



WiMAX Opportunities in the Broadcast Environment

A White Paper From WireIE's Office of the CTO

What is WiMAX and Where Does it Fit into Today's Wireless Broadband

WiMAX¹ is a fully integrated companion to the widely adopted Wi-Fi² wireless broadband technology found in homes and businesses around the world. While Wi-Fi was developed to cover small areas such as a home, coffee shop or office floor, WiMAX is intended to deliver 'last mile' wireless broadband access over large coverage areas – typically as an alternative to Cable and DSL (Digital Subscriber Line). Put another way, Wi-Fi is analogous to the cordless phone, whereas WiMAX is analogous to a macro wireless Personal Communications (PCS) network.

Opportunities for the Broadcaster in Deploying WiMAX

FM and television broadcasters have an inherent opportunity to leverage their tower investment by collocating WiMAX base stations and antennas. Much like FM and TV, WiMAX is a line-of-site or near line-of-site radio frequency technology. As such, fundamental coverage objectives of the broadcaster and WiMAX operator are aligned to a large degree.

In addition to being a last-mile customer access technology, WiMAX is also a viable backhaul solution for linking disparate elements in a network. For example, the radio station Studio-Transmitter Link (STL) payload (including primary audio, SCMO content and RDS data) could be delivered across the WiMAX backhaul. WiMAX's extensive flexibility in predefining a Quality of Service (QOS) for a given class of traffic would allow the station to configure the STL payload as highest priority.

In addition to the core engineering opportunities associated with a broadcaster-operated WiMAX network, there are a number of user (listener/viewer) oriented opportunities arising from such a marriage.

- The splash page greeting a WiMAX subscriber could display station promotions and upcoming events dynamically.
- Visitors via the WiMAX network could be provided with Google Ads (or other Ad-sense services) strictly from the station's advertisers.
- VLAN (Virtual Local Area Network) capabilities within the WiMAX network could be used by the station's advertisers for on-site promotions. For example, a customized splash page for a coffee shop could be presented. The promotion could include free or discounted use of the station's WiMAX network while logged on to the coffee shop's VLAN.
- A VLAN could be configured on an advertiser's premises whereby the station's feed is run through the store audio system. Any commercial breaks could be bypassed allowing content specifically targeted at store visitors to be played.
- The WiMAX network could be used to deliver high quality audio and control signaling for remote broadcasts.
- For newsgathering, high quality audio dispatches from the field could be delivered using the WiMAX network.
- The WiMAX network could be used for Webcam connectivity where wired ISP access is not possible.

¹ "Worldwide Interoperability for Microwave Access" and is standardized under the IEEE as 802.16-2004 and 802.16-2005. Whereas Wi-Fi is completely unlicensed, the WiMAX standard(s) support both licensed and unlicensed deployment.

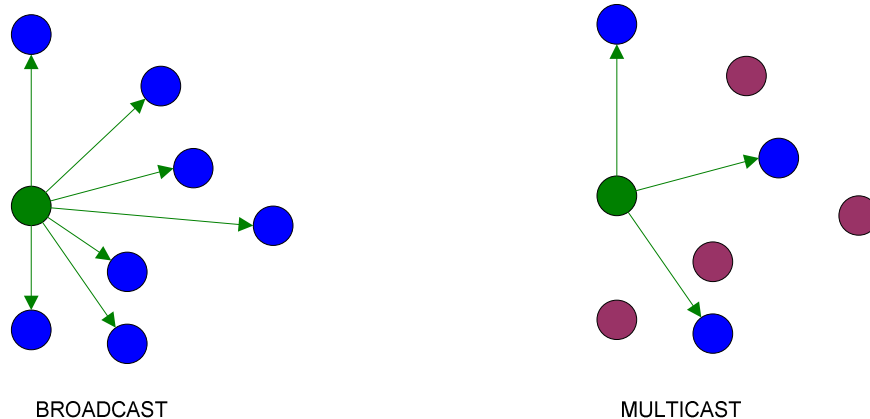
² Standardized under the IEEE as: 802.11a, 802.11b, 802.11g & 802.11n

Delivering Premium Content Using a WiMAX Single Frequency Network

WiMAX can be used as a digital broadcast mechanism through a Single Frequency Network (SFN). This approach assumes a simplex downlink where data (in this case the multimedia content) is streamed to the user through multiple base stations on the network, all using the same RF channel. The protocol assumes the user need not transmit acknowledgements back to the base station as would be the case in interactive duplex mode applications such as web browsing or email activity. Unlike conventional analogue broadcasting where a single site typically transmits the content, multiple WiMAX base stations transmit the content – all using the same RF channel.

Not only does the SFN approach optimize spectral efficiency, it also makes user transition from one sector to another virtually seamless. The SFN approach has never been feasible with conventional analog broadcasting modulation techniques (and most digital telephony modulation schemes) because of issues around co-channel interference³. The WiMAX modulation scheme, known as OFDM (Orthogonal Frequency-Division Multiplexing) is conducive to an SFN because the modulation is spread spectrum, making co-channel interference a non-issue.

A variation on the broadcast model is what is known as multicast. Whereas broadcast assumes a one-to-all model, multicast assumes one-to-many. Business cases for multimedia would determine the suitability of one model over the other. The two are contrasted on the following page.



Linking the WiMAX Base Stations

A core IP (Internet Protocol) network is required to provide WiMAX base station connectivity back to the internet. This core network also houses billing and authentication, along with other administrative services. Interestingly, WiMAX is sufficiently robust to provide the actual backhaul link from the broadcast tower to the point of presence where the core IP network resides – typically at the studio. This eliminates the need for costly fiber or microwave backhaul.

³ Some FM radio broadcasters use two or more carefully situated synchronized co-channel transmitters – usually with mixed results. Topological isolation is critical and the inevitable ‘contention zone’ between transmitters is usually rife with co-channel interference. Variations in propagation due to seasonal ‘ducting’ in the troposphere further aggravate the situation.

Potential Constraints for the Broadcaster

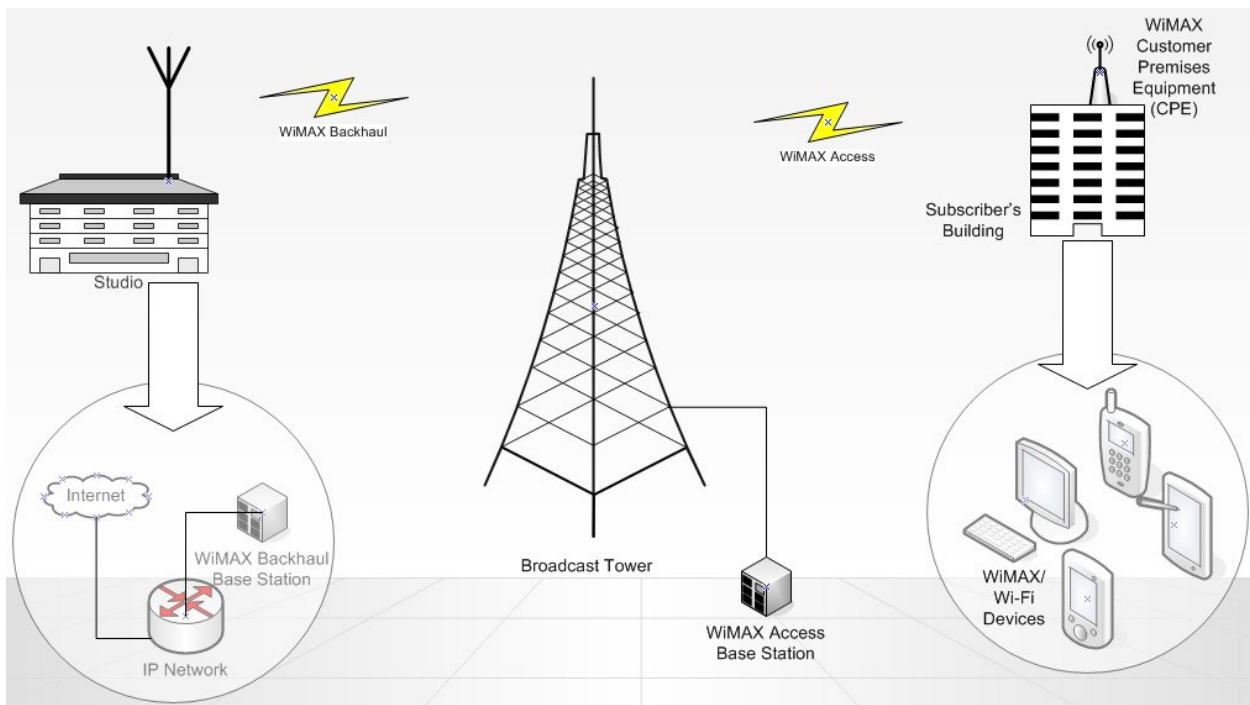
By design, the large coverage footprint of a FM/TV transmitting tower reaches a substantial, concentrated population. Depending on the objectives (both technically and commercially) of the WiMAX business, the vast reach of the broadcast tower may mean demand for WiMAX services within the coverage of the tower could exceed the capacity of the base station.

In addition, microwave frequencies used in WiMAX, combined with the duplex nature of a WiMAX session (i.e.: subscriber-to-base station/base station-to-subscriber) results in a less forgiving radio frequency link budget when compared with a conventional FM or TV broadcast signal. These capacity and coverage constraints are typically addressed by deploying 'filler' sites within the coverage contours of the broadcast tower. On the assumption coverage is satisfactory and an increase in capacity is the only requirement, a third option could be to overlay a second WiMAX network on a different frequency band on the existing broadcast towers.

Impact of Broadcast Signal on WiMAX Base Station Receiver

With the high Effective Radiated Power (ERP) emanating from an FM/TV broadcast tower, the subject of WiMAX receiver de-sensing should be explored. WireLE is qualified to assess whether such a risk is actually present or not.

WiMAX/FM Broadcaster Collocation: High Level Network Topology



Conclusion

The concept of leveraging existing broadcast infrastructure in offering fixed point-to-multipoint WiMAX services is compelling. WiMAX can create new revenue streams and reinforce the station's brand in exciting, innovative ways.