silicon Valley, Dallas, and San Diego, the Seattle area has been home to a surprising number of wireless companies:

- Advanced Radio Telecom (ART)
- Broadstorm
- Connexion by Boeing
- Icom's US Headquarters
- Meteor Communications Corp. (yes… that's just what it sounds like)
- Metawave

- SEA Marine Communications
- SGC
- T-Mobile
- Teledesic
- Tenzing Communications
- Terabeam (optical, but still wireless)
- Wavtrace
- Western Wireless
- And… Boeing (airplanes have a *lot* of radios).

Not to mention that the greater Seattle area seems to have become the area of the country most heavily saturated by Wireless HotSpots due to Starbucks being headquartered here and Cometa deciding to make the Seattle area its first "saturation" market.

Suffice it to say, McCaw won't have a hard time finding sufficient, and qualified staff for Clearwire.

Details – Financing Unfortunately, I have no details to offer on financing, other than to note that Clearwire represented approximately US$100M in investments, and NextNet Wireless was valued at US$80M in 2002. To quickly execute spectrum acquisitions, McCaw needs ready access to capital… and it's apparent that spectrum acquisitions are in fact occurring. It is rare for McCaw to commit much of his personal funds; more typical is for McCaw to arrange investment partners, which in previous ventures have including Boeing and a Saudi prince. It's unlikely, but conceivable that McCaw could be planning on a relatively early IPO; given the reaction to Google's impending IPO, given that wireless is "hot", and the "McCaw Star Power" is present.

Details – Branding Branding seems one of the hardest things for BWIA companies to get right… probably because they're usually loathe to spend money on something so "soft". Any business that plans to market to consumers needs a memorable, non-offensive, not-too-techie, and at-least-vaguely-representative brand name. In acquiring (Dallas) Clearwire. McCaw had such a brand… barely developed, but otherwise meeting

the criteria above (though the logo has been completely changed.) Admittedly… it's pretty good – "Clear" as in "sky, or air" and "clear of wires" implies "wireless" without actually saying it. In short, it's an easy-to-say, easy to remember, "friendly" brand. Companies can spend years and millions of dollars and not do so well. Not much more need be said about the Clearwire brand, other than that is one more "item of business", critical in the aggregate, that is completed in preparation to aggressively launch the new venture.

Details – Target Markets Information to date suggests that Clearwire will initially target Tier II markets in its initial deployments; Sacramento, not Los Angeles; Jacksonville, not Miami; Columbus, not Cleveland. *[The cities listed are illustrative; they do not reflect hard information on Clearwire's initial markets – Ed.]* Doing so is a sound strategy.

- Sprint and Nextel own the majority of 2.5 – 2.69 GHz spectrum in the Tier I markets.
- Spectrum licenses are less expensive and more easily procured in Tier II markets in comparison to Tier I markets.
- For wireless services, Tier II markets require fewer resources (tower, base stations, backhaul connections) to provide effective coverage than a Tier I market.
- Tier II cities are "less aggressively defended" by incumbents; for example Verizon will deploy its Broadband Access service initially in Tier I markets; it offers 300 – 500 Kbps speeds, the CPE is a PCMCIA card, it works almost anywhere, and is offered by a "name brand" for such services. Another example is that startup TowerStream offers fixed BWIA service in Providence, Boston, New York City, Chicago, and at least one other major market by the end of the year.
- Clearwire's primary advantage (now that "Stealth" has been stripped away) is to emerge rapidly, in a number of markets, with a compelling service offering. It's a simple calculation; whether to make a big

splash in a number of smaller markets, or make a small splash in a number of bigger markets. Things simply take longer and cost more to get done in larger markets.

- To compete aggressively in Tier I markets, Clearwire may decide to wait for WiMAX interoperability and cost reductions to take effect, and to allow the VOIP telephony option more time to mature.
- Tier II (and below) customers are actually grateful to be offered an option. The original Clearwire targeted Dayton, Ohio as one of its first markets, and was well-received there because Dayton businesses were grateful to have a choice of early broadband Internet access other than what Ameritech chose to offer.

Details – Base Stations, Backhaul, and Internet Bandwidth In comparison to McCaw's buildup of McCaw Cellular, building towers in the right areas is rarely an issue. Almost always, there's a suitable tower already in place and the owner is happy to take on another client. This is a legacy of as many as ten national wireless companies each building out their own dedicated wireless infrastructure. In many cases, the only way to get tower space in a critical service area was to build one's own tower. Eventually, sanity, budgetary pressures, and community backlash prevailed and most wireless service providers divested themselves of tower ownership and now simply lease on existing towers managed by "tower management" companies. In particular, there is a wealth of "PCS" towers, built and sited for use with 1.9 GHz digital wireless telephony systems… which have about half the range of the previous generation 800 MHz analog wireless telephony systems.

Spectrally, 2.5 GHz is more than close enough to 1.9 GHz, so Clearwire should be able to find usable PCS towers wherever they need them. Not only is this an economic advantage, it's a huge time-to-market advantage. Assuming an existing tower, antennas can be bolted on, feedlines run, and equipment installed in a day (I've actually witnessed an "under one day"

deployment – show up in morning, test of system by evening.)

It's said that when discussing war, "amateurs discuss tactics, but true professionals discuss *logistics*". The corollary of that story for Wireless communications would be something like "amateurs discuss tower siting, but professionals discuss *backhaul*." Backhaul is problematic to arrange, reliability is an issue (if the backhaul fails, a tower is useless), and expensive (backhaul is one of the primary expenses for wireless service providers – of all kinds.

Clearwire has a number of backhaul options:

- Conventional approach – order up a T-1 or multiple T-1's from the telco to the cell site. Doing so will take a long time, be costly, be of limited capacity, and be "feeding the enemy.
- Fiber from a Competitive Local Exchange Carrier (CLEC), plenty of capacity, lower price than the telco, but takes a long time
- Wireless backhaul

The second and third options are easily accomplished by XO Communications, a company that McCaw founded as NextLink. McCaw no longer has any formal holdings or position in XO, but likely there are "good feelings" and "understanding" between the founder and the founded. Such feelings, if they in fact exist, are minor in comparison to the synergies between XO and Clearwire. The biggest synergy is that XO has an extensive footprint of fiber already installed, most of which is "dark". XO also acquired fiber and other "route" assets as part of its recent acquisition of Allegiance Telecom.

It is simply faster, easier, and cheaper to "extend" fiber than it is to install it for the first time. XO may well be able to get fiber to Clearwire base stations for a reasonable price. XO also has extensive 28 GHz licenses (another McCaw influence, bought at about the same time as the Sprint/Worldcom MMDS acquisitions)

and XO could easily constructed licensed P-P wireless links to supply backhaul to Clearwire base stations.

Clearwire could also handle its own backhaul by using its spectrum as both user-access and backhaul; the two systems can be isolated from each other to allow extensive frequency reuse, and may well reduce Clearwire's costs significantly, allowing it to "shop" for connectivity to a base stations within a several mile radius of the base station. Find reasonably-priced connectivity and connect from there to the base station via a Point-to-Point link. This approach is being used to great effect in Mexico by MVSNet to construct its own backhaul network using its own spectrum and equipment from Aperto Networks, and thus avoid paying Telmex, the wireline telephony incumbent, at all.

XO is also quite capable of supplying Clearwire with Internet backbone access because it is one of a handful of large telecommunications companies who directly interconnect with each other at very high speeds to form the majority of what is now the Internet's backbone connectivity. There are few other Internet backbone companies that Clearwire could partner with where there isn't some competitive overlap, such as Sprint or AT&T.

Upon examining the history, and the potential synergy of Clearwire partnering with XO Communications, it *seems highly unlikely that such a relationship isn't in the making*. The advantages to Clearwire are simply too compelling. To XO, having recently emerged from bankruptcy caused by the Internet downturn, it would be foolish not to quickly embrace the amount of new business that a partnership with Clearwire would bring.

Details – Mobility It's been apparent for a number of years that "Fixed" Broadband Wireless would evolve into "Mobile" Broadband Access, which is why I have used the phrase "Broadband Wireless Internet Access" and almost never "Fixed Wireless". NextNet

FOCUS on Broadband Wireless Internet Access

Wireless has joined a growing number of vendors whose BWIA systems are capable of mobility. "WiMAX hype" has asserted itself to the point that most of those with casual knowledge of BWIA assume that Mobile BWIA will have to wait until the efforts of the 802.16e and 802.20 standards groups complete their work and WiMAX embraces those standards. But that's not the case at all, and NextNet Wireless' Expedience system is an excellent example of why that's not the case. For Expedience to work while mobile, its algorithms had to be improved (mobility wasn't a high priority for initial products) and there had to be sufficient processor power in the customer premise equipment to execute those algorithms in a rapidly changing radio-frequency (RF) environment – mobility.

NextNet does not seem to publicly offer the mobile version of the Expedience CPE. Much like an early wireless telephone, "Expedience-Mobile" needs to be permanently mounted in the vehicle, an external, roof-mounted antenna connected, and adequate cooling and electrical power provided. While Expedience-Mobile isn't "easily portable" (that will take another generation of refinement), mobility is a significant advantage, offering higher speeds than wireless telephony while mobile. *[The standard Expedience CPE and system fully supports "nomadic" use; turn it off, take it somewhere else in the coverage area, turn it back on, and connectivity is quickly re-established. – Ed.]*

There's a proven market for mobile BWIA services, especially in public safety. CDPD is widely used as a low-speed, reasonably priced service but CDPD is being

Lincoln County (Washington) Sheriff's Department patrol car

phased out along with the analog wireless telephony systems upon which is operates. Wireless telephony providers are positioning their data/Internet services as a CDPD

replacement, but at much higher cost. Some public safety agencies have resorted to building their own mobile broadband systems such as San Diego County Sheriff's Department using Alvarion license-exempt equipment.

Clearwire could offer public safety (and all municipal service agencies) mobile BWIA service on its existing systems for attractive prices – essentially the cost of the equipment and installation and the "regular" fee for Clearwire service. Limiting the sale of mobility service in this way minimizes Clearwire's support overhead, establishes a new source of revenue and a somewhat captive customer base. Offering mobility service would also significantly differentiate Clearwire's BWIA service from wireless telephony (higher speeds, lower prices) and wireline Broadband (we can do *mobility*!)

Details – Voice Over Internet Protocol (VOIP) Most current BWIA systems make specific provision for VOIP; such systems will prioritize VOIP and minimize latency that VOIP works well on BWIA. This capability is yet another differentiating feature for BWIA in general and one that Clearwire can actually market, as illustrated by the following (purely fictional) "radio spot": *Love your Vonage phone, but hate how it works on your cable modem at night when everyone else in your neighborhood is online? Clearwire Wireless Internet's system takes special care with Vonage and other VOIP services… unlike the cable company, who wants to sell you **their** higher-priced, sounds-worse "voice over cable" service. Call Clearwire today and your Vonage phone will work better than ever."*

I use Vonage above only to illustrate how popular VOIP is becoming; Vonage markets to consumers using inexpensive advertising slots on late night cable television… and it works. As discussed previously, Clearwire could easily partner with XO Communications to offer their own branded telephony service using VOIP. To re-emphasize, that the Expedience system seamlessly accommodates VOIP with Quality of Service (QOS) mechanisms makes VOIP completely viable on Clearwire service where it

may well not be feasible on other Broadband Internet Access services due to their *lack* of QOS mechanisms.

Vonage currently requires customers to install a small, Linksys-like router in their system, and plug their telephone(s) into the router's Telephone Line 1 jack (there are two; use of a second phone line is optional). The router provides dial tone, decodes touch tones, and generates ringing signals; in short a phone works completely normally when plugged into a Vonage router and using Vonage's service.

You start to appreciate the synergies of owning an equipment vendor when you consider the possibility of adding the functionality of a VOIP router / telephone interface into a new version of the Expedience CPE. Because Clearwire is in a position to directly drive sales of telephony services, it could recoup the non-recurring engineering expenses and higher unit costs of the Expedience "telephone" CPE relatively quickly. Other vendors have to endure such expenses on their own, with no guarantees that a buyer will value the work that went into integrating VOIP, nor pay the extra cost for the VOIP functionality.

Inexpensive, or bundled telephony services are likely to be a large draw for potential Clearwire customers.

Details – Timing There are so many ways in which McCaw's timing is perfect for launching Clearwire in the Summer of 2004. It's easiest to simply list them.

- First and foremost, Wireless is hot – with potential customers, potential investors, regulators… in short, Wireless has "Buzz", which helps enormously in launching a new venture because the impact of your launch is magnified because every editor wants to cover a new angle on a hot topic; Clearwire's launch will be just such a hot topic.

- Frustration at the lack of progress in "finishing" broadband deployments by telephone companies is rampant – by the FCC, by lawmakers, and especially by

officials of communities for who lack of affordable broadband is an economic development issue. So much so that communities are obtaining economic development grants and creating their own community wireless systems… and that approach does work well. There are a number of high-profile such efforts such as Cumberland County Maryland and Scottsburg, Indiana. Increasingly, wireless is seen as a viable way to bypass the telephone companies when they're not willing to deploy broadband. Broadband Wireless Internet Access is now being seen as mainstream.

- The future of MMDS is uncertain; the WCA plan has been proposed to the FCC but not accepted. The lack of use of MMDS is increasingly visible, and the FCC may be forced, by Congress and/or activists to adopt an *effective* "use it or lose it" stance on MMDS

- The publicity push from the WiMAX forum and especially Intel (and its investors) is intensifying the pressure on BWIA vendors. Those who don't have a solid migration path to WiMAX compliance and aren't well capitalized will be under severe stress. Those who have solid products, good customer bases, and reasonable financial positions will are still being stressed by the WiMAX juggernaut. The result is that Vendors are "willing to make deals" for pre-WiMAX systems.

- The wireline telephony industry is distracted with dealing with line-sharing issues which it has finally gotten changed to its full advantage… just in time for VOIP and wireless telephony to start becoming a major threat to its revenue base by poaching profitable voice customers.

- The wireless telephony industry has even more challenges: completing E911 compliance; consolidation issues following Cingular's pending acquisition of AT&T

Wireless; dealing with the lingering issues of the NextWave spectrum ownership debacle; trying to appear relevant in "Broadband" Internet Access when the Internet Access speeds that can be offered on GSM systems are considered paltry at best; wireless telephony's looming VOIP threat – VOIP over Wi-Fi (especially metro-area Wi-Fi systems), trying to staunch the inclusion of Wi-Fi in the phones they sell and/or trying to "lock down" the Wi-Fi capability so that it can only be used at (carrier) selected Wireless HotSpots. With all that, the wireline telephony business is faced with two "nightmares". The first is that Nextel will prevail with its consensus plan to vacate 800 MHz for a nationwide 10 MHz spectrum allocation at 1.9 GHz. The prospect of Nextel armed with such choice spectrum and the chance to completely reinvent its network (likely with current-generation broadband + VOIP technology rather than continue with Motorola's proprietary iDEN) is daunting. The second "nightmare" is that as a result of years of pressure from the wireless telephony industry (Want better cell phone to have more reliable coverage? Call your congressman and tell him that the FCC needs to free up more spectrum for cellular phones!) the current administration has succeeded in pressuring the US Department of Defense (DOD) to vacate 90 MHz of "3G" spectrum… which will be auctioned, with the "winner" to pay the cost of DOD systems to other parts of the spectrum. With the NextWave spectrum, the consolidation of AT&T Wireless and Cingular systems, the wireless telephony industry will soon be awash in spectrum… before the DOD's 90 MHz is factored in.

- (Discussed previously) The pending acquisition and almost certain liquidation of AT&T Wireless operations in Redmond, WA and to a lesser degree the failure of Monet Mobile Networks will make available a pool of skilled and motivated workforce at precisely the time when Clearwire needs to form such a workforce.

- The markets are coming back with the pending Google IPO; once again "tech investments are cool". Coupled with "wireless is hot"… McCaw may well have a far easier time raising money for Clearwire in the Summer, 2004.

Details – Integration / Consolidation Quite simply, McCaw and his Clearwire lieutenants are highly experience at acquisition, integration, and consolidation of acquired assets. To date, (Kirkland) Clearwire will be busy consolidating (Dallas) Clearwire and the operational and management functions of NextNet Wireless to Clearwire facilities in Kirkland, Washington. Going forward, one of the most effective ways for Clearwire to rapidly gain market share is to acquire existing ISPs; not necessarily just those with wireless experience and consolidate them under the Clearwire brand. This has been tried, with mixed success in the past with ISPs, but McCaw's past experience with McCaw Cellular was (as such things go) one of the most successful of such "rollups". This scenario is one of the most plausible reasons why McCaw would have assembled such a strong lineup of management talent.

Details – Market Positioning While it's not yet clear what Clearwire's business model will be, the fact that "Clearwire" is well-positioned to become a strong brand suggests that Clearwire will operate "retail" – marketing to and selling its services directly to customers under the Clearwire brand. That approach is certainly the most efficient, but doing so "locks out" the potential revenue stream of partnerships. In the last few years, a new model has emerged in the wireless telephony industry – the "Mobile Virtual Network Operator" (MVNO). The most high-profile MVNO currently is Virgin Mobile in the US. Virgin owns no infrastructure; its services are purely "overlay" with Sprint PCS' wireless telephony system. Apparently the MVNO model works, at least well enough for convenience retailer 7-Eleven to soon begin

marketing its own MVNO which will in turn be virtualized (7-Eleven doesn't even want to do its own customer service or deal with the "underlying" wireless telephony carrier – Cingular.)

Internet Service Providers AOL, MSN, and Earthlink operate as "Virtual Network Operators" (VNO's); typically they own and operate only their servers and directly related operations. The network through which subscribers connect to them, either via dialup or Broadband connection, is built, owned, and operated by another entity. Often the exact same facilities (the non-virtual Network Operator) will service competing companies such as dialup calls to Earthlink and AOL terminating in the same "modem bank".

Similarly, Clearwire could simultaneously offer retail (Clearwire) and wholesale (VNO services for AOL, MSN, and Earthlink). AOL, MSN, and Earthlink are highly motivated to find a cooperative, reasonably priced partner capable of "wholesaling" Broadband Access for their branded services on a national basis. The "Big Three ISPs" are increasingly being squeezed out as their former Broadband Internet Access partners cut prices and more directly compete with them for customers. A partnership with one or more of the "Big Three ISPs" in the formative years of Clearwire could, again, allow it to grow quickly and rapidly gain market share at the expense of wireline Broadband Internet Access.

It's hard to tell at this point whether Clearwire will opt for a "retail" operational model, a "wholesale" operational model, or simply do both.

Details – Lessons Learned In addition to the lessons from McCaw Cellular, Nextel, NextLink / XO Communications, and even ill-fated "ICO / Teledesic", McCaw has had plenty of experiences to learn from. In buying NextNet, Clearwire inherits a large base of direct experience from the successful deployment o Expedience in Mexico by MVSNet, as well as a number of smaller NextNet Wireless

deployments in the US and Canada (one of which, Microcell, McCaw is an investor.)

Experience with MVSNet's operational model is likely to be particularly instructive. MVSNet operates as "carrier" – constructs the network of base stations and backhauls, and a number of "retailers" actually procure the customer using their own marketing, branding, and back-end services such as web hosting, email, etc. MVSNet simply provides the wireless connectivity and transports each individual customer's "bits" to and from each retailer's network. Each "retailer" has different financial models. Some require the customer to pay for the CPE up front and the customer owns it. Others bundle the price of the CPE into the service price. Some bill the monthly service charges to a credit card while others require the use of prepaid cards bought over the counter. Some retailers offer "premium" services – faster speeds with Quality of Service (QOS) guarantees while other retailers offer only "best effort" service. Using customer profiles, managed by the retailers, MVSNet's Expedience system accommodates all of those operational and financial models simultaneously.

As well, McCaw has no shortage of high-profile BWIA service provider failures to study in depth for clues on how to avoid a similar fate. Such companies include Advanced Radio Telecom (ART) in nearby Bellevue), AT&T's Project Angel, Darwin Networks, Metricom Ricochet, Mobilestar, Monet Mobile Wireless in nearby Bellevue, Sprint Broadband Direct, Teligent, Terabeam next door in Kirkland, Winstar, XO Communications, Worldcom's Broadband Wireless… even AT&T Wireless itself, so weakened in the AT&T spinout that it began quietly looking for a buyout partner within months of becoming independent.

FOCUS on Broadband Wireless Internet Access

Details – The "McCaw Factor" The "star power" of Craig McCaw is a significant factor in the ultimate success of Clearwire that cannot be underestimated. McCaw's now-legendary sale of McCaw Cellular to AT&T Wireless is the stuff of Wall Street legend, and McCaw's moves have a huge following among investors. While "personality" discussions are almost entirely excluded from discussion in *FOCUS*, I'm making an exception in the case of Clearwire because McCaw's entree into the BWIA industry is equal parts personality, accomplishment, and reputation as "telecom visionary" as well as the overall soundness of the company, its market prospects, and the technology behind it.

Likely the primary motivation for McCaw to "get back in the wireless game" is that McCaw is wants to get his blood pumping fast with another challenge akin to building up McCaw Cellular from scratch. McCaw is still young, he's got billions of dollars to play with, and the telecommunications industry is in disarray with no clear winner emerging from that disarray. McCaw apparently… and correctly, perceives that conditions are ripe for a new "McCaw" play, this time in Broadband Wireless.

McCaw is known for "thinking outside the box" and one example of this was the creation of the Cellular One brand that could be used by any independent (non-telco) cellular service provider. In the infant cellular industry, McCaw was able to create a new paradigm with the Cellular One brand; it had better brand identity for potential customers of cellular service than did the far better-established wireline carriers.

Another reason McCaw is likely getting involved in MMDS is that he sees distinct parallels in his experience in the cellular business and later with his involvement in Nextel, where spectrum assets were acquired early and relatively inexpensively, and with considerable development, were later valued at millions and billions of dollars. Given the ultimate potential of services based on 190 MHz of spectrum just above the "more-amazing-every-day" 2.4 GHz license-exempt band… you can understand how McCaw sees dollar signs in undervalued spectrum.

McCaw may well have been "pulled" into forming Clearwire by his talented lieutenants that felt like "nothing really interesting is going on in wireless or telecom… "Let's *do* something." Or the lieutenants may have spotted an enormous opportunity.

Overall, as I've tried to make clear at several points along the way, for Clearwire to have as much potential as it has would not be nearly so much so if McCaw was not a formative and ongoing influence. Clearwire could not have happened the way it has, or positioned itself nearly so well without McCaw.

McCaw may be reluctant about it, but he will inevitably be thrust into the role as figurehead for BWIA as the "new" wireless and "new" Internet industries. McCaw's voice *will be needed* as the wireline telephony industry in its dying throes will be lashing out at the Internet as the cause of its death. With Clearwire, McCaw will be able to demonstrate the future of Internet Access… and telecommunications in general… won't be a gloomy one once we're deprived of the pervasive influence of wireless telephony.

Similarly, the wireless telephony industry will also "lash out" as its difficulties grow more severe, (profiled previously) especially the lack of acceptance of its flavor of "Broadband Internet Access" (at the offered price points) and the increasing obviousness of its trending-towards-obsolete choice of technology.

It is a stretch of imagination… but not much… to posit that Clearwire and McCaw will ultimately run afoul of mighty Microsoft. Clearwire, from all indications, will benefit most from open standards as it straddles the wireless and Internet industries… precisely those industries that Microsoft targets as its highest potential for growth. A younger, less experienced McCaw might have given over to Microsoft's machinations as simple expedience. The Craig McCaw of this era, of an age that "legacy" is a tangible concern, may be inspired to "do the right thing" with Clearwire and resist Microsoft's trend towards dominance.

FOCUS On Broadband Wireless Internet Access

Backup: Why Another Type Of Wireless; Why Another Network; Why Now? *[This section was prepared as the original lead-in to this issue It contains enough useful information to make it worth including for readers. – Ed.]* Why another type of wireless? Because it offers the potential to be better, cheaper, and… most of all *different* (as in the fabled facilities-based competition) than what we have now. Space and time don't permit an exhaustive discussion of the deficiencies of typical wireline copper infrastructure. Technology that can offer next-generation broadband via wireline copper infrastructure is available, but too expensive for widespread deployment in typical US urban and suburban scenarios. Fiber-to-the-premises is capable of meeting any conceivable future service requirements… but is simply too expensive for wireline companies to seriously consider widespread deployments. Wireless telephony companies have locked themselves into "optimized for voice" infrastructure that doesn't accommodate new requirements such as Voice Over Internet Protocol (VOIP) (needs relatively low latency), and lowered costs to compete with a new competitor in wireless – Wi-Fi HotSpots/HotZones, Wireless ISPs, Broadband Wireless Service Providers, municipalities, enterprises… campuses, and most recently, neighborhood groups.

As stated in the tenets of this newsletter, Broadband Wireless Internet Access has the potential to be "*...the most likely technology to provide cost-effective, ubiquitous, always-on Broadband Internet Access.*" In 2004, there is a confluence of factors that hasn't existed previously:

- It's now widely accepted that Broadband Internet Access is being driven or pulled towards absolute ubiquity. For those that don't have need of "Internet access" (web, email), they will get Broadband Internet Access whether they know it or not as a result of always-on connectivity required for less expensive telephony service based on VOIP, entertainment (downloading content onto a TiVo-like settop box), or even at-home medical monitoring, security systems, etc.

- Accepting that Broadband Internet Access will be present in every household and business, achieving ubiquity is a matter of cost to deploy and operate, ability to deploy, and timing. In all these areas, BWIA is, or has the potential to be, superior to wireline alternatives.

- BWIA can easily be cheaper to deploy and operate than wireline – no low-capacity, expensive-to-maintain network of copper wires, or obscenely-expensive-to-install fiber optic cable is needed.

- BWIA can be deployed at the speed, and ease of installing towers (if indeed, towers are even needed; rooftops of "taller" buildings, existing structures work fine, and dynamic wireless mesh networking has the potential to remove the need for most towers.)

- BWIA can deliver higher bandwidth than is economically feasible with cable modem or DSL, or even T-1. While cable modem and DSL have demonstrated the capability to achieve much higher speeds, it is unlikely that cable modem and DSL service providers will be willing, or capable, of investing the capital to do so. While fiber optic cable inherently can deliver very high bandwidth, it is similarly very expensive to deploy and upgrade and thus will remain unavailable for the vast majority of residences and businesses.

- BWIA can easily be upgraded to higher bandwidth or new services – new radios on the tower, and the user buys a new unit.

- BWIA can offer mobility and portability; no longer does Broadband Internet Access require connection to wireline, or even proximity to a Wireless HotSpot.

- Broadband Internet Access enables entirely new categories of services and the corresponding ability to generate additional revenue above and beyond current services.

- BWIA offers new companies the ability to create an infrastructure that's completely independent of using Incumbent Local Exchange Carriers (ILECs) infrastructure – no leasing of copper pairs, nor even the need to lease access rights to poles (although mounting low-power, localized-coverage radios on poletops is one scenario for creating ubiquitous wireless coverage)

- Wireless telephony companies have created expectations for Broadband Wireless Internet Access in the minds of customers and potential customers that cannot currently be met, and potentially cannot be met at all. The various flavors of "3G" suffer from high service costs, low capacity per cell, widely varying speed and latency, and lack of true ubiquity. BWIA service providers could potentially capitalize on that lack of satisfaction with wireless telephony companies by offering a superior and/or less expensive Broadband Wireless Internet Access experience.

- BWIA, more so than any other form of Broadband Internet Access, is evolving at the pace of Moore's Law; the newest generations of BWIA devices will be faster, smaller, cheaper, and work better. Moore's Law advances are far less important in wireline Broadband Internet Access.

FOCUS on Broadband Wireless Internet Access

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Steve Stroh is the perpetrator of the "FOCUS on Broadband Wireless Internet Access" newsletter, an in-depth review that gets it. The subscription fee is worth every penny. - **David Isenberg**

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**

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**

To the increasingly large group of people who talk sense about broadband wireless services, I have to add Steve Stroh. His subscription publication is full of sensible advice born of deep technical and market knowledge. Anyone trying to make a living, start a company, or run a division in which this is your market shouldn't hesitate before subscribing. - **Glenn Fleishman, 802.11b Networking News (now Wi-Fi Networking News)**

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Steve Stroh is *the* most knowledgeable writer about emerging Wireless issues, and is far ahead of the journalistic curve on the growing role of License Exempt businesses, from manufacturers, and Wireless ISPs, to emerging efforts to form national companies aggregating local 802.11b hot spots. - **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**. I intend that *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.