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ASK THE EXPERTS

Technical Issues in the Debate Over WMAN (Wireless Metropolitan Area Networks)

Editor:

I hear a lot of claims and counter-claims regarding the ability of WiFi and WiMAX to deliver useful service in a downtown or city-wide network. Are there good technical reasons for these questions, or is the "discussion" based more on competitive motives? This tone is hard to miss in some of the published comments I've seen.

I prefer not to have my name published, since I have clients on different sides of this debate.

There are Both Technical and Political Issues

You are correct in seeing the competitive issues. We prefer to describe them as "political" since some arguments are about private versus government-operated services, and others are clearly "turf battles" not based on any well-defined economic competition.

For this discussion, we will focus on the technical issues that are also part of the debate.

First, the discussion involves the growing use of mobile/portable computer communications—Internet access wherever the user wants it. WMAN is one of the areas where convergence is underway—bridging the gap between localized WiFi access points and the much wider range of mobile communications using 3G cellular data communications capabilities.

The arguments are basically this: the 3G wireless operators claim that WiMAX cannot provide the service quality that is promised by the IEEE 802.16e mobile standard, while the WiMAX advocates claim that the data rates experienced by 3G users will be much lower than the service providers are advertising. Both arguments are partially true.

For example, a 3G provider may suggest that their systems will provide 500 kbps data rate, but this is a peak rate. Heavy system loading and poor signal quality for a given connection will cause a reduction in data rate that may be substantial. In areas of good coverage and off-peak traffic, users will experience data rates that approach the maximum.

With mobile WiMAX, the performance issues are related to coverage area. Most WMAN systems are being designed to support WiFi access, with WiMAX providing a wireless network backbone to avoid the need for a wired connection to each WiFi hub. WiMAX also provides user access to the network from areas without local WiFi connectivity. Also, because WiMAX (fixed version) provides very high speeds, it can deliver performance that is competitive with DSL and cable modem technologies.

However, WiMAX/WMAN promoters want to address the largest possible potential market. First, these systems will be deployed where other high speed access options are already in place. And the number of laptop/palmtop computer users is just a fraction of the mobile communications marketplace. The answer from a competitive point of view was mobile service, which is the reason for the "e" version of the standard.

Nearly all of these systems will operate above 2.5 GHz. As frequency increases, reliable mobile communications becomes more difficult as the shorter wavelengths increase the detrimental effects of multipath—the distance between cancellation points in the interference pattern is smaller, and smaller-size objects can reflect the signal, increasing the number of reflections.

Next, WiMAX systems are being designed with the minimum necessary base stations, since WiFi will often provide the equivalent of close-spaced cells or microcells. The longer distance from user to base station increases the likelihood of a poor propagation path or a problematic multipath environment.

Orthogonal frequency division multiplexing (OFDM) modulation mitigates the multipath problem, but does not eliminate it. Future expansion may add base stations, but this will not help coverage issues in new deployments that must prove themselves in the marketplace.

Looking ahead, it is clear that some time in the future (timetable unknown), convergence is unavoidable. A common thread in discussions of what "4G" wireless communications should be includes a multitiered, multiformat approach that uses all the available wireless systems. A user will have a device that automatically selects the best available service route from WiFi, WiMAX, cellular, UWB, Bluetooth—connected fully wireless or through a DSL, cable modem or T1 line, and maybe even satellite services. The technical challenges are significant, but identifiable and solvable. All that's needed is money, which always brings that argument back to the marketplace.

Summary

Yes, there is some exaggeration and hyperbole among 3G and WiMAX/WMAN proponents, but it may all be moot in another 10 years, when the diversity of services evolves to the next level.