Kiss Those Cables Goodbye?

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Some folks start talking wireless and you can almost see visions of connected homes dancing in their heads: Video, phone calls, and network packets enter through a single box, from either the cable or satellite company. From there, five TVs receive high-definition video from a variety of sources, including a digital video recorder, the Internet, a PC, a game console, and a digital video camera, all without wires. The surround-sound system also connects wirelessly. And it's all controlled by a single remote in each room.

To hear such folks talk, we're even now stepping into a wireless nirvana; products will hit the market by the end of this year. Others flat-out scoff.

"There's nothing on the horizon that could possibly do all that," says Mark Bowles, cofounder and vice president of business development for Staccato Communications, which makes silicon chips with some of that potential. "You need a whole lot of bandwidth, and you need to transmit it at fairly high power."

Bandwidth and power: Those are the essential hurdles in the way of full integration of home wireless systems. And as always, the reality is pretty murky, with no clear paradigm, standard, or solution rising above the others. Some companies think ultra-wideband (UWB) radios have potential for high-definition video transmission. Also known as wireless USB, UWB is making its debut in the marketplace as a wireless connection platform for computer peripherals, including cameras, keyboards, and the like. But last winter, an Israeli company called Amimon introduced its Wireless High Definition Interface as an alternative standard. And following in its wake are a variety of people developing WirelessHD.

Three ideas, none perfected and none currently on the market? That suggests a strong probability of a standards war. "Absolutely. I can guarantee it," says Bill Rose, cochair of the technical workgroup for the High-Definition Audio-Video Network Alliance, or HANA. Rose also chairs the home networking committee at the Consumer Electronics Association. But don't worry, he smiles. The standards war "won't be portrayed to the user. We'll do our best to hide it." — next: Why Wireless Anyway?

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Why Wireless Anyway?

The issue is far murkier, of course. For starters, standards for transmitting video over wires are hardly ratified or consistent. HDMI, for High-Definition Multimedia Interface, has become the de facto standard (ignoring the minor difference between HDMI 1.0 and 1.3, of course). High-def TV sets have one, two, or even three ports. True HDMI is a single point-to-point connection over a cable, with a chip at either end of a link that lets components speak to each other. It can instantaneously and securely transmit an uncompromised high-definition video signal from any of various units, such as a set-top box, DVR, PC, or game console, along with as many as eight channels of digital audio.

Wired connections—particularly HDMI—have significant advantages. They are very fast, practically instantaneous—an important issue for hard-core gamers, for whom even a 5-millisecond delay can make the difference between winning and losing. HDMI initially transmitted at 5 Gbps; the newest generation (version 1.3) transmits at 10 Gbps. And wires are secure: Thanks to HDCP (High-bandwidth Digital Content Protection—the standard used by HDMI to encrypt the signal) piracy becomes exceedingly difficult. Content providers, such as broadcast networks and cable or satellite providers, want that security to protect their

business.

But the downside of wires we know all too well. It starts with the rat's nest of cables behind the entertainment center. HDMI connectors alleviate that nest somewhat by transmitting both audio and video data. But that isn't going to help much if the cable guy installed your jack on the worst wall in the house in the first place, forcing you to run tons of cabling. Nor can it connect different set-top boxes in other rooms or cut into the time you spend hunting down the movie you want after someone's put it back in the wrong place.

Wireless networking alleviates most of these issues. There's no rat's nest of cables. Components can be neatly tucked away in different parts of a room, since they no longer need to be wired together. And then there's the holy grail of wireless networking—room-to-room transmission of signals, so that you can play the latest version of Final Fantasy either in the basement rumpus room or in the living room—never mind that the PlayStation itself is downstairs and across the house.

Wireless networking also opens up the possibility of networking more peripherals into the family entertainment system, including video and still cameras, Internet TV streams, and your PC itself. There's just one problem: Making any of this happen at all. — next: WirelessHD: In the Airstream

WirelessHD: In the Airstream

The ultimate challenge that must be overcome is how to move a high-definition video signal's vast amount of data through the air without latency or loss of quality, and then how to move it through walls and all the different materials that walls are made of—without moving it into the house next door.

If the wires could replace themselves, they'd opt for the dark horse: WirelessHD. "We've always been big proponents of the idea that uncompressed is better," said Joseph Lee, the HDMI technology evangelist for HDMI Licensing, LLC. That's why Lee is looking to the WirelessHD solution, which uses the 60-GHz spectrum to transmit uncompressed video over short distances.

"Our first specification will achieve an actual data rate of 3 Gbps," says Lianne Caetano of the WirelessHD Consortium, which counts manufacturers LG, NEC, Panasonic, Samsung, Sony, Toshiba, and SiBeam (the company actually making the product) among its members. "It's the only true uncompressed wireless video. There's no latency. Every pixel is sent, bit for bit, pixel for pixel."

But such bandwidth doesn't come without trade-offs. For one thing, at 60 GHz, waves donw't move through walls very easily, nor do they go very far. At 3 Gbps per channel, they're packing a whole lot of data into each wireless pulse, shortening the range. It's like a conversation with a fast talker who's right next to you. The more bits packed into a given area, the more sensitive a receiver you need.

In addition, that wavelength of data has problems with interference. "60 GHz is stopped dead by a person blocking the path," points out Stephen Wood, president of the WiMedia Alliance. His group works with the UWB platform, although Wood says it has plans to embrace WirelessHD technology eventually. Still, "you would have to ensure a clear line of sight," he says with a shrug.

Caetano counters that a smart WirelessHD antenna is in development that will not only overcome this problem but help move the signal around an entire house as well. She believes that the limitations of the 60-GHz spectrum work in its favor, in terms of security. Higher radio frequencies are not only shorter in range, they are more focused directionally. Caetano compares the omnidirectional signal of 802.11 Wi-Fi to a donut, while the 60-GHz signal is more like a flashlight beam. There's less likelihood that receivers in the apartment upstairs will pick up your signal. — next: The Leader Board: UWB and WHDI

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The Leader Board: UWB and WHDI

The other challenge WirelessHD faces is that its development is well behind the pace set by ultra wideband, although Caetano says she can't comment on individual projects. "We're not far behind," she says, estimating that companies are only a few months from prototypes. Wood, however, believes that WirelessHD is still way behind. "I don't see it coming to market within three years. Five years is more like it," says Wood, who is also the UWB technology strategist for Intel.

Ultra wideband not only has the jump on WirelessHD but also uses technology, previously developed by the military, that is already in production and expected to hit the marketplace soon. Using the 50-GHz frequency allows a huge amount of data to be transferred quickly over a short distance, but to get video through, the signal must still be compressed.

"There's really no way to do video wirelessly without compression," says Matt Keowen, senior director of marketing for Tzero Technologies, one of the major forces behind UWB. While UWB can transfer huge data

files very quickly, the problem for video is isochronous applications, such as the streaming required for gaming.

Tzero's solution is to use a milder form of compression, JPEG 2000. "With MPEG, you're going to get all that macro blocking on the screen," Keowen notes. "With JPEG, the picture will soften a little bit." Tzero is also working on latency, compression's other disadvantage. "Right now, we are hovering in the range of a 50- to 60-millisecond lag, which is still a little slow," he says. "By the time we get commercial products in broad distribution this year, it's not going to be a problem."

Currently UWB can transmit at 480 Mbps. "We will increase the throughput to over a gigabit," claims Wood. But he conceded that this is still a relatively low throughput when you've got some video requiring 10 to 12 Gbps. Security and content protection also remain a problem, but, because of its short range, UWB is fairly hard to pick up by outsiders. Still, concerns from service operators and broadcasters about content protection are slowing down development.

Keowen expects to see TVs with UWB at the 2008 Consumer Electronics Show, along with a host of laptops and other peripherals containing the radios on the market around the same time. Amimon is expecting the same thing for its WHDI technology, which uses a specialized video modem working from 802.11n technology to transmit the signal. The company claims to send video at 3 Gbps over the 5-GHz band used by 802.11.

"The rest of the industry uses a data modem," points out Noam Geri, Amimon's cofounder and vice president of marketing and business development. WHDI takes a video signal and prioritizes data. "The more important video information gets slight priority, and the result is a very efficient modem that can deliver very high rates of video," he says. And the range of that signal, since the modem is working off the 802.11 platform, is pretty much the same as that of regular Wi-Fi.

"We did a demo with Sanyo, with a 720p projector and uncompressed video over 20 meters. We put it side by side with the wired. Not only is there no delay, there is no degradation in quality," Geri says proudly. WHDI is being designed with tight security in mind, of course. The company plans to use a 256-bit encryption scheme to ensure that only user-approved devices can establish links with the system.

Geri is fully aware of his colleagues' skepticism. "People who are used to the data modem basically conclude that what we're doing is impossible," he says. To do what Amimon claims with 802.11n technology requires channel bonding, in which data is transmitted over two or three channels together. That's not really a problem until you get multiple streams going into the same house or even the apartment upstairs—and then the spectrum starts to disappear and everything slows down. "I'm not going to say it can't work," says HANA's Rose. "But I would say show me."

Motorola is less skeptical; last March it announced an investment in Amimon. Paul Alfieri, the spokesperson for Motorola's Connected Home business, says the company is looking at several solutions, including Tzero's UWB product. "We haven't chosen one or the other. We've invested in both. We're going to evaluate all the technologies out there and offer a choice to our customers." — next: Which Will Triumph?

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Which Will Triumph?

Among all the uncertainty about which technology will survive, let alone dominate, one thing is clear: The consumer will ultimately have the last word. "In the end, the company that manages to slap all these pieces together on one piece of silicon and sell it for ten dollars is going to be the one that wins," said Kurt Scherf, vice president and principal analyst for Parks Associates, a Texas market research firm specializing in emerging consumer technology.

On the other hand, it's entirely possible that to get the wirelessly networked home, it's more than one of these solutions will be needed, perhaps along with some wired connections to move data between rooms in the house. Among the connections in a single house may be Wi-Fi, WHDI, and even wired connections, with UWB and WirelessHD working in individual rooms.

One solution to do it all would be great—something robust enough to send uncompressed video, to cover the whole house and provide the flexibility that wireless should. That may be somewhere down the road. In the meantime, there will be dongles and hubs and wired messiness and format wars. Reality, it seems, is tied down for the time being. — next: Know Your Digital Multimedia Vernacular!

Know Your Digital Multimedia Vernacular!

HANA: *The High-Definition Audio-Video Network Alliance* A collaboration between content providers, service providers, and consumer electronics and technology companies to facilitate easier A/V networking over FireWire.

HDCP: *High-bandwidth Digital Content Protection* A form of digital rights management that encrypts data transmitted over compliant DVI and HDMI cabling to ensure content protection.

HDMI: *High-Definition Multimedia Interface* A standard digital cable for transmitting multimedia content between devices. HDMI evolved from DVI and is backward-compatible with the video-only standard.

UWB: *Ultra wideband* A technology for transmitting data over the unlicensed spectrum of bandwidth above 3 GHz. UWB signals travel a very short distance but are capable of transmitting a great amount of data.

WHDI: *Wireless High Definition Interface* A proprietary technology for wirelessly transmitting uncompressed video signals in the 5-GHz band. Created by the Israel-based company Amimon.

WiMedia Alliance An organization dedicated to UWB connectivity solutions. The group develops standards for transmitting multimedia data wirelessly.

WirelessHD A specification under development for a digital interface that will transmit uncompressed multimedia data wirelessly among devices. The WirelessHD signal uses the unlicensed 60-GHz frequency.

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