Broader Broadband

Yet another flavor of Wi-Fi is coming, and it will be the fastest one yet

By Steven Cherry

You can never be too rich or too thin, as the saying goes. And for networking, you can never be too speedy. Unfortunately, to date, no wireless standard has been fast enough to send large files around the home. So if you want to send movies from your personal video recorder to your television, for example, you have to place the two near each other and add yet another cable to an ever-growing thicket.

That's about to change, at least for values of "about" that include "in about two years." A year-old task group within the IEEE's 802.11 local-area networking committee, designated "TGn" has begun reviewing proposals for a new flavor of Wi-Fi, as the standard is more popularly known, that would double data rates from the current top speed of 54 megabits per second specified by IEEE 802.11g. The planned 802.11n standard aims to have a top speed of 540 Mb/s. That's faster than even the new USB 2.0 wired standard. Currently, there are four complete proposals before the task group, as well as 38 partial ones.

The IEEE won't have an approved TGn standard until November 2006 at the earliest, but manufacturers aren't waiting. In late October, Belkin Corp., a Compton, Calif., maker of wireless networking equipment, was the first to jump the gun by shipping to CompUSA and Staples stores laptop cards and transmitter/receivers that incorporate some of the technology proposed for 11n.

Belkin's pre-release announcements called the new equipment "pre-11n." That raised a few hackles at the Wi-Fi Alliance, an industry association that works with the IEEE committee. The alliance is concerned that Belkin and other manufacturers will create early products that won't be compatible with one another. In response, Belkin, which was using the phrase "pre-11n"—without saying "IEEE" or "802"—as late as August, is now using the even more obscure term "pre-n."

Belkin's products are based on some fundamental radio innovations by a Palo Alto, Calif., start-up, Airgo Networks Inc., which is a member of a clutch of companies behind one of the complete 11n proposals. Known as WWiSE (World Wide Spectrum Efficiency), the companies include Broadcom, Conexant, STMicroelectronics, and Texas Instruments.

PHOTO: GETTY IMAGES; PHOTO MANIPULATION: MICHAEL R. VELLA

ANOTHER PROPOSAL comes from a group calling itself TGn Synch. It contains two chip makers, Atheros Communications Inc., in Sunnyvale, Calif., and Intel, as well as some heavyweights from the consumer electronics world—Matsushita, Philips, and Sony.

As it turns out, the TGn Synch scheme incorporates the same innovations as the proposal from WWiSE, something known as MIMO—short for multiple input, multiple output—which is a way of sending two or more streams of data down the same radio channel. So do the other two complete proposals, one of which is from Qualcomm and the other from Motorola and Mitsubishi. All four approaches use orthogonal frequency-division multiplexing, an increasingly popular form of spread spectrum that reduces distortion and RF interference by transmitting over a large number of precisely defined frequencies.

The largest difference is that the WWiSE proposal defines the same 20-megahertz-wide channel that current Wi-Fi standards (IEEE 802.11a, b, and g) use. The three other camps propose to bond two such channels into a new width of 40 MHz. Doing so nearly doubles data rates—from a WWiSE top rate of 135 Mb/s to TGn Synch's 243 Mb/s. But this comes at a cost. "If you use more channels, any single link can get a higher data rate," says Airgo's chief scientist, V. K. Jones. "But that channel becomes unavailable to others."

A pair of nearby wireless local-area networks, in an office, in an apartment building, or at the mall, can avoid interfering with one another only by using nonoverlapping channels. Jones's concern, then, is that there will not be any nonoverlapping channels available.

He isn't worried, however, about proposing lower speeds than his competitors, because MIMO contains other ways to move data more quickly. MIMO gets its supersonic data rates by exploiting a loophole in some fundamental speed limits of information theory, first discovered by Claude Shannon in the 1940s at the old Bell Telephone Laboratories.

These speed limits govern the maximum amount of data that can flow between two antennas. The loophole is simple, although exploiting it in silicon and software is complex: increase the number of antennas. Thus, all the TGn proposals use at least two antennas for every Wi-Fi device. Today, routers usually have a pair of antennas, but a laptop's Wi-Fi card has only one. Belkin's pre-n cards, on the other hand, have two antennas, and the routers have three.

And why stop at three? All of the TGn proposals have an optional mode that uses four transmitting antennas at both ends, for an optimal data rate of 540 Mb/s. Such speeds will put 11n in the range of another standard being worked on within the IEEE, 802.15.3a, better known as ultrawideband.

Ultrawideband achieves its high data rates by ranging across more of the spectrum than radio transmission generally employs. It avoids interference issues by, among other things, using as little power

as possible. But that reduces its range.

"Ultrawideband is a same-room technology," says Jones. "I have a TiVo personal video recorder downstairs in my home. How cool would it be if I didn't need a second one upstairs, if an Airgo chip in the TiVo could send video to a TV that's upstairs and three rooms away? With 11n, we should be able to deliver even high-definition television to any room in the house."

It's a little early to short-sell your TiVo stock based on the arrival of 11n. Frank Hanzlik, managing director of the Wi-Fi Alliance, in Austin, Texas, notes that the earliest the industry could move certified 11n products out the door is late 2006. The alliance helps 802.11 chip and appliance makers test their products for conformance with the standard and for interoperability with one another.

The alliance starts, in other words, where the IEEE standards process leaves off. And the IEEE group, which meets every six weeks, won't be leaving off for a while. In November 2004, TGn began to winnow down the proposals. Next comes the actual drafting of the specification, and finally ratification. The alliance will start on its test and interoperability suites in 2005 so that they're ready by the time 11n is complete.

Hanzlik notes that the latest Wi-Fi flavor, IEEE 802.11g, was released early, but not nearly as early as Belkin's pre-n. "With 11g," he says, "there was a mild jumping of the gun. Products went to market within six months of the standard being ratified. With 11n, given that it's two years out, there's the potential for confusion." ■

Putin Acts, Taiwan Reacts

With the Kyoto Protocol taking effect, Taipei seeks to get into step

Russia's ratification of the Kyoto Protocol on climate change has sent ripples around the world, with effects being felt especially in places where emissions trading systems are being established. Russia's accession to the agreement means that the protocol takes effect this year, requiring signatory states to reduce their greenhouse gases back to below 1990 levels by 2012.

The effects of Russia's action are also, however, being felt in some unlikely places—among them Taiwan, a country that's not even a party to the Kyoto pact. The island state, so long a dependent satellite of the United States, ironically has adopted a position on Kyoto that is almost the mirror image of the U.S. attitude. It is outside the protocol not because it wants to be—in fact, it would much prefer to join—but because for three decades it hasn't been allowed to be part of the U.N. system. (The agreements that brought the People's Republic of China into the United Nations left Taiwan out in the cold.)

Generally, Taiwan complies with international treaties, especially those pertaining to the global environment, because it wants to be seen as a world citizen in good standing. With the Kyoto Protocol in place, it