



Wireless Broadband Utopia: Are We There Yet?

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The pieces appear to be falling in place for wireless broadband: Sprint Nextel says its next-generation high-speed network will be launched in a few markets by the end of 2007. Intel plans on embedding so-called "WiMAX" enabled semiconductors in laptops by the end of 2008, and the Federal Communications Commission on May 1 approved a laptop device that will receive WiMAX signals from a company called Clearwire. Other companies, such as T-Mobile, are supporting hybrid wireless networks so devices can hop between technologies.

Although these developments could be the Next Big Thing in broadband wireless access, it's too early to say where this will all end up. For years, the industry has had a crystal clear vision of how users will connect to the Internet in the future: High-speed wireless devices will allow consumers to watch videos, share pictures, socialize and do many activities that haven't even been thought up yet. The big unknown is when technology -- or a combination of technologies -- will make that vision a reality.

Kendall Whitehouse, senior director of information technology at Wharton, sums up the current state of affairs. "The long-range future vision is very clear and a virtual certainty. At some point, you will be connected with a broadband link everywhere you go by devices that are always on. The question is: How are we going to get there?"

There seem to be three possible answers: the expanding network of WiFi "hotspots," the emerging WiMAX standard or 3G (third generation) cellular wireless data services. However, the eventual answer could be none -- or all -- of the above.

The now familiar Wi-Fi ("wireless fidelity") networking can send high-speed wireless signals over short distances and is commonly used to provide wireless Internet access in homes, businesses, hotels, cafes and other wireless "hotspots." In comparison, WiMAX, which stands for "worldwide interoperability for microwave access," is a standard that allows wireless signals to be sent over long distances. WiMAX is broadcast from towers that can cover up to 3,000 square miles. The hope is that WiMAX could replace broadband lines running into a home much like cell phones have begun to replace landline telephones. Indeed, chipmaker Intel is embedding WiMAX capabilities into some of its semiconductors.

Another option comes from telecommunications providers such as Verizon and AT&T Wireless/Cingular. These companies are using 3G wireless cellular networks to offer broadband and multimedia services, such as Verizon's and Sprint's, which use the EV-DO (evolution-data optimized) wireless data standard.

Wi-Fi -- which operates, on its smaller scale, much like WiMAX -- remains popular and is being championed by numerous municipalities as a way to offer inexpensive broadband service. Several cities, including Philadelphia, Pa., plan to place Wi-Fi access points on telephone poles to network much of the population.

In the end, none of these contenders is perfect, and it isn't clear exactly what will pave the way to what



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the Yankee Group, a research and consulting firm, calls the "Anywhere Consumer" -- someone who is always tethered to the Internet for commerce and communication. Wharton business and public policy professor [Gerald Faulhaber](#) says wireless networks are unpredictable by nature, and that can put business models in flux. "No one knows what [wireless broadband access] is going to do, how well it will be received or how well it will work," he says.

Wi-Fi is the well-known technology, but can only do so much, Faulhaber adds. WiMAX is largely unproven and "hasn't developed as quickly as we initially thought." Cellular providers' wireless broadband services, he notes, can only go so fast because their networks have to allocate bandwidth for phone calls.

This hodge-podge of wireless broadband technologies means that it may take a while for any of them to win -- even if a winner eventually emerges. A more likely outcome is some sort of hybrid where consumers, armed with smart computing devices, go back and forth between various ways to access the Internet wirelessly.

T-Mobile is reportedly trying just such a hybrid approach. The *Wall Street Journal* reported on May 3 that T-Mobile is running a trial called "HotSpot at Home" where mobile phones can use Wi-Fi access points for a fee. These phones would be able to hop between T-Mobile's traditional cellular network and Wi-Fi "hotspots" to extend its network coverage. T-Mobile has a bevy of hotspots in locations such as airports and Starbucks outlets.

"There is no one perfect wireless technology, thanks to the laws of physics and the laws of economics," says Wharton legal studies and business ethics professor [Kevin Werbach](#). "We need to stop thinking about wireless connectivity as all-or-nothing. Going forward, most of us will use multiple wireless connections in different situations, without necessarily realizing it."

[Kartik Hosanagar](#), an operations and information management professor at Wharton, agrees that it's likely the wireless broadband hodge-podge will continue. "I would not be surprised if no single technology wins within the next five years," says Hosanagar. "Different providers may use different technologies, and consumers may not" be aware it's happening.

While the wireless technology landscape is muddled, the end game is clear. Wireless broadband is expected to enable new applications and services for consumers. In a March report, Yankee Group analyst Boyd Peterson outlined how this next-generation consumer would navigate the wireless landscape. Most of America will join the ranks of the "Anywhere Consumer" who wants to get to the web "in the fastest, most economical way possible, whether through sharing an Ethernet cable or Wi-Fi connection at a friend's house, at a coffee shop, in a park or at the airport. The Anywhere Consumer's use of BlackBerry devices or smart phones is an early indicator of what's to come," writes Boyd, adding that these untethered consumers would then buy and sell goods, communicate and share information from any place.

WiMAX: Is There a Business?

The current darling of the wireless broadband parade is WiMAX, which is backed by a number of major companies, including Intel. The semiconductor manufacturer announced on April 18 that processors for notebook PCs and mobile devices will have WiMAX built in by the end of 2008. Cellular communications pioneer Craig McCaw is also placing a big bet on WiMax through a wireless Internet access company he founded called Clearwire. As of March 30, according to McCaw, Clearwire had 258,000 subscribers worldwide. The company recently completed an initial public offering. On May 1, the FCC approved a laptop card to get Clearwire's WiMAX signals.

Clearwire's IPO indicates some level of support for WiMAX. In a report forecasting the growth of WiMAX, research and consulting firm Gartner Dataquest estimates that the size of the North American WiMAX market will increase from about 30,000 connections in 2006 to 21.2 million in 2011. Thus far, Clearwire has targeted mid-sized cities and rural areas. Merrill Lynch analyst David Janazzo notes that Clearwire's service today primarily competes with digital subscriber line (DSL) technology, which is slower than cable access, and Verizon's [new fiber optic network](#).

According to Hosanagar, Clearwire has a fighting chance as a service provider. "There is definitely a

business here. I buy the value proposition of a truly mobile broadband wireless network. [But] the technology is yet to mature to the point where the cost is sufficiently low and devices sufficiently small. When it gets there, this will reach a tipping point. So, the question in my mind is whether Clearwire can stick around long enough. Given the money it has managed to raise, I think it can." Clearwire raised \$600 million on March 8 in an initial public offering priced at \$25 a share. Shares closed May 14 at \$17.30.

If Clearwire doesn't succeed, other telecommunications companies could. Sprint Nextel said in August 2006 that it would build a new wireless network -- dubbed by Sprint Nextel officials as "4G" and based on WiMAX technology -- with Intel, Samsung and Motorola. "None of us today can envision our lives without wireless connectivity or the Internet," said Sprint Nextel CEO Gary Forsee in a statement announcing the ne

Faulhaber says the Sprint Nextel effort is a feather in WiMAX's cap, but there are still difficulties. WiMAX's big selling point is that it can use one antenna to send a wireless broadband signal. However, as Faulhaber notes, one antenna has to feed a large number of Internet users and, as a result, can lead to congestion. For instance, a large city with a WiMAX network could have a large number of residents vying for access on the same antenna. "With WiMAX, you need a lot of bandwidth. That's Clearwire's problem. It can cover the whole town, but they still need more bandwidth."

Both Hosanagar and Faulhaber suggest that the WiMAX engineering issues will be figured out. The question is whether Clearwire, which lost \$284 million in 2006, will be the one to do it. "My one worry about Clearwire and other similar firms is that they bet big on being first movers. I think that the case for first mover advantage is somewhat weak in the broadband wireless space," says Hosanagar. "There is limited opportunity for differentiation from an operator's standpoint. So, when the big guns -- Verizon, Sprint, Comcast -- start firing, what will help Clearwire retain customers?"

Indeed, Sprint's Forsee said during the company's first quarter earnings conference call on May 2 that its WiMAX deployment is making "solid progress," adding that the company will unveil its business plan and rollout schedule for the WiMAX network this summer. Sprint will launch its WiMAX network in Washington D.C. and Chicago in late 2007 and "will be in more than 20 markets by the end of 2008," Forsee predicted.

Can Existing Cellular Services Deliver?

According to Whitehouse, before the WiMAX bandwagon fills up, it might be prudent to examine cellular wireless networks, and what companies like Verizon and AT&T/Cingular are providing today with 3G networks. "The telecoms are closest to offering ubiquitous wireless broadband now. If you are on an unlimited data plan, you get pretty good wireless access nationwide," says Whitehouse. "It may not be the fastest or the cheapest, but it's available nearly everywhere."

The cellular networks work well for on-the-go Internet access, adds Faulhaber, but they are limited in terms of speed because these networks operate on frequencies auctioned by the FCC. The issue: There's only so much spectrum the FCC makes available on the cellular phone frequency. "They just don't have bandwidth and there hasn't been new bandwidth for five years," he says. "That means you have voice and data traffic. They [the telecom carriers] have engineered a way to deliver wireless broadband, but it's limited."

Hosanagar agrees. "3G does not fully address the needs of a metropolitan area broadband wireless service." Moreover, 3G's limitations will be critical as video is increasingly shuttled around the Internet, Werbach adds. "Already, wireless operators touting the data capabilities of their 3G networks are having trouble coping with video and other high-bandwidth uses."

Faulhaber points out that the wireless data networks deployed by the likes of Verizon and Sprint Nextel were expected to merely complement voice service. Instead, they have become another way to access the Internet. Now carriers have to choose between voice and data services as they manage their networks because bandwidth is limited.

Furthermore, confusion is likely to reign among cellular networks, which use several different standards worldwide. Wireless equipment suppliers are pushing their own technologies. Qualcomm, for example,

is demonstrating a technology called ultra mobile broadband, or UMB, an upgrade to its code division multiple access (CDMA) standard. Asian and European telecom companies have their own standards, gravitating toward one called high-speed downlink packet access (HSDPA).

Hybrid Approaches

Given the lack of clear-cut winning technologies, chances are good that the consumer Peterson highlighted will have to make use of a combination of services. For instance, WiMAX will be used to supplement current cellular networks, Hosanagar predicts. And WiMAX and cellular networks will continue to evolve. Meanwhile, T-Mobile's joint cellular and Wi-Fi network could be a precursor of services to come. Whitehouse believes this idea has merit, but stresses that success depends on how well the hybrid services are integrated. "A solution that combines WiFi with 3G cellular may provide the best of both worlds." Whitehouse states, "But the devil is in the details. The service needs to seamlessly switch between the different networks. It will succeed only if the underlying patchwork of networks is completely invisible to the user."

Assuming that the technology hurdles with next-generation wireless broadband networks can be overcome, there are a few unanswered questions to be addressed. What will consumers do with ubiquitous Internet access? What will the so-called killer applications be? And will these wireless services be priced low enough for most consumers to afford them?

Peterson notes that many of the favorite items on the Internet -- socializing, sharing pictures and watching videos -- will be moved to every device once the technology hurdles are worked out. Whitehouse argues that ubiquitous online access will introduce a new generation of devices to take advantage of the service. "Once you're always online, you'll be doing more than sending short text messages on your phone or tapping out brief email replies with your thumbs on your BlackBerry. I think you'll see new, vest-pocket sized devices with full keyboards that allow you to do everything you now do from your desktop while you're on the go," he says.

Key to this will be new devices that can navigate various technology standards in a way that's invisible to the consumer. After all, the Anywhere Consumer doesn't want to get hung up on an alphabet soup of wireless standard acronyms. "Supporting the range of wireless uses, from real-time video to reliable messaging, will require a patchwork of different technologies," says Werbach, "And don't discount the dark horse potential of [new] alternatives."

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