

An IPTV Primer and News Update

Hardly anyone gets TV over the Internet now, but it could be a \$44 billion business in four years.

By Lawrence Kingsley ■ *Contributing Editor*

It should escape no one that we are witnessing a torrent of announcements about the convergence of television and the Internet. The announcements are coming from so many points in so many companies that there is not even universal agreement about the meaning of the term “IPTV.” Most basically, IPTV encodes video into packets, which are sent to an IP address. IPTV is often streamed to a PC, but it also can be sent to smart phones, PDAs, iPods and other mobile devices. As in the case of the Slingbox from SlingMedia, the video may first go to a set-top box, but then can be re-routed, typically to a user’s laptop, even if that laptop is in a hotel room 5,000 miles away.

Not to be left behind, cable TV multi-service operators (MSOs) are venturing into IPTV, though they tend to insert the IP packets into the radio frequency (RF) signal used to communicate to set-top boxes. New cable systems like the Lightspeed project AT&T (the former SBC) is building employ pure IPTV.

Thus, IPTV is becoming just another media type sent over a computer network. No longer limited to proprietary networks, bulky set-top boxes, and city franchises, IPTV theoretically can travel the world to any subscriber or business partner with an IP address and a sufficiently fast Internet connection. A new report from Infonetics (See Glass Mile, *Broadband Properties*, December 2005) predicts 53.7 million IPTV subscribers by 2009 and \$44 billion in service revenue.

For consumers – at least the ones who have gotten educated – IPTV provides a means of routing entertainment throughout a home network, of displaying email on a TV set, and, generally, having a richer experience than the typical couch potato enjoys today.

Why is it all happening now, and what will it mean for your business and your viewing pleasure?

Why IPTV Is Taking Off

For an MSO, IPTV holds out the promise of mixing Internet data with video, so that video, Web, VoIP, and mobile communications can travel the same path, achieving engineering efficiencies and, long-term, resulting in bundled discounts that can reduce customer churn. IPTV thus is a means of enhancing the service to provide new revenue sources and stickiness – the MSO wants to reduce the consumer’s motivation to explore competitive services from phone and satellite companies.

For phone companies, IPTV presents a long-term strategy for protecting turf. Because MSOs are offering phone and Internet connectivity, the ILECs, for self-preservation more than retaliation, want to eat the MSOs’ lunch. For consumers – at least the ones who have gotten educated – IPTV provides a means of routing entertainment throughout a home network, of displaying email on a TV set, and, generally, having a richer experience than the typical couch potato enjoys today. AT&T Lightspeed subscribers, for example, will be able to

record to a DVR from any TV in the house.

For entrepreneurs, filmmakers, musicians, and special interest groups, IPTV invites an end-run around gatekeepers – Hollywood studios, TV networks, and cable systems. Marketing is an issue, but with IPTV anyone can place intellectual property on the Internet and hope that millions of people – or at least enough people to make the exercise profitable – will come to savor it. With audio on the Internet, we have already seen how new rock groups are willing to surrender immediate payment in return for recognition and anticipated future sales. Commercials and most Web sites have a similarly relaxed standard about access. BrightCove (Cambridge, MA) is building a security and e-commerce suite that will let anyone distribute videos over the Internet as easily as audio is distributed today.

The fact is, however, that companies have not been able to take full advantage of the technology because of bandwidth restrictions (Figure 1). The real payoff is in the convergence (Figures 2 and 3).

Aiding the IPTV Push

Other drivers of IPTV include:

- **The transition from analog to**



Fig. 1 - Microsoft's IPTV programming user interface. Look familiar? Most cable subscribers would think so.

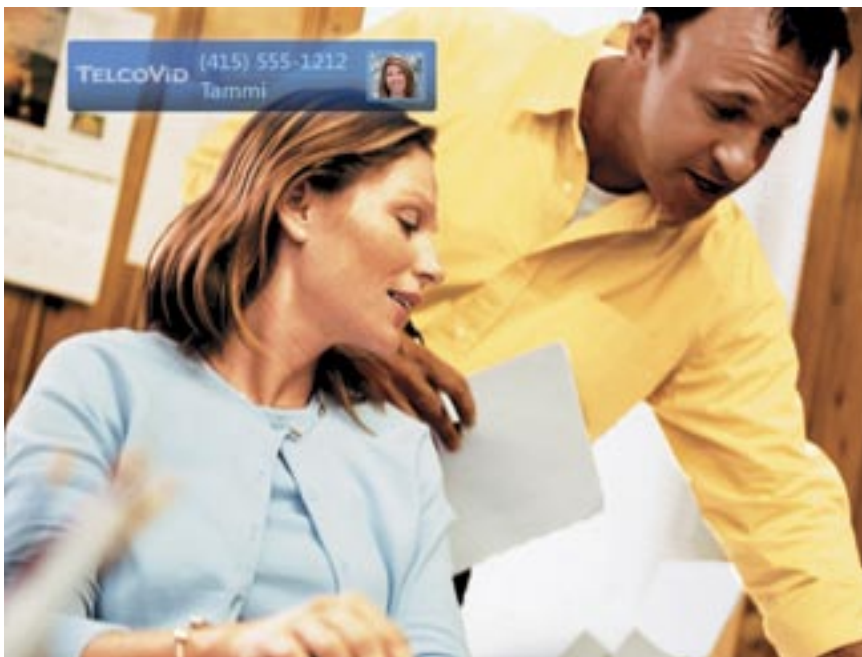


Fig 2 - Now it gets interesting. Microsoft's on-screen caller ID.

digital camcorders that immediately interface with a computer. The resulting compressed MPEG-4 files are not easy to edit with the current generation of home video software, but they will be within months. Also, storage of the videos on hard drives tends to be more convenient, compact, and long-lasting than tape libraries. And, of course, once a video is in the form of a digital file,

it can be easily sent over the Internet, if bandwidth is available.

- **The FCC mandate that broadcast stations have to give up their analog spectrum.** The date, progressively postponed, is now set for February 18, 2009 in the latest bill approved by the Senate. As TV becomes digital (DTV), it is ready to be Webcast.
- **The increasing adoption of high-**

definition TV, a type of DTV, introduces compelling content, which gives consumers reason to upgrade their TV sets and set-top boxes.

- **The success that cable companies have had with VoIP** is convincing them to use IP for video distribution as well. Simon Applebaum, Editor-at-Large of Cable World, says that for this reason: "Many operators have the commitment that when they go all-digital, they will build infrastructure that will also include IP."

- **The popularity of TiVo** has convinced cable operators that, to be competitive, they must offer a digital video recorder feature (DVR) as an option. The DVR increases video consumption not only through the convenience of time-shifted viewing, but by letting customers record one channel while watching another.

- **The long-sought quest for interactivity** (especially for gaming and for online shopping), hotlinks to the Web, email on the TV set, video on demand (VOD), control of picture in picture, and so on requires a robust system with two-way communication from the user. Software already built for the Web can be brought to cable systems in a standard language often easier to use than proprietary systems with their quirks.

New Services

Given these factors, new IPTV products and services are pouring out. Among the new services that have implemented IPTV in one fashion or another:

- SES Americom, the satellite company, is starting a test with The National Rural Telecommunications Cooperative (NRTC), whereby eventually 300 channels of IP video will be beamed to head-ends operated by telephone companies. The telcos will redistribute the data on their own networks to customers. The service is called IP-Prime.
- Apple allows customers to purchase Disney and Pixar films from iTunes and play them on a video iPod.
- NBC working with Comcast, CBS working with DirecTV, and ABC working with Apple, will let you download selected hits and view them on a video iPod.



Fig. 3 - Sports fans, an early customer base for HDTV, get multiple views and at-home playbacks, with this Microsoft approach.

- TiVoToGo (www.tivo.com/4.9.19.asp) extends this capability to any of your TV shows and links not only to iPods, but also to Sony's PlayStation Portable and to other mobile devices.

- Yahoo and TiVo will bring the Internet to regular TV sets.

- Warner Brothers will make around 14,000 TV episodes available on AOL. This service is called In2TV and focuses on old classic TV fare.

- The BBC is conducting a test of a peer-to-peer network, which will let viewers share programs among themselves as on Kazaa.

- AOL and Brightcove will let anyone upload, market, and search videos through AOL.

- MobiTV and wireless carriers are bringing TV to cell phones.

These services are enabled by new products, and the markets for new products are expanded by the services. Among the products:

- Provided that you have broadband, the Slingbox bounces TV around multiple TV sets in your home, from one home to another, or, if you choose, from your home to your hotel room during a trip (Figure 4).

- In addition to VoIP, Skype offers

video communication that the user can turn into a Podcast.

- Continually enhanced, Microsoft's TV IPTV edition is middleware that integrates content acquisition, distribution, security, VOD, DVR programming, and subscriber management.

Inhibitors of IPTV

It would seem that the entire TV industry is moving headlong into IPTV of one form or another. But before cheers

go up for IPTV, we should consider the difference between streaming video, which we associate with today's Internet, and professional quality video needed for cable systems. IPTV is not an easy technology to master (Figure 5).

In today's low-bandwidth streaming video, image quality is less important than the pleasant surprise of seeing television where you never expected it, as on a PC or smart phone. The user may tolerate jerkiness, small pictures, and

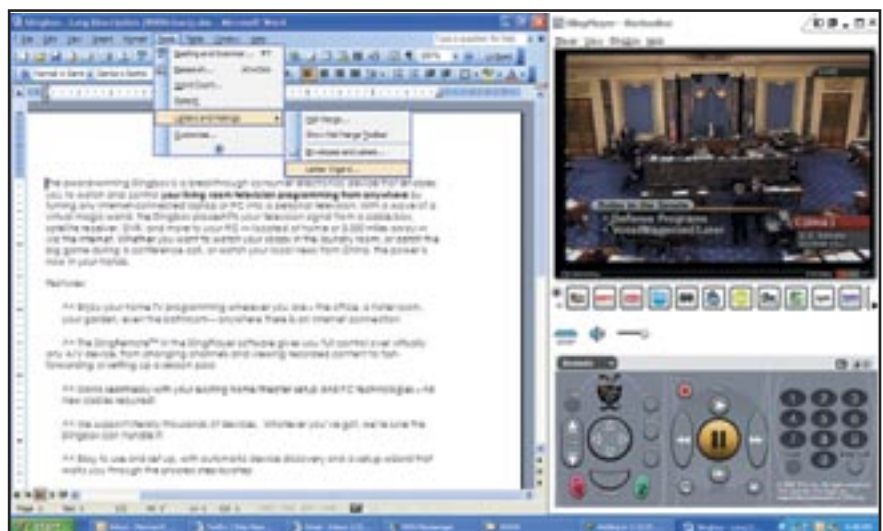


Fig. 4 - Slingbox sits near your TV; here's what you see on the remote screen.

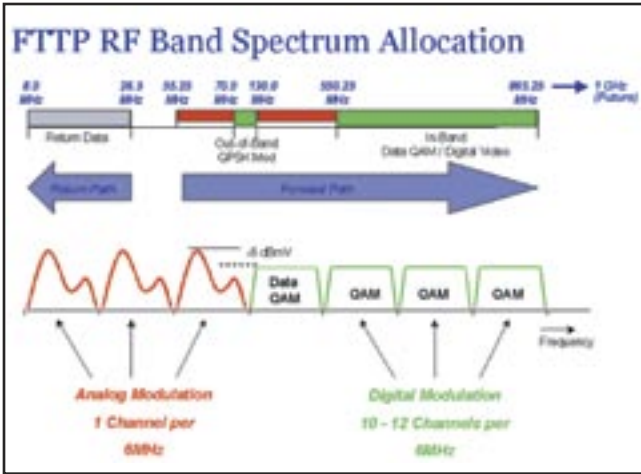


Fig. 5 - How fiber carries a TV signal (from Scientific Atlanta).

visual artifacts in the picture in return for such factors as novelty, timeliness (news), romance (matchmaking), titillation (pornography), convenience (teleconferencing), or lack of an alternative (viewing a broadcast he or she missed at the regular time). Digital rights management may be a matter of limiting access to paid users (for instance, students taking a correspondence course), but generally streaming video has no security, for there is no effective security on the Internet. Anyone can pirate anything and redistribute it on BitTorrent.com.

Professional quality video, in comparison, introduces considerations that need to be borne in mind before we assume that IPTV is a given. Tony Stanley, Director of FTTH Networks at Scientific Atlanta, which is being acquired by

content providers strive for high network availability using redundant servers, the latest firewalls, and anti-viral software, one communicates with a cloud on the Internet, where the on-ramp may be under one's control, but not the intermediate pathways and off-ramps. Failure anywhere along the route can be catastrophic and, minimally, creates delay.

But when viewing a movie, we cannot go back to a sequence missed when packets are lost. Large buffers help, but we do not want long delays when we switch channels on a TV set. Realistically, there is no quality-of-service (QoS) on the Internet and no operator control, Stanley says. In contrast, a private, controlled network (like the MSOs have) provides for the possibility of a guaranteed QoS. MSOs, according to Stanley, will not

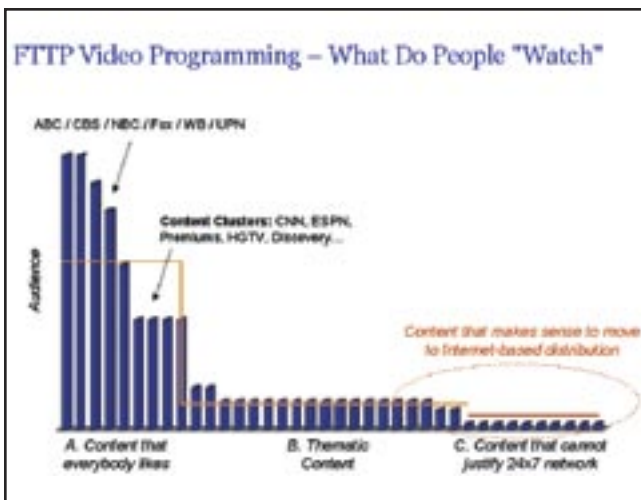


Fig. 6 - Few shows attract broad audiences, obviously. For niche markets, the technology and the marketing strategy will change... and so will the content (from Scientific Atlanta).

Cisco, addressed this subject during his presentation to the Fiber-to-the-Home (FTTH) conference in Las Vegas in October. BBP magazine later interviewed him for this article.

Among the challenges that IPTV is facing, according to Stanley, are:

The Internet's poor quality of service.

Although

foster efficiencies in the traditional cable model of distribution. MSOs pipe their entire programming suite into the home at once; through conditional access, the user then has access to the selected tier of programming (Figure 6).

Bandwidth limitations. The high bandwidth requirements of video accentuate the fact that bandwidth is always an issue on the Internet. We need 4 Mbps for traditional standard definition (SD) television, but 14-18 Mbps for high-definition (HD) TV. If the user only has 6 Mbps on a cable modem, streaming HDTV is not an option. Even at 4 Mbps for SD, there is little bandwidth available, say, for the kid browsing the Internet while Dad watches IPTV in the living room (Figure 7).

Obsolete codecs. IEEE H.264, known as MPEG-4, needs half the bandwidth required for MPEG-2, in which most video today is encoded. But MPEG-4 headends today cost \$5 to \$10 million. Even though prices over time can be expected to drop, only large MSOs can afford capital outlays in the current range, Stanley says.

Even with MPEG-4, HD requires higher bandwidth than today's DSL or cable modems can deliver. Stanley offers the accompanying chart to show how multiple channels of HD and HD-DVR tax the system. He assumes dual-stream DVR (watch and record at the same time), 2 Mbps for SD, related audio, and network overhead, and 7 Mbps for HDTV, related audio, and network overhead (reduced to half the normal 14-18 Mbps by MPEG-4). According to Figure 7, more than 30 Mbps to each home will be required for an MSO that wishes to compete for HD customers.

Digital Rights Management (DRM). The last thing a content provider wants is pirated DVDs made in China off an IPTV feed. It therefore would be foolhardy to send out a theatrically released film over the Internet without appropriate security. The security, at a minimum, should include encryption and digital rights management – namely, protection of intellectual property, conditional access, and an armor-plated payment mechanism.

Distance from DSLAM. Even

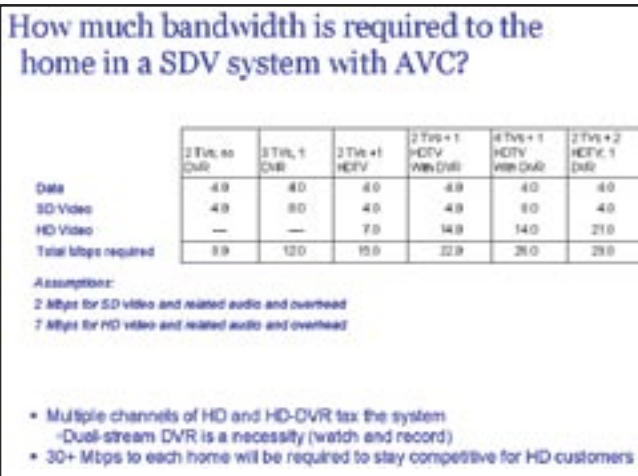


Fig. 7 - Customers need ever-increasing bandwidth for HDTV, gaming and so forth. The current top-end FiOS offering, 30 Mbps, could be the norm in just a few years (from Scientific Atlanta).

though many customers may be content for a while with compressed IPTV arriving over a DSL modem, not all DSL customers will fare the same. Since the signal attenuates over distance once it is no longer carried by fiber optic cable, customers located more than 2,500 feet from the neighborhood DSLAM (where DSL trunks branch out to individual customers from the fiber feed) will begin to lose packets of data, resulting in problems like noise and crosstalk. The DSL Forum produced Figure 8, showing how the signal strength falls off with distance.

PC drawbacks. The delivery of video to a PC, as opposed to a set-top box (for which, of course, Scientific Atlanta is known), is fraught with difficulties. Stanley says there has to be an easier interface than we now have before IPTV will approach the lean-back environment that we expect in TV-watching. Microsoft has gone a long way toward emulating a set-top box in the Media Center PC, but its cost is higher than that of a set-top. The Media Center PC is uncommon in homes, but that is changing. Half the desktops sold in the last six months of 2005 came with the “media center” version of Windows XP.

Scalability. Any IPTV solution system must be both scalable (able to handle any new digital variants that come down the network) and proven, for no one wants to wind up having to reboot the TV set.

Cisco Acquisition

Stanley recognizes the potential of IPTV, and Scientific Atlanta already markets IPTV products, including headend systems and encoders for both HD and SD. Scientific Atlanta’s IPTV set-top boxes are being deployed by SES Americom and by AT&T in its FTTH rollout.

Cisco’s intended acquisition of Scientific Atlanta

confirms the importance of video in a networked world. In the press conference announcing the acquisition, John Chambers, President and CEO of Cisco, explains the Scientific Atlanta acquisition as completing “a large part of our quadruple play as data, voice, video and mobility converge.... Our strategy has clearly been that intelligence will be distributed throughout the network and that the network will eventually become the platform of the future.”

Scientific Atlanta, Chambers says, brings to the table “the eighth advanced technology” needed for today’s digital

video – the seven other advanced technologies are home networking, enterprise IP communications, optical networking, security, storage area networking, wireless and, linked small-business systems.

Video, Chambers says, encompasses consumer entertainment, communications and online services: “In fact, video may be the most critical element in this bundle for ensuring consumer differentiation and loyalty or stickiness, if you will, to service providers. The opportunity for Cisco is to dramatically reduce the complexity of converging data, voice, video over IP in both a fixed and mobile environment, which is at the core of our expertise.”

Chambers says an integrated, end-to-end architecture is the only way to reduce this complexity, gain market share, and effectively deploy new services. Cisco thus envisions a market where consumers download information through a Linksys portal (Cisco owns Linksys). The information is distributed throughout the home wirelessly and tied together in the set-top box. Nowhere is it written that we have to wait for the integrated solution envisioned by Cisco, however (see box).

Alan Brody, one of the most experienced observers of IPTV, notes: “Ultimately, people still want a delivered

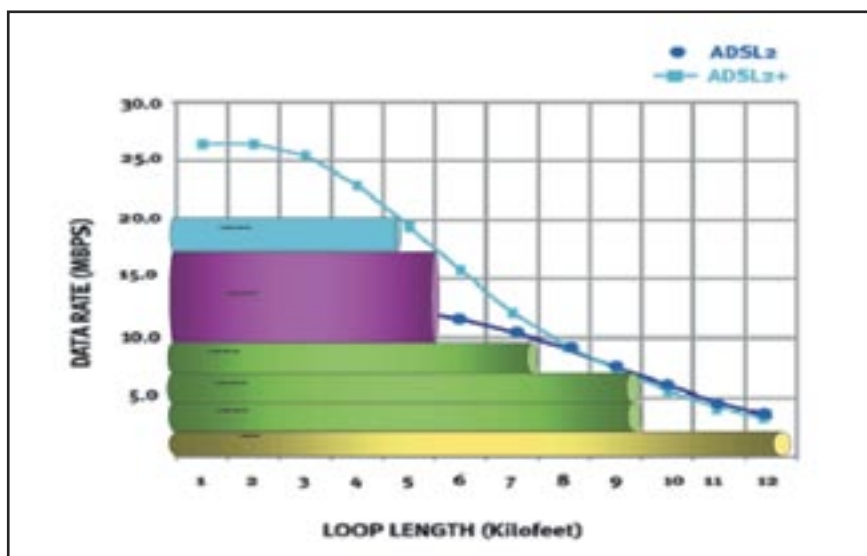


Fig. 8 - Bandwidth falloff versus distance, using DSL over copper. The yellow band represents 2 Mbps data. The green bands represent standard-definition TV bandwidth with MPEG-4 compression. Purple represents HD-TV (9 Mbps with MPEG-4). Scientific Atlanta expects another 1.5 Mbps for “headroom,” other services to the home.

Optical Entertainment Network: First Houston, Tomorrow the World

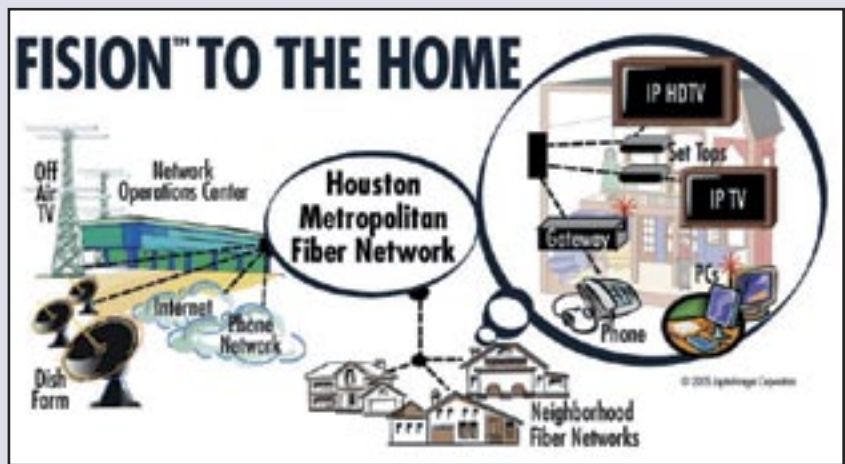
A startup, Optical Entertainment Network (OEN), shows how IPTV can be cobbled together from today's equipment. There is inherent risk. OEN is trying to launch a 400-channel, all fiber system in Houston. The initial test is of 200 homes. OEN made a splash at the October FTTH Council show in Las Vegas, where Scientific Atlanta also exhibited.

The founder and CEO of OEN is Thomas Wendt, who was CTO of Intertainer. Intertainer had a creative rotary interface and, in 2002, was poised to deliver films over DSL and cable modems at 1-2 Mbps. Major Hollywood studios backed out at the last minute, leaving Intertainer in litigation limbo, where it remains.

IPTV, Wendt says, has changed so dramatically in last decade that a lot of the previous intellectual property framework is now invalidated. During the last decade "80 percent of the spending went into figuring out how to compress the video." However, on an all-fiber network we no longer have to compress the video: OEN converts everything to IP and dispatches it straightway to the subscriber. He says OEN is the first IPTV system designed from the ground up to exploit the advantages of fiber.

OEN has ambitions of licensing the technology and serving its content to other fiber communities throughout the U.S. via three headends. A single headend could handle the load, Wendt points out, but a programming service can never be out of commission. The other two headends, complemented by \$15,000-\$35,000 routers, would provide redundancy. Wendt assumes that long-haul fiber optic cables in the U.S., many of which have been unused since the Internet bubble, will allow OEN to avoid the cost of satellite distribution. All of the U.S. thus would be served from OEN's headend, whereas Time Warner's satellite network, Wendt says, deploys three headends just for Houston.

Unlike cable companies, OEN has



OEN's basic network technology.

no capacity problem, according to Wendt. "We have noted how a cable system sends all channels to the subscriber at once, blocking off channels for which the subscriber has not paid a premium. With fiber, however, OEN switches to the subscriber only the content that is desired."

This switching "allows us to kill [competition] with capacity," Wendt says. For example, Houston has few Hispanic channels. To add new Hispanic channels Time Warner must either compress the existing signal or eliminate other channels, for the typical cable plant is limited to 750 Mhz (about 120 standard channels). OEN, however, offers 55 Hispanic channels. "We're licensing every Hispanic channel we can find anywhere in the world and piping it into the home," Wendt says. OEN also has 55 channels of HD, compared to about 16 from local TV stations.

As to how he will compete with RBOCs like Verizon and their deep pockets, Wendt expresses little concern. OEN claims to have patents in DRM, ad insertion, and how an entire system works. Operationally, ILECs would have to emulate OEN, but have yet to do so. BellSouth, Wendt points out, is bringing copper to the home. AT&T is bringing fiber to the neighborhood and copper to the house. Only Verizon brings fiber into the home, but Verizon is starting its

FiOS video service with RF insertion, which retrofits a legacy system to work on fiber. He concedes, nonetheless, that Verizon "may get it right in 2-3 years."

Wendt was at the first meeting of the FTTH Council and served on its first board of directors. He remains on the current board of directors. His CTO, Allen Easty, worked with Wendt at Intertainer and chaired the FTTH Council's first Emerging Technologies subcommittee in 2001.

OEN is working with several notable partners. It has a 35-year agreement with Phonoscope, whose seven-county network around Houston is believed to be the largest privately held metro-fiber network in the U.S. Focused on distance learning and telemedicine, Phonoscope connects every hospital, elementary school, and high school in certain neighborhoods. Phonoscope has been in business for 53 years and fiber for 23 years, Wendt says. OEN will bring Phonoscope's classrooms to OEN subscribers and in return provide production studios for the schools.

Another partner and an investor in OEN is Nexans, a French company that earned 5 billion Euros (about \$6 billion) last year. Aside from capital, Nexans brings its complete manufacturing facilities, which fabricated a wall mount for the Amino OLTs used by OEN. Nexans thereby "helped us decrease labor and materiel cost," says Wendt.

OEN hopes to connect 10,000 homes by April and 50,000 homes by the end of 2006. Wendt hopes to go public in the first half of 2006. "We will have no shortage of capital at that point."

Equipment

OEN has announced that it will use a combination of Alloptic and PacketFront equipment and software and that the system will be active where distance is a factor, but passive in the case of condo buildings. Yet, OEN declines to elaborate beyond isolated details.

PacketFront will supply BECS, its

control and provisioning system. BECS provides for on-demand, self-provisioning, whereby households can change services for themselves, sparing OEN the administrative cost.

OEN will use Amino's set-top boxes, including the AmiNET120 STB, which supports HD and standard definition television, broadcast TV, and Video-On-Demand. OEN will also offer Amino's AmiNet 500 set-top, which features built-in DVR.

Prospects

Fiber aficionados tend to praise

OEN's concept, but whether OEN can move from concept to implementation remains to be seen. Apparently, OEN is still raising funds for its first headend, without which the trial with 200 homes cannot begin. We are also nervous about OEN's refusal to answer simple questions about its network, business partners, patents, or target dates, although of course this reticence could reflect discretion in the face of potentially fierce competition from the RBOCs and cable operators.

TV product for the old-fashioned purpose of vegging out, but they also want to share it with others, take it on the road, add to it, and customize it in ways we have yet to discover."

Brody runs the iBreakfast lecture series in New York and has served as Executive Director of eTV World, the conference and consultancy that began tracking IP and Internet convergence in its earliest days.

There seems little doubt that IPTV is coming and that it has profound implications, not just for distribution of TV, but for DRM, programming, product development, customer satisfaction, and financial leadership.

Any company that expects to compete in converging TV, computer, and Internet domains has to take notice. Yet, technological innovation alone will hardly improve the overall TV experience if the program is not worth watching in the first place.

The jury is still out on that score, but one thing is clear: IPTV breaks the Hollywood monopoly and makes possible niche programming on a scale never before imagined.

There may be a worldwide audience of only a few hundred viewers for a Bosnian cooking show in Spanish. But there will be one. **BBP**

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