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How Carriers Will Deploy WiMAX

WiMAX is clearly a front-runner as this year's most hyped communications technology, and already seems to be set to garner the prize again next year. Most of us can remember when Wi-Fi, and before it Bluetooth, went through similar hype cycles even before real interoperable products were available and any meaningful market penetration had been established. In addition, WiMAX has been parlayed into endless possible dimensions for enterprises, consumers, government, service providers and carriers.

Only time will tell with regard to the real implementations of WiMAX, in the mean time, several key trends current exist and provide some insight into how WiMAX technologies may be deployed.

WiMAX's Role Will Vary Based on the Service Providers' Orientation

Carriers and service providers will take different approaches to deploying WiMAX, just as they have with Wi-Fi. However, clear deployment patterns will evolve in part based on whether the service provider is a LEC (an incumbent facilities-based local exchange carrier owning an access network) or a CLEC/WISP (relatively new non facilities-based competitive local exchange carrier, not owning any access network).

WiMAX will be used as a wireless access technology and will be deployed in three significant ways:

- For incumbent mobile wireless providers as a high speed data overlay for cellular networks
- For fixed wireless infrastructure providers as a standards-based interoperable network for underserved areas
- For CLECs and WISPs as a central office bypass to avoid using existing wired infrastructure.

A key factor in which orientation is chosen will be driven by what the carrier considers its major infrastructure and business assets.

Let's take a quick look at the anatomy of access networks. For our simplified purposes, we will break it down into two segments: (1) From the central office, or equivalent, to the customer premises, and (2) From the premise edge to the destination user devices, e.g., PCs, laptops, DVRs, cameras, etc.

Traditionally, the premises LAN was exclusively wired. The issue of a separate LAN cable required within the premise for this second network segment was a major problem.

Several solutions emerged:

- Phone line networking – Using existing home phone line wires
- Power line networking – Using existing electrical wiring and outlets
- Wireless – Using the Wi-Fi 802.11 standard, which was just emerging

As all are aware, because of usage factors, standardization, and cost, Wi-Fi emerged as the winner with the proliferation of Wi-Fi routers, Wi-Fi-enabled devices, low cost adaptor cards, and finally with the integration of Wi-Fi into virtually all new laptops shipping.

The result is an access network made up of two distinct parts, each interconnected via wired Ethernet, which allows either segment to change independently.

Given their overwhelming investment in a capital-intensive network infrastructure, an incumbent wired or wireless carrier will naturally center their business around their access network and only move to a new technology due to specific business drivers or infrastructure reasons. As such, the focus is on Segment 1, with Segment 2 being the consumers' to deal with. Segment 1 examples include ISDN, Cable, DSL, and fiber. WiMAX and Wi-Fi mesh will also be utilized in this segment.

The competitive provider looks for new technologies to drive business opportunities with limited tethers to existing infrastructure, especially on the access side. As such, they look to lower cost-per-subscriber options for Segment 1, like Wi-Fi mesh (and possible WiMAX mesh when it is available). For segment 2, this means being able to capitalize on trends of what may be used and what already exists, which, in this case, is Wi-Fi.

Over the next 5 years, WiMAX will be an option for deployment by incumbents and competitive carriers in Segment 1 only. Because of the technology's massive existing installed base, Wi-Fi will be used as a user-device access RF and will continue to dominate Segment 2. WiMAX is clearly not going to be the best solution for all carriers and has distinct deployment requirements and device needs based on whether you are an incumbent operator, a CLEC/WISP, and/or a mobile network operator (MNOs).

MNOs Will Deploy WiMAX as a High-Speed Data Overlay and Backhaul Technology

For MNOs who do not deploy wireless mesh, WiMAX offers the ability to provide a high-speed data overlay to existing cellular networks. WiMAX has the advantage of utilizing the same tower/hilltop mounting real estate already used by MNOs, but data bandwidth density needs to be balanced against existing cell sites. The big issue for high speed data overlay is the availability of mobile WiMAX (802.16e) which is just being ratified, and then the typical development and cost-reduction cycle that must take place to make it viable for infrastructure deployment and for end-user devices in the form of adaptors, etc. As such, WiMAX does not offer a near-term solution in this area.

WiMAX and Wi-Fi can offer some potentially significant cost savings for MNOs by providing an alternate means to backhaul base station traffic from cell sites to the base station controllers. MNO's typically utilize some type of wired infrastructure that they must buy from an incumbent operator. A Wi-Fi or WiMAX mesh can offer a much more cost-effective backhauling capability for base stations in metropolitan environments.

While WiMAX will offer a high-speed data overlay several years down the road, Wi-Fi mesh can provide a high speed network today. By selecting the appropriate mesh-based Wi-Fi systems, one can deploy tens high-speed wireless broadband networks capable of supporting voice, video, and data over hundreds of square miles.

WiMAX Will be Used as Carrier Infrastructure for Fixed Wireless

Fixed wireless data systems lack standards to facilitate interoperability, resulting in high priced CPEs. As

such, to the fixed-wireless operator, the cost of proprietary network access per subscriber (including both the infrastructure and CPE) has made WiMAX suitable for T1-type services to enterprises in underserved areas or other markets capable of supporting competitive offerings. Further, the deployment topology for these networks is a star with a single base station servicing numerous CPEs, typically within the line of sight. Base stations are mounted on towers or on top of buildings and are spaced miles apart with point-to-point links.

WiMAX will represent a standardized RF with interoperability between the base station and CPE, pushing CPE pricing down to the $500 range, and with time, even lower.

Wi-Fi Mesh Will be Used as Service Provider/ Carrier Infrastructure for Fixed and Mobile Wireless

For CLECs, WISPs, and city governments that are looking to deploy a local broadband network, the recent Supreme Court rulings and FCC changes focuses industry deregulation and mandatory physical plant access to voice only, not broadband data. As such, the incumbents – both DSL and cable operators – are no longer required to provide unbundling of their wired networks to CLECs or WISPs. Wireless is a logical and very cost-effective option in this scenario. Wi-Fi Mesh is already filling that role today. WiMAX will also present an option, but only if tall building and tower type real estate is available and the entity is able to lease licensed spectrum from an existing spectrum holder.

In all other cases, Wi-Fi mesh represents a better alternative because of its pico-cell architecture and the abundant availability of light/utility poles which typically have size and weight mounting limitations. Mesh based on 802.11a eliminates the channel contention issues, by providing in excess of 20 non-overlapping channels, while still providing 54 mbps per channel.

Wi-Fi multi-radio (3 or more) mesh nodes can provide both a fixed wireless and a mobile infrastructure. A high performance Wi-Fi mesh can cater to mobile and nomadic end devices via the 2.4 GHz 802.11g RF and provide high-throughput , low-latency mesh backhaul links via 5 GHz 802.11a RF.

Because of its central office bypass capabilities via a pico-cell topology with .11a and .11g, Wi-Fi Mesh is better suited for wireless broadband deployment in dual fixed and mobile wireless environments.

WiMAX Mesh Will Complement Wi-Fi Mesh

Multi-radio, mult-RF systems that support new RF upgrades will provide the option to use one or both of Wi-Fi and WiMAX in the same mesh network. This allows for the deployment of a mixed and integrated Wi-Fi and WiMAX network for both infrastructure and, eventually, access for end user devices.

The ability to use WiMAX as a mesh will become a necessity for some Wi-Fi mesh vendors, especially those using single- or dual-radio architectures where only one radio is available for the mesh backhaul. These systems lose a significant amount of throughput and introduce a significant amount of latency per hop due to half duplex nature of Wi-Fi. WiMAX is an effective way to solve this problem for all mesh vendors that do not offer multi-radio, multi-channel nodes that provide a high level of performance and minimal throughput loss.

One example of the different approaches that can be used with Wi-Fi and WiMAX is the concept of a hotzone versus a hotspot. Hotspots can be connected via different Segment 1 technologies, including WiMAX. WiMAX will be used as a backhaul backbone, with CPEs at each hotspot that attach to or support Wi-Fi access. Wi-Fi mesh presents the notion of a hotzone, where the Wi-Fi zone covers numerous hotspots and creates a large area of coverage – up to hundreds of square miles in some cases. The mesh backhauling can be handled by multi-radio Wi-Fi systems. Some high-performance, radio-agnostic systems can also transparently integrate WiMAX radios.

Wi-Fi Will Continue to Provide Client Device Access Throughout the Decade, Not WiMAX

The result of the second network segment for connecting the end user device to the broadband network is the proliferation of Wi-Fi devices globally. Wi-Fi access is ubiquitous for the office, home, and public and private enterprises. We can all access the Internet via a Wi-Fi connection through a Wi-Fi-enabled device that we already own, or in the next communications device we will own, including cell phones.

This proliferation of Wi-Fi-enabled laptops, PDAs, and cell phones and the low cost of Wi-Fi adapters create an enormous potential pool of users. By the end of 2005, analysts' numbers predict the number of Wi-Fi devices to be around 130 million, with that number tripling by 2007 to 400 million. During that same period, mobile WiMAX devices will just begin to hit the market.

With a Wi-Fi access network, a separate CPE is not required for end-device connectivity, allowing some carriers to combine Segments 1 and 2. The user devices direct connection makes the availability of appropriate subscriber devices paramount. The cellular model enables this through subsidies for mobile phone purchases in return for contractual commitments.

Enterprises Will Not Deploy WiMAX. They Will Continue Using Wi-Fi (802.11) and New Standards

For the next several years, two factors make WiMAX a bad choice for the enterprise: (1) the lack of availabile WiMAX-enabled PC/Laptops, adaptors, and access points; and (2) the lack of adequate, available WiMAX bandwidth from each channel.

Within the developed regions of the globe, wiring for fixed systems along with the switched infrastructure is frequent, so wireless connectivity is used for specific vertical industries and/or applications. Organizations and groups with a high percentage of laptops now demand wireless connectivity in all of these instances, the vast majority of which are Wi-Fi enabled and will not be WiMAX enabled until the end of the decade. Initially, WiMAX will offer between 7 and 11 mbps per radio. Wi-Fi will more than meet and exceed the WiMAX throughput with current .11a & g, and even more so with 802.11n on the way.

Conclusion

Through the end of the decade, WiMAX will predominantly be used as a high speed backhauling technology. The type of carrier and the applications planned for use will play a major factor in the utilization of WiMAX, which will begin mostly in fixed wireless architectures. The carrier also needs to procure access to WiMAX-licensed spectrum to utilize WiMAX as a benefit over Wi-Fi. Wi-Fi mesh will provide deployment capabilities where a star topology and tower mounting are not practical, expanding the practical applications of mesh. Depending upon the type of Wi-Fi mesh equipment being used, it can offer more flexibility in deployment scenarios, too. While there is clearly some overlap, to a large extent WiMAX and Wi-Fi mesh will work together in complementary deployment scenarios. In all cases, the use of Wi-Fi, no WiMAX, for end device user access will dominate for the next 5 years.