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## **HDTV over the Internet**

Companies are finding ways to stream high-definition TV signals over the Web. Could the technology make low-quality video at sites like YouTube a distant memory?

By Wade Roush

The Internet is about to deliver beautiful high-definition TV to your PC. Matrixstream of Vancouver, British Columbia, has introduced technology for streaming real-time, interactive HDTV signals to home computers over the public Internet.

Today's PCs are more than capable of decoding and displaying both standard-definition TV (with a resolution of 480 pixels vertically and from 640 to 720 pixels horizontally) and high-definition TV (720 to 1,080 pixels vertically and 1,280 to 1,920 pixels horizontally). Indeed, media organizations have been using digital video processors and the Internet's underlying communications standard to send TV signals over private networks for years -- a practice called Internet Protocol TV, or IPTV.

Still, it may be hard to imagine the Web offering high-definition video, which has as many as 1,080 lines of vertical resolution, when sites like CNN.com and YouTube still deliver TV pictures at a measly 320 by 240 pixels of resolution. Delivering HDTV signals has always been the province of cable and satellite TV companies and over-the-air broadcasters, all of which own or license private, dedicated, high-bandwidth channels to get their shows into consumers' living rooms.

The challenge is how to get high-definition TV signals into a computer, short of hooking it directly to a subscription cable line. One solution is to translate a TV signal into standard Internet Protocol packets -- IPTV -- and send it to homes via broadband Internet connections, which are increasingly common. As of March 2006, 42 percent of U.S. homes had broadband Internet connections via DSL or cable modems, according to the Pew Internet and American Life Project.

But HDTV is a big bandwidth hog. Transmitting HDTV signals in real time, using the telecommunications industry's usual MPEG-2 compression standard for moving images, means sending data at 18 to 20 megabits per second (Mbps). The typical consumer DSL connection, by contrast, delivers data at only 1.5 to 3 Mbps, and the fastest cable-modem connections top out at 5 Mbps.

And even a 5-Mbps Internet connection isn't guaranteed to operate that fast all the time: engineers call the Internet a "best effort" network, meaning data packets are delivered as quickly as the myriad bottlenecks in data centers, the Internet backbone, and the last-mile connections into homes allow. Hence the long wait while your PC's media player software is "buffering" an audio or video download.

Matrixstream, founded in 1999 and headquartered in Vancouver, British Columbia, claims to have found a way around these difficulties. Like other companies in the video-processing business, it has adopted a new compression format, called MPEG-4 Part 10/H.264, which allows high-quality video transmissions at less than half the bit rate of MPEG-2. "But it's not just a compression issue -- it's an Internet transport issue," says Jack Chung, Matrixstream's chief technology officer.

According to Chung, Matrixstream's engineers developed a system of video servers that encode and encrypt a video signal, then send it to a special player program on the user's PC, using proprietary buffering and error-correction techniques that compensate for Internet bottlenecks. In this way, Matrixstream can transmit a DVD-quality TV signal at

1.5 Mbps and a high-definition signal at 2.5 Mbps -- well within the capacity of a cable-modem connection.

Along with the compression and transport technology, Matrixstream has written subscription, billing, and digital rights management software that any content provider could use to set up and manage its own broadband HDTV network. The PC player program -- which can also run inside a simple set-top box, eliminating the need for a computer -- includes controls that allow users to pause, rewind, or fast-forward an Internet HDTV program just as they would a DVD. Says Chung: "The experience is exactly like satellite or cable TV or better."

Matrixstream is in negotiations with Internet service providers, mainly telephone companies, to get the company's set-top boxes out to broadband subscribers. It is also partnering with [Movie99.tv](http://www.movie99.tv/) (<http://www.movie99.tv/>), a Blaine, WA-based company that's building a library of high-definition movies and other programming for streaming to Matrixstream's PC player. "Right now most of [the content] is still niche channels and movies, because the big content companies don't understand our technology yet," says Chung. But he predicts that broadcast TV networks will be providing high-definition feeds to Matrixstream customers within two years.

IPTV's first commercial application has already revolutionized how video production and distribution work. IP-based networks are far more economical to build and operate than microwave or satellite transmission systems, and major news organizations are adopting systems from companies like Seattle-based [Streambox](http://www.streambox.com/) (<http://www.streambox.com/>) to extend their reach around the world. "All they need is a reporter, a photographer, a camera, a microphone, a satellite phone, and one of our encoders, and they can get video back to headquarters live from anywhere in the world," says Jeff Woiton, technical sales manager at Streambox.

Telephone companies such as Verizon and AT&T are also investing heavily in IP networks, since they can handle video, voice, and data simultaneously. The phone companies hope this "triple play" will help them compete with cable companies like Cox Communications, which already provides TV, digital telephone, and high-speed Internet service to its customers through the same coaxial cables.

One of the companies helping the telcos realize this vision is Cambridge, England-based Vidanti, which supplies software and equipment for delivering high-definition video to set-top boxes over telephone companies' private networks -- and for returning data from the home, enabling applications like video conferencing.

Vidanti CEO Paul Walsh says IP networks are a great way to transmit HDTV signals, but only if they're guaranteed not to be jammed with other traffic. "In the industry we work with, we're talking about sending broadcast-quality, state-of-the-art HD -- the full pay-TV experience," Walsh says. "You can't rely on best-effort transmission for that. I'm quite fond of YouTube -- but it isn't what I'd rely on for my evening TV."

The challenge for Matrixstream and other companies sure to explore Internet-based HDTV may be finding an audience that doesn't mind the occasional network hiccup, and that values a large variety of quirky, niche content over mainstream TV shows. As it happens, that's exactly the group Matrixstream is going after first: independent content producers who could use high-definition Internet IPTV to reach niche audiences with premium programming that makes today's streaming video look primitive. "We're talking about the real long tail," says Chung. "Instead of 500 channels, you'll have a million. Or, to put it another way, you'll have just one channel -- yours."

That could give pause to big media companies and further upset the chaotic ecosystem of digital entertainment, where cable, satellite, broadcast, telephone, software, hardware, and Internet companies are all competing to sell content and services to the

same consumers. "The telephone companies are trying to move into the entertainment space, and the cable companies are trying to move into the voice space, and they're both earning very skinny margins," notes Walsh. "The only place you can think of to look not just for revenue but for profit is the interactive space. That's what makes IPTV a big 'gotcha' for them."

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