NETWORK BANDWIDTH, LATENCY, AND SIGNAL DISRUPTIONS LIMIT DEPLOYMENT OF DISTRIBUTED VIDEO BY BOTH CONSUMER-ELECTRONICS VENDORS AND MAJOR SERVICE PROVIDERS.

Video-enabled home-networking technology TRICKLES TO MARKET

BY MAURY WRIGHT • EDITOR IN CHIEF

Consumers have readily adopted home networks to share Internet connections, files, and printers. And, although some consumers have wired networks that use the same Category 5 cable that businesses use, more consumers rely on "no-new-wires" technologies, such as HomePlug power-line networks or Wi-Fi (IEEE 802.11) wireless LANs because these choices don't incur costly cable installation. Now, with the transition to digital representations of music and video virtually complete, we need to move multimedia-data streams over home digital networks, as well. Note that the "we" is purposely ambiguous, because consumers want their entertainment throughout the home, and consumer-electronics vendors and service providers want to offer the same thing. But, thus far, the no-new-wires options struggle to distribute video in real time.

If there is a single device that has prompted the demand for video-capable networks, it's the DVR. Consumers have enthusiastically adopted TiVo and DVRs from cable or satellite companies because of the simplicity of recording programs and the ability to pause live programming and fast-forward through commercials. And consumers would now like to replicate that experience. Nick Chakalos, senior director of software-product management for the Motorola Connected Home group, says, "When they sit in front of the second, third, or fourth TV, they want that same experience."

To some extent, a DVR connected to each TV would solve the consumer demand. Indeed, satellite- and digital-cable-TV providers have conditioned consumers to accept an STB (set-top box) that controls each TV. But the DVR is more problematic. Putting a disk drive into each STB still means that the program of interest might not be on the STB of choice at any given time unless you in some way link the STBs. A better answer is networked STBs than can share programs stored on one disk drive.

Competing TV services from the legacy telephone carriers will increasingly demand video-capable networks, as well. The telephone carriers, such as AT&T and Verizon, are pushing to offer video over IP (Internet Protocol) using either DSL (digital subscriber line) or fiber to the home (**Reference 1**). Generally, the term "IPTV" (Internet Protocol TV) implies an architecture in which an STB receives a video stream over IP and decodes and displays that video. The STB sends channel changes at the STB up the network to carrier equipment. So, an IPTV deployment to serve three TVs in a home will require three networked STBs, and the network will need the bandwidth to carry the three video streams in addition to Internet traffic.

HDTV (high-definition TV) adds to the demands on home networks because higher resolution implies a faster data stream to serve the video. Whether the application is a shared DVR, IPTV, or both, each HDTV stream can require a

AT A GLANCE

- No-new-wires technologies haven't hurdled the video obstacle.
- Carriers may need a mix of technologies for different applications and regions.
- The 802.11n standard has perhaps the most promise, but standards skirmishes continue to burden it.

Figure 2 A multisegment smart antenna allows Ruckus Wireless' 802.11-based MediaFlex products to deliver video over long range and with no signal fading.

continuous 10-Mbps or faster stream on the home network. And note that the video application requires data delivery in real time. The STBs at each TV will not buffer more than a few seconds of the streaming program in the decoding process. Any significant latency in stream delivery interrupts the program that the STB delivers to a TV.

Consumers using home networks don't notice problems that would be deal killers for video. For example, signal fading can cause Wi-Fi networks to retransmit packets. For the Internet surfer, the result is a slightly slower page download. Dropped packets can mean a program interruption to video. So, home-video networks will need a combination of the aggregate bandwidth needed to deliver multiple video streams and QOS (quality-of-service) provisions that minimize disruptions in packet flow.

Proponents of the various home-networking technologies have been vigorously preparing for video delivery, believing that the first to handle video well would become the long-term winner in the home. The efforts have included the development of faster data rates and QOS network layers.

The list of candidates starts with Category 5 cable. Increasingly, new homes have this cable, just as offices do. In other cases, service providers or home owners have retrofitted homes with Category 5. The no-new-wires approaches either rely on wireless or attempt to use power-line, phone-line, or coaxial wiring that's present in most homes. In the wireless camp, some flavor of 802.11 or Wi-Fi is the likely choice, although some in the UWB (ultrawideband) camp also hope to play in the market. The HPNA, or HomePNA (Home Phoneline Networking Alliance), group is the driver of phone-line technology.

Several companies and industry groups have targeted the coax-cable plants that are present mostly in North American homes. For instance, even the HPNA group now claims its technology works over coax as well as phone lines. Coaxsys has also developed coax-capable products. But the MOCA (Multimedia over Coax Alliance) group that Entropic Communications originally spurred seems to have the most momentum in the coax area. In the power-line area, both the Intellon-driven HomePlug

Figure 1 The Follow Me TV technology from Motorola will yield a distributed network of set-top boxes that allows consumers to view any live or stored programming anywhere in the home.

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Check out the Web version of this article at www.edn.com/070301df for more details on various no-new-wires technologies, including a sidebar on in-room wireless video and a vendor box. Come back throughout the year for updates as products ship with embedded-video-network technologies.

group and DS2 (Design of Systems on Silicon) are supporting separate initiatives.

When *EDN* scheduled this article, we expected the Consumer Electronics Show in January to yield real consumer products or products to be deployed by service providers that embedded technology from most of the aforementioned candidates. Although all performed videocentric demonstrations, little in the way of deployment is happening. Still, we expect near-term activity. So, at the Web version of this article at www.edn.com/070301df, we'll provide a current status of each candidate and updates that detail any real products as the year passes.

For now, however, let's focus on what *is* happening, and it's compelling. Motorola has been the most aggressive among the STB players in pushing a distributed-video architecture. The company based its Follow Me TV service on the notion of getting the full DVR experience anywhere in the home (**Figure 1**). Verizon, in its FIOS (fiber-optic-services) deployment, is shipping Motorola STBs with the Follow Me technology.

The Verizon deployment is a relatively simple replication of DVR functions on each STB, with a hard drive present only in the main STB. But Motorola has more in mind. Motorola's Chakalos claims that the technology will ultimately virtualize the tuning capability and storage resources in a home. He describes a scenario in which one STB includes dual tuners and a hard drive, and two remote STBs include single tuners. Motorola intends for the consumer to see that distributed system as a four-tuner DVR accessible from anywhere in the home. Likewise, consumers would see one storage resource for the entire house, even if the entire library relied on hard disks in multiple DVRs and even music or photo libraries from home PCs. Motorola hopes to begin rolling out this more advanced technology this year in a Comcast-cable deployment.

For now, Motorola is relying on MOCA to deploy Follow Me STBs. Chakalos claims that MOCA can today support the goal of three- to four-TV homes with HDTV support. But Chakalos is quick to say that Motorola is also testing and even investing in the other no-new-wires technologies. MOCA has a number of wins in other regions of the world, as well.

On the Wi-Fi side, the industry has great hope that 802.11n will finally make video distribution possible, especially when bolstered by the 802.11e QOS layer. But the industry has continued to battle over the 802.11n standards process. The industry expects a final standard to emerge this year, and "draft-compliant" products are already rolling into the home-data-networking market.

But Ruckus Wireless is the only company that's made real headway into Wi-Fi-video delivery. Ruckus doesn't actually make 802.11 baseband technology. Instead, the company has developed the BeamFlex smart-antenna scheme, which relies on a multisegment antenna and which extends range and eliminates signal fading. (**Reference 2** provides some detailed hands-on tests that *EDN* performed on early Ruckus products.)

Ruckus Director of Marketing David Callisch claims that the company has delivered 100,000 of its MediaFlex systems, which comprise an access-point and client-device pair, to consumers through service providers in the IPTV market (**Figure 2**). The success has come largely in IPTV deployments by small regional carriers in North America, Europe, and Asia. The product relies on Atheros Wi-Fi ICs.

What can we expect for the rest of 2007? AT&T is committed to using HPNA technology in its U-Verse IPTV service. But that deployment is still in an early stage. Callisch claims that Ruckus has a prototype 802.11n product that can handle three HDTV streams. But he doesn't expect carriers or consumer-electronics companies to adopt 802.11n in 2007 because of the delay in finalization of the standard and the confusion of the draft-compliant products from chip vendors.

It's increasingly looking as though all of the home networking candidates might get a piece of the market. In fact, Motorola's Chakalos says, "We would like to see them all happen." Chakalos, for instance, believes that 802.11n will prove useful in video distribution in North America but that brick-and-concrete construction in many European homes may limit the use of wireless in video distribution. EDN

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For the two references associated with this story, visit www.edn.com/070301df.

You can reach Editor in Chief Maury Wright at 1-858-748-6785 and mgwright@edn.com.

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IN-ROOM WIRELESS VIDEO

Whereas the main article discusses distributing video around a home, another set of players are focusing on wireless video within a room simply to eliminate the growing cluster of cables that connect TVs, set-top boxes and other gear. Two of the UWB (ultrawideband) players in particular have announced such cable-replacement technology. Wiquest's (www.wiquest.com) Wireless Digital Video technology includes both the UWB communications link and a video-compression technology to transmit video short distances. Tzero Technologies (www.tzerotech.com) is combining its UWB technology with video-compression ICs from Analog Devices (www.analog.com) to support the in-room application.