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- Stalking the meaty middle of the business market
- What's cable's role in video-to-go?

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World Radio History



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World Radio History

Coming out of the cave

Like a groggy bear waking from a long hibernation, the nation's largest telecom companies are beginning to stir. But instead of feasting on a nearby cache of meat, the bear seems to be settling for a decidedly less-filling diet of fruits and berries.

I find it astounding that the same companies that are out there touting their efforts to drive fiber into their networks so they can more effectively compete with cable TV operators will spend billions of dollars, untold months, and way too much intellectual capital to acquire nothing more than their telecom brethren.

And here I was, all excited to see how the telcos' assault on cable's turf was going to pan out.

Verizon's FiOS is supposed to be available to 3 million homes by year-end. SBC is pushing

its Project Lightspeed initiative, and plans to spend \$4 billion to put fiber in front of 18 million homes by the end of 2007. Over that platform, SBC intends to roll out its U-verse suite of IP-based voice, video and data services.

Now that's exciting stuff.

Why then would SBC make a \$16 billion bid to buy AT&T? The experts say

such an acquisition would catapult SBC toward the top of the telecom world by giving it access to Ma Bell's extensive commercial contracts as well as the world-renowned brand.

Likewise, troubled RBOC Qwest touched off what became a small bidding war for MCI when word leaked that it was mulling a \$6 billion takeover offer. The day that news hit the wires I recall hearing comments like, "Two wrongs don't make a right," and "this is one case where one-half plus one-half equals one-quarter." It wouldn't be so funny if it weren't so true.

Not to be outdone by the baby of Bells, Verizon jumped into the fray with a formal offer to buy MCI for \$6.75 billion, an amount inferior to Qwest's sweetened offer of \$8 billion.

So what's going on here? Are Verizon and SBC serious about fiber and rolling out video, or are they more enamored with familiar brands like MCI and AT&T, which give them more share of a dwindling—but very familiar—market?

Meanwhile, Time Warner Cable has rolled out an IP-based telephony service in each and every one of its 31 divisions, and at the end of 2004 had 220,000 phone customers. Cablevision is stealing telephony marketshare in the Northeast with its Optimum Voice service, which passed the 250,000 subscriber mark in December and is adding 1,000 new customers per day.

Comcast might prove to be the last straw when it makes good on its promise to roll out VoIP to 15 million homes in 20 different markets this year and to the rest of its footprint in 2006. In all, Comcast predicts it'll garner 20 percent marketshare of homes passed with VoIP within five years.

If that comes true, the RBOCs just might wish they could keep on hibernating. ■



*The RBOCs might wish
they could keep
on hibernating*
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features

22 CAPACITY **Drilling for bandwidth**

As in prospecting for oil and gas, uncovering new bandwidth reserves is often a matter of money and effort expended. The good news is that cable operators now have a variety of tools to help them exploit their resources, ranging from "drop-in" amplifiers, switched broadcast, and forcing the digital conversion, to boosting existing 750 MHz and 870 MHz cable spectrum to 1 GHz and beyond.

By Jeff Baumgartner

30 COMMERCIAL MARKETS **Gunnin' for big game**

Medium-sized businesses may prove to be the tastiest game in the cable operator's hunt for the commercial customer, but which technological weapon will bag the most prey?

By Karen Brown

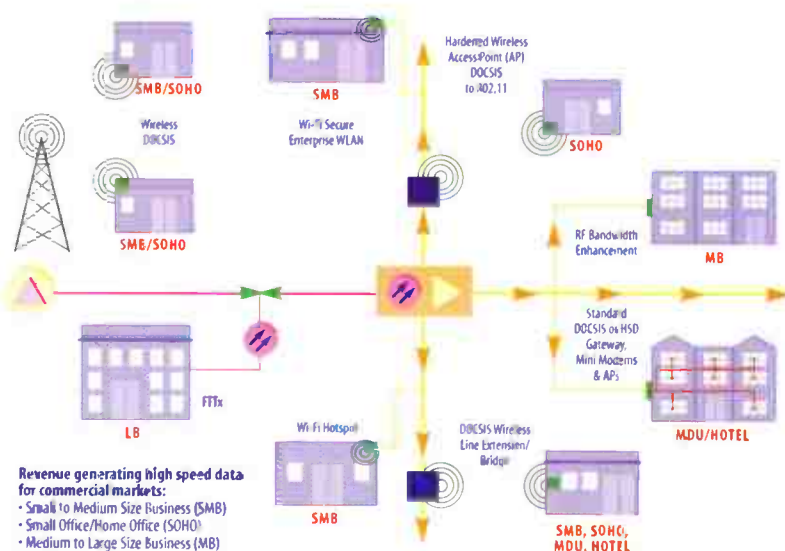
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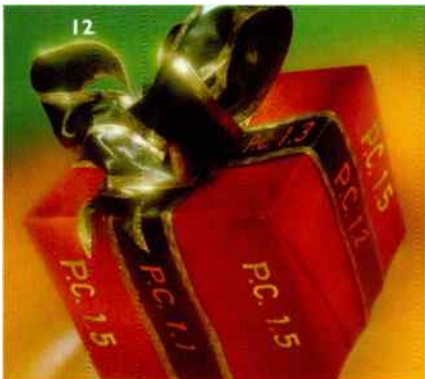


Revenue generating high speed data for commercial markets:

- Small to Medium Size Business (SMB)
- Small Office/Home Office (SOHO)
- Medium to Large Size Business (MB)
- Large Business (LB)
- Multiple Dwelling Units (MDU)
- Hotels

departments

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ADVANCED NETWORKING

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The decoupled CMTS provides flexibility and scalability, while an integrated approach may be more manageable and reliable, at the expense of greater flexibility. Operators will thus face some tough decisions about architectural tradeoffs.

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40 TV-TO-GO

Cable operators and satellite service providers hope to become the "king of the road" with portable DVR services aimed initially at consumers' cars.

44 COUNTING ON CONTENT

Steve Wadsworth, president of the Walt Disney Internet Group (WDIG), discusses how WDIG has crafted broadband content to keep consumers engaged, as well as build a growing advertising segment.



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3 IN PERSPECTIVE Are Verizon and SBC serious about fiber and video? Or are they more comfortable with familiar turf like MCI and AT&T?



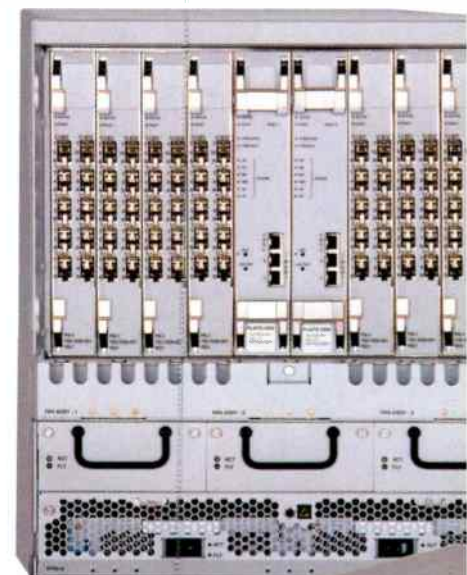
20 MEMORY LANE This is not the first time that the telcos have harbored grand video ambitions.

42 IN THE LOOP Nanotechnology—telecom savior, or creation gone wild?

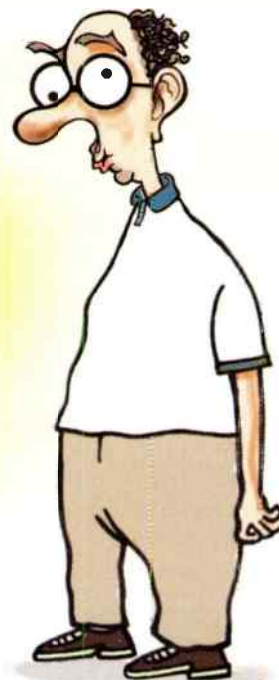
50 CAPITAL CURRENTS From the looks of many new offerings at the Consumer Electronics Show, the industry has recognized that consumers want to watch TV anytime, and anywhere.

ALWAYS ON

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New Equipment Rebuild Quote More Than Expected?



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LATEST NEWS AND INSIGHT

Charter switches it up in St. Louis

Charter Communications has “upgraded” its video-on-demand platform in St. Louis, essentially replacing existing VOD gear from Concurrent Computer Corp. with servers and software from rival vendor C-COR Inc. Charter has since said it plans to re-deploy the Concurrent gear in another market yet to be disclosed.

It marks the first big win for C-COR since closing an \$89.5 million deal to acquire nCUBE Corp. earlier this year.

It also marks the second time Charter has changed out its video-on-demand infrastructure in the St. Louis system—once because of necessity, and now once by choice, apparently. Before awarding its headquarters system to Concurrent, Charter used servers and backoffice software from Diva Systems, a soup-to-nuts VOD vendor that went bankrupt in May 2002.

Concurrent CEO Gary Trimm noted that Charter’s move was not a “wreck out,” but a move that stemmed primarily from the MSO’s decision to regionalize VOD vendors.

Charter’s decision also gives more credence to cable’s migration toward “open” VOD backoffice systems designed to work with different types and brands of video servers. N2 Broadband (now part of Tandberg Television) and C-COR both have integrated their backoffice platforms with other vendors. SeaChange and Concurrent have yet to announce integration deals with third-party server vendors.

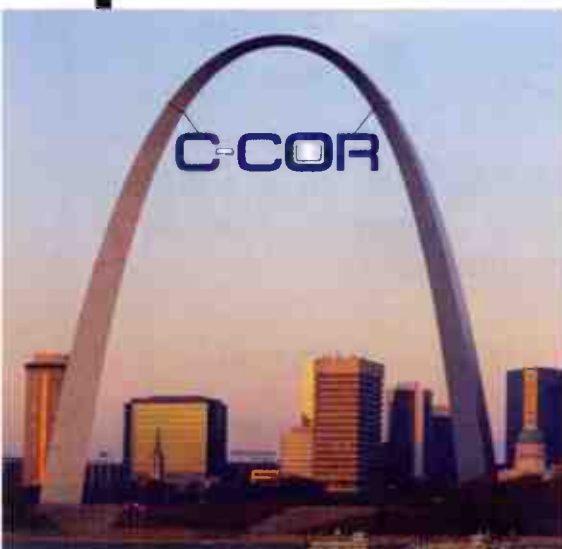
Video server startup Arroyo Video Solutions Inc. has moved ahead with a platform that supports native 10-Gigabit Ethernet broadband networks and can push out up to 5,000 standard-def video streams per 3-RU server.

Arroyo gets 10-GigE with it

Support for 10-Gig networks and the additional streaming capacity will position Arroyo

to meet the demands of expanded VOD libraries, higher usage patterns and HDTV-on-demand services, explained David Yates, Arroyo’s vice president of marketing and business development.

Arroyo’s competitors also have plans for the technology. SeaChange International and Concurrent



RCN tees up 10-meg tier

RCN Corp. has once again raised the bar on residential cable modem service speeds, this time capping the downstream of its high-end tier at 10 Mbps.

RCN has launched the new service, dubbed MegaModem Mach 10, across all its markets. Customers who take RCN’s 7 Mbps service will automatically be upgraded to the 10 Mbps service. Those taking the company’s 5 Mbps service will be moved to a 7 Mbps tier for no additional charge.

RCN’s latest upgrade follows a general trend by cable operators that are being careful to not fall into a price war with DSL. Among recent moves, Comcast Cable is in the process of upgrading its flagship tier to 4 Mbps downstream and its high-end tier to 6 Mbps. Time Warner Cable has boosted the downstream cap of its primary Road Runner tier to 5 Mbps from 3 Mbps.



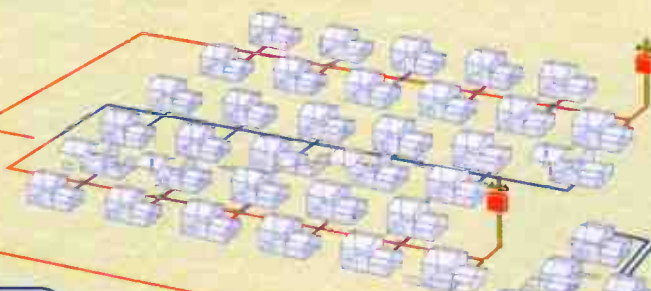
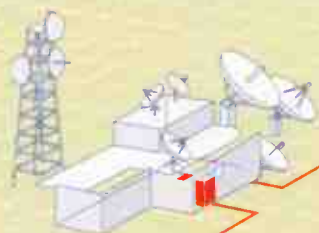
Computer Corp. officials said they have 10-Gig plans in the cards for 2005. C-COR Inc., which recently acquired nCUBE Corp., said it will incorporate 10-Gig when it believes the technology is mature to the point of commoditization. C-COR said it anticipates that could occur by mid-2006.

DOCSIS® Monitoring

Protecting revenue and reducing costs

In today's competitive world, cable operators must actively monitor their networks as they roll-out new interactive services.

Alpha Technologies embedded and external DOCSIS transponders enable operators to reduce cost and better manage their HFC network, resulting in increased profits and market share.



XM2 DOCSIS Card

Embedded and External Transponders

- DOCSIS
- HMS
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CableCARD installations hit 25,000-plus

The cable industry has installed about 25,000 CableCARDs, up from the 700 the National Cable & Telecommunications Association reported to the Federal Communications Commission back in August 2004.

Willkie Farr & Gallagher, a law firm representing Comcast Corp., revealed the figure in an FCC Ex Parte document filed with the FCC on Feb. 10. Of the 25,000 CableCARDs deployed, about 12,000 have been provided by Comcast.

The filing noted some details tied to a Feb. 9 meeting between Comcast SVP of Strategic Planning Mark Coblitz, Comcast Chief Policy Advisor James Coltharp, FCC Commissioner Michael Copps, and Copps' senior legal advisor, Jordan Goldstein.

There, Coblitz pushed cable's position that the industry should not be prohibited from deploying set-tops with integrated security, noting that the CableCARD deployments so far should demonstrate that the cable industry is fully honoring its commitments to support the CableCARD and that it is working in good faith toward a two-way Plug & Play agreement with the consumer electronics industry.

The cable industry has pressed the FCC to either lift or extend a deadline that operators be banned from distributing set-tops with integrated security by July 1, 2006. A ban on boxes with integrated security, the industry has held, will impede cable's progress toward low-cost digital set-tops, because CableCARD support adds unnecessary costs to the picture.

The Consumer Electronics Association, however, has called on the agency to retain the current deadline, arguing that CE companies would find themselves at a competitive disadvantage without uniform support for the CableCARD interface, and that the equipment required for the interface will not reach commodity levels without a mandated ban on boxes with internal security.



Terayon sheds silicon tech

ATI Technologies Inc. will pay \$14 million to acquire the cable modem silicon intellectual property of Terayon Communication Systems Inc. ATI plans to use Terayon's silicon technology and expertise to build DOCSIS-based two-way capabilities into set-tops and digital TV chipsets.

The sale closes another chapter on Terayon, which has been repositioning itself for profitability by shifting its focus on cable modems, multimedia terminal adapters and digital video equipment. Last fall, Terayon announced it would cease investment in cable modem termination system products.

Terayon once had grand plans for its silicon division. In October 2001, the company announced plans to spin off the unit under the name of Imedia Semiconductor, and sell chipsets to other cable modem and CMTS suppliers.

America Online and Time Warner Cable have finally joined forces on a broadband service that will combine an AOL front end with high-speed connections from Road Runner.

Under the deal between corporate cousins, AOL will handle the advertising and search applications for the new offering and the Road Runner portal. Time Warner Cable, in turn, will provide subscription billing and customer care, and provide an

AOL, TWC do the high-speed dance

undisclosed share of subscription revenue to AOL.

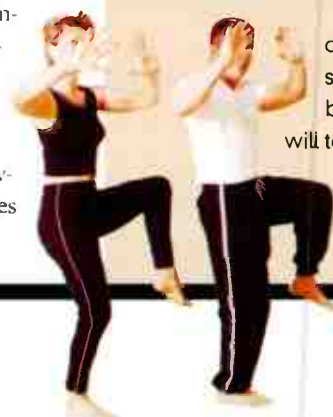
Among the goals, the companies hope the move will

beef up advertising and premium service revenues, and entice AOL's dial-up subs to migrate to broadband.

AOL and Time Warner Cable expect to introduce the new service "over the next several months," according to company executives.

The AOL-TWC offering will include unlimited high-speed access and 10 hours of dial-up connectivity. In addition to a new AOL client, the service will set up AOL.com as the default home page. Time Warner Cable will continue to sell Road Runner on a stand-alone basis, however.

The companies did not disclose specific pricing, but noted they will test a range of price points during the initial rollout.





C-COR Solutions

Interoperability, Software Now Keys to Revenue-Generating Services and Efficient Network Management

In today's competitive environment, systems operators are being asked to build and maintain complex, sophisticated infrastructures, as well as develop a compelling bundle of next generation revenue-driving services including video, voice, data, and On Demand.

In addition, they are trying to gain a customer base being wooed by as many as three competing providers in a single market. Amid this murky, complicated, and highly competitive environment, the industry is fighting back.

Enter the new C-COR, a trusted partner to the cable industry for more than 50 years. It has listened carefully to its customers who have invested billions of dollars in network upgrades as it developed products and services to meet the demands of an IP-driven world.

Meeting the demands of an on demand world.™



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Meeting the demands of an on demand world.™



C-COR recognized that the most efficient platform for this new environment includes standards-based components that work together to deliver a full end-to-end suite of hardware, software, and management tools for best-of-class services. Over the last year, the company has acquired Alopa Networks, Stargus, and nCUBE to bring its all-IP vision to market.

C-COR has organized itself into three separate but complementary business units, allowing customers to effectively manage the migration. These performance-driven groups include C-COR Solutions, C-COR Access and Transport, and C-COR Network Services.

C-COR Solutions offers operators a choice of a complete, integrated, application-oriented IP suite of back office automation tools for network content, subscriber, and workforce management, as well as advanced advertising and On Demand services. Or, with the interoperable capabilities incorporated into the product lines, customers also have the flexibility to build their own end-to-end suite.

"The clear message from our MSO customers is that they need help generating new revenues, achieving greater network efficiencies and lowering costs. We've built C-COR Solutions on that foundation," says Ken Wright, CTO of C-COR. "We focus on ways to help our customers build profitable, predictable services infrastructures while also providing the ability to choose exactly the technologies and software they need at each phase of the network lifecycle. Through our acquisitions, we are creating valuable synergies at C-COR among our three groups. It will allow quick access to the parts of a network that are potentially ready to deliver new services while maintaining flexibility."

C-COR Solutions Group and the New C-COR

C-COR Solutions consists of four key disciplines: Advanced advertising and On Demand hardware and back office management; service assurance, including policy management; mobile workforce; and fulfillment.

"The Solutions group is part of a collaborative effort with C-COR's two other business units to simplify technology, facilitate its implementation, and enable operators to confidently manage the changing needs of increasingly demanding subscribers," says Mike Pohl, President of C-COR Solutions. "Our belief in simplicity and interoperability sets us apart. We support open architecture solutions rather than proprietary technology platforms, which streamlines operations for our customers saving them valuable money and time."

Driving revenue through advanced advertising and On Demand

On Demand and digital advertising are growing markets, projected to reduce churn and leverage revenue opportunities at the local, regional, and national levels. As both content libraries and customer expectations grow, the need for network efficiencies increases.

Proven integration expertise, interoperability, scalability, and an understanding of the nexus between storage and content are all necessary elements to deliver cost effective and reliable On Demand products to market.

Advanced advertising is also evolving quickly. The ability to deliver digital-to-analog, digital-to-digital and digital-to-HD from a single platform using automatic, one-step distribution and centralized system and content management all lower advertising costs for cable operators and provide a smooth migration path to the latest digital television technology.

C-COR simplifies the deployment of On Demand content and digital ad insertion systems with the market's most powerful video server and a comprehensive set of software tools for session and resource management, content management, entitlement management, and operations monitoring.

Service assurance means healthy networks

Yet delivering On Demand services requires a healthy network, and C-COR's service assurance is the only comprehensive, combined and integrated platform designed to monitor all broadband services and the overall health of the network. With nearly \$1 billion in lost revenue due to churn, and the emergence of two-way services such as VOD, HSD, VoIP and more, ensuring the health of cable's transport network becomes paramount.

What makes C-COR's service assurance solution unique is its ability to monitor, analyze, and recommend ways to increase a network's health and vitality by observing the entire network, not just portions of an MSO's service offering or network. The end result is a set of timely and preventive metrics of an MSO's network and service offerings that ensures any outage or bandwidth efficiency issues are resolved quickly and cost efficiently before they impact the customer.

And, with DOCSIS standards moving to Packet Cable/Multimedia, and SIP to NGNA, along with ever-changing business strategies, real time network monitoring is crucial. C-COR's services assurance platform allows a holistic view of the network and the tools to manage and maintain it efficiently.

Efficient, mobile workforce lowers costs

C-COR's service assurance component is closely tied to its mobile workforce solution, providing a natural bridge of information to a cable operator's workforce system.

Its product suite is part of C-COR's Mobile Workforce Manager that is designed as a set of products that proactively manage service delivery and network integrity, and is a product-oriented solution, not project-oriented.

Mobile workforce is also saving operators significant dollars, evidenced by an average of 60 percent fewer repeat calls and a significant reduction in the cost of truck rolls, most notably, follow-up truck rolls.

Additionally, customers are reporting dramatic operational savings using automation, which manages scheduling, routing, and workflow management tools combined with real-time communications between the operations center and mobile workforce. It is also a vital link to the fulfillment side.

Subscriber fulfillment reduces time-to-market

The company's fulfillment solution is the only end-to-end integrated subscriber management system that includes work flow management, subscriber management, an open interface based on industry standard SOAP, and device provisioning that includes data, voice, and residential gateway.

It provides an easy-to-use GUI tool for MSOs to model new service offerings in their efforts to reduce time-to-market and is an invaluable tool for the reliable and secure provisioning of VoIP.

Yet with networks becoming even more complex and sophisticated, the bar is being raised in integrating a myriad of network elements as the march towards IP-based services intensifies.

C-COR's answer is the easily extendable architecture of its fulfillment solution which allows future services through simple add-on components, and a single integrated solution, as opposed to a point solution from different vendors, for workflow, device provisioning, and VoIP security.

Concludes Pohl: "We bring flexible and reliable solutions backed by 50 plus years of trusted products to the market. C-COR Solutions is a true representation of the new C-COR and its mission to bring a fully integrated suite of products and services to the cable industry."

THE

REVIEWS Are In!!

We asked the attendees of the live, online Cable Television and Broadband Expo what they thought, and they told us...

"It was amazing!
It was incredibly easy to
listen in as I carried on with
daily work. I didn't have to
travel anywhere, and yet I got
virtually the same benefits of
attending a physical conference.
Whatever I missed, I can review
at my leisure for the next 6
months."

"Top-notch speakers."
"It certainly
will be the way trade shows
will be done in the future."
"No travel, no hassle.
Loved it."

"It was a very
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interface (resembling a real
conference/tradeshows)
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intuitive."

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CableLabs releases PacketCable 1.5

With little fanfare, CableLabs has released a new iteration of the PacketCable specification that fuses together some previous versions and adds important new features such as fax support.

PacketCable 1.5, released on Jan. 28, essentially combines PacketCable 1.1, 1.2 and 1.3 into one tidy document. That leaves PacketCable 1.0 and PacketCable 1.5 as the two active specs related to certification and qualification for cable VoIP equipment.

PacketCable Multimedia, a spec that provides QoS for a wider range of IP-based services and applications, remains untouched, explained Ed Miller, vice president of advanced network systems at CableLabs.

"It was the right time for PacketCable to make this change," Miller said, noting that cable operators have migrated from the tech-

nology development period to a deployment phase. "The core architecture and extension of telephony [services] are done," he added.

PacketCable 1.5 includes the primary elements of 1.1 (electronic surveillance and high availability), 1.2 (inter-domain VoIP), and 1.3 (call management server-subscriber provisioning). The 1.5 version also supports additional enhancements and features, including fax relay capabilities and the incorporation of advanced audio codecs from Broadcom Corp. and Global IP Sound.



Infinera has photonics in the chips

Infinera has developed a photonics platform that condenses and integrates multiple optical elements—including lasers, modulators and receivers—onto one chip.

Infinera, which was founded in 2001 and developed the silicon in-house, is using that technology to power a metropolitan optical platform called the DTN. Instead of dealing in electronics, Infinera's platform deals in

optical waves. In typical analog-to-digital and digital-to-analog conversions, operators require a spate of components to do that converting. Infinera integrates all of those components.

"Now we have a low-cost way to go from photonics to electronics. This eliminates the need to manage the optical core as optical waves. If I'm managing performance and error correction, I can do it all digitally [with this technology]," explained Rick Dodd, Infinera's director of marketing.

In the cable arena, the company views it as a prime component for the transport of regular high-speed data services, as well

as video-on-demand and high-definition television content.

The DTN is capable of pumping out 100 Gbps per line card, or 400 Gbps per chassis.

Infinera's only announced customer is Freenet, an ISP based in Germany that operates a 1,800-kilometer core network connecting cities such as Frankfurt, Leipzig and Dusseldorf. Freenet is using Infinera's platform to support more than 6 million subscribers.

The Freenet deployment "provides first proof that integrated photonic circuits...are carrying mainstream applications," Dodd said.



The Infinera DTN.

TiVo opens up

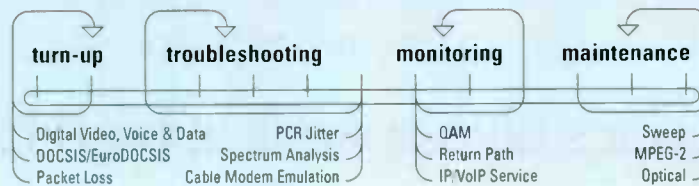
In a move that shares some aims of the CableLabs Open-Cable Application Platform (OCAP), DVR pioneer TiVo said it has opened its doors to third-party software developers.

Following up on the company's new "Tahiti" service strategy, TiVo's software development kit (SDK) will give third-parties the ability to create new applications that ride alongside the TiVo service.

Those applications, to become available to Series2 DVR customers, will be hosted by TiVo servers or run locally on customer PCs. Among early apps, TiVo envisions program and movie guides, local weather info, and multiplayer games.

TiVo is backing the initiative with a contest for developers.

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GigaBeam does high speeds at high frequencies

GigaBeam Corp. is using a new \$2.5 million round of capital to fuel the technology behind a fixed wireless system capable of data speeds as high as 1.25 Gbps.

GigaBeam's "WiFiber" platform delivers point-to-point links in the 71-76 GHz and 81-86 GHz bands. Later this year, the company plans to deliver products capable of 10 Gbps. The technology uses a tight beam (less than 1 degree) in that FCC-licensed spectrum.

"It's wireless fiber in the air," said company Chairman and CEO Louis Slaughter, who claims that GigaBeam's system can deliver the same reliability of fiber up to one mile. The platform itself is capable of delivering data services to links as far as 10 miles, he added.

Slaughter estimates that the GigaBeam system can be deployed for \$1 to \$3 per megabit per month. That compares favorably to a traditional T-1, which can run \$500 to \$1,200 per megabit per month, he said.

Whereas WiFi and WiMax are considered copper alternatives, Slaughter views his WiFiber platform as an alternative to fiber because it can provide connectivity to the metro access network via the cheapest POP (point of presence) in the area. WiFiber, he added, also isn't hindered

by the fiber backhaul issues a technology like WiMax is expected to encounter.

"WiFiber is the final key that's been missing in the last mile access," Slaughter claimed, noting it can complement the technology of ILECs, CLECs and cable operators.

GigaBeam, founded a year ago and headquartered in Herndon, Va., moved

ahead last July with a beta link in New York City that connected the Trump Hotel near the Lincoln Center to Trump-owned multiple dwelling units on the west side of Manhattan.



GigaBeam has 10-Gig on the roadmap.

RemotePipes is giving cable operators the ability to roam, if they want to. Counting customers such as Adelphia Communications, Shaw Communications, Rogers Cable and Charter Communications, RemotePipes, a small firm based in Minneapolis, provides access to about 10,000 Wi-Fi hotspots (and tradi-

RemotePipes offers Internet mobility

tional dial-up access) around the world that, in turn, can be tapped by cable high-speed subs

who are looking to get Internet access even while they're on the road.

Although RemotePipes' IPR Roamer platform works with other types of service providers, "cable was a natural fit for us," said company CEO Doug Bonestroo, noting that the company's technology is specifically tailored to service small- and medium-sized businesses.

RemotePipes' cable MSO customers, he added, only have to direct their subscribers to a co-branded landing

page. "From there we handle everything, and pay [the cable operator] a 35 percent revenue share," Bonestroo said.

The service itself charges users by the minute. "People love that it's not a subscription," he added. RemotePipes charges about 1 cent per minute for local dial-up, and up to 40 cents a minute for a Wi-Fi connection in areas like Europe. While that might sound expensive, Bonestroo points out that in some regions of the world, people can expect to pay \$5 per minute for a simple phone call.



Cable VoIP subs jump 900 percent

The number of North American cable VoIP subscribers jumped to about 500,000 in 2004, a 900 percent increase from 2003's totals, according to Infonetics Research.

Operator spending in the area matched sharp VoIP subscriber growth. Infonetics surmised that North American MSOs spent \$123 million on VoIP gear in 2004, compared to \$63 million in the year prior.

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LATEST NEWS AND INSIGHT

To catch a cable thief



New research from the Cable & Telecommunications Association for Marketing (CTAM) suggests that operators must discard a “one-size-fits-all” approach to signal theft in favor of deterrence tactics that target specific groups based on how aggressive or passive they are in filching service.

Cable theft is not a minor financial issue. According to the National Cable & Telecommunications Association (NCTA), signal theft costs the cable industry nearly \$6.6 billion a year.

The CTAM study defined individuals as belonging to distinct categories of theft. The study derived behavioral and attitudinal data from how each of 1,666 respondents scored in a series of 18 theft scenarios.

“Aggressive theft,” representing five percent of the base, identified those who scored very high on both the aggressive and passive scenarios, and viewed cable theft as a minor ethical infraction. The category includes people

who are actively stealing cable service, and those who see nothing wrong with others stealing cable and would not do anything to stop them. The group also included individuals who would steal signals if presented with the opportunity. The study recommended that the best way to deal with this group is to make it technically more difficult for them to steal services.

“Passive theft and enablers,” representing 21 percent, scored high on passive scenarios, but lower on the aggressive ones. This group is less deliberate with theft (i.e. moving to a new home and linking to a hot drop). This group’s perception of the seriousness of signal theft is somewhere in the middle, and it has a stronger anti-theft sentiment toward intentional theft.

CTAM said targeted communications are likely to be the most effective and successful with the “passive theft and enablers” segment. Specific tactics include focusing on the theft of the channels themselves rather than the service itself, and to “make it personal” by explaining that the theft can hurt individuals as opposed to companies.

“Copyright theft,” a newer segment, represents 37 percent of the base, and includes people who are apt to copy movies, software and music illegally via the Internet. This segment can also be a subset of the other three theft groups identified by the study.

SCTE seeks nominations

The Society of Cable Telecommunications Engineers (SCTE) is accepting nominations for awards to be handed out during the Society’s annual Cable-Tec Expo, including the Member of the Year, Hall of Fame, and Safety honors.

SCTE has set a nomination deadline of Thursday, March 31, 2005. Nomination forms are available on the Web (www.scte.org/membership/index.cfm?pid=26).

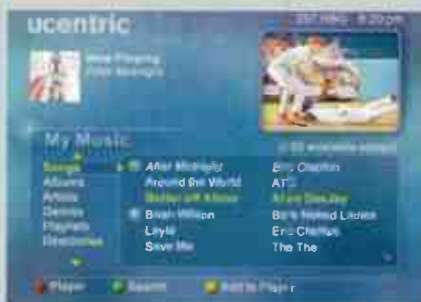
SCTE will formally introduce the award winners at the Expo awards luncheon, set for June 15 in San Antonio.

Motorola Inc. has sealed a deal to acquire Ucentric Systems, giving the set-top maker a suite of whole-home entertainment networking software. Financial terms were not disclosed.

Motorola snaps up Ucentric

Founded in 1999, Maynard, Mass.-based Ucentric has been a strong advocate of whole-home digital video recording technology that enables users to watch recorded video and music and photos in multiple rooms and on multiple devices.

Despite being a small company, Ucentric has managed to cobble together deals with larger service providers such as VOOOM and DirecTV, as well as with a range of manufacturing and technology partners such as Broadcom Corp., Samsung and Entropic Communications.



Ucentric and Motorola announced an integration deal last year. Motorola is on target to ship set-tops—including the DVR-capable DCT-6208 and DCT-6412—outfitted with Ucentric’s software by the second half of 2005.

Ucentric CEO Michael Collette will stay on as a consultant with Motorola for an unspecified time.

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Terayon makes wireless a snap

Terayon Communication Systems has introduced a wireless home networking module that snaps onto the vendor's line of TJ700x DOCSIS cable modems.

Terayon said the Wx-54G module lets operators deploy home networking capabilities to cable modem customers without incurring networking equipment costs across the entire deployed base of cable modem customers. The Wx-54G only works with the Terayon TJ700x series, however.

Although vendors have migrated to cable modems with integrated home networking capabilities, there are millions of stand-alone cable modems in the field, noted Joe Benigno, vice president and general manager of Terayon's home content access solutions division.

He estimates that Terayon has 3 million 700-series modems installed. U.S. MSOs that use Terayon 700-series modems include Adelphia Communications, Comcast Cable, Cox Communications and Time Warner Cable.

Cable modem gateways are "taking up the slack" where stand-alone cable modem shipments are declining, but Terayon wanted to introduce a product that would work on the installed base, he noted.

Among its features, the Wx-54G supports 802.11g, and an Ethernet port, and can enhance the device's wireless footprint via a three-foot extension antenna.

Terayon did not release specific pricing on the module, but the module costs more than a stand-alone modem.

Terayon is also looking at the possibil-



Terayon's wireless module connects to the primary modem.

ity of creating modules that support HomePlug, a home networking technology that uses existing power lines. About a year-and-a-half ago, Terayon considered a VoIP module, but found the idea to be cost-prohibitive.

Terayon also has an integrated cable modem gateway on its product roadmap, Benigno said.

Comcast invests in RGB

RGB Networks has polished off a \$12 million round of funding from a group that included participation

by Comcast Interactive Capital (CIC).

The round also included help from Mitsui & Co. Venture Partners and from existing RGB investors Accel Partners and Kleiner Perkins Caufield & Byers.

The latest round "will enable

us to accelerate our efforts to deliver a family of products for effectively expanding a cable operator's usable bandwidth," said RGB President and CEO Adam Tom, in a written statement.

CableLabs integrates testing

Discovering that one head may in fact be better than three, CableLabs has pooled all of its testing resources.

The newly streamlined System Evaluation Group now heads up all certification, qualification and verification testing for projects such as DOCSIS, CableHome and PacketCable.

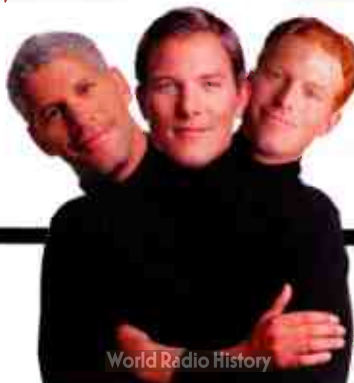
Heading the group is Craig Chamberlain, who was promoted to the new post of vice president of system evaluation. There, he will spearhead testing for CableHome, DOCSIS, Digital Program Insertion (DPI), PacketCable and OpenCable. Previously, he was director of certification for broadband access at CableLabs.

The testing integration applies to the first

certification wave of the year, which kicked off Jan. 17.

CableLabs said the decision was in response to a growing number of products that integrate functions from the various CableLabs specifications and projects. Cable modem gateways, for example, use both DOCSIS and CableHome. Set-top makers, meanwhile, are integrating DOCSIS capabilities.

The new group is made up of six unit heads: Mark Meyer, director of interops; Maria Stachelek, director of program management; Mark Guzinski, director of lab facilities; Jesus Lopez, program director of certification for data; Robin Sam Ku, manager of certification for multimedia; and Craig Richardson, manager of certification for video.



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Channeling the telcos

They've abandoned video before. Will they do it again?

The turn-of-the-century futurist S. Colum Gilfillan believed technology evolved in a sort of biological fashion, progressing not in revolutionary leaps, but in increments that arose from a steady flow of relatively small ideas.

Yet even this conservative thinker was wholly smitten by a new invention called the telephone. In 1912, Gilfillan predicted that within 30 years, telephone networks would allow the commoner to summon up a three-dimensional presentation of a Shakespearean play to a sort of home theater in the living room.

It turns out that Gilfillan was off by about 60 years. But let's not quibble over timing. He got some of it dead-on.

Telephone networks of today indeed are capable of delivering video content on-demand to the living room, the office or even a

and episodic TV programs to about 1,000 homes over a DSL network. "Americast" was the joint venture of Walt Disney Co. and several regional Bells. The granddaddy of them all, though, was "Tele-TV," a name so steeped in optimism and artifice you'd swear it had been invented in 1956.

Howard Stringer, the well-respected chairman and CEO of Sony Corp. of America, ran the joint venture of Nynex, Pacific Telesis Group and Bell Atlantic from its 1994 inception through its 1997 dissolution. We shall charitably describe that 36-month interlude in Stringer's career the way parents dismiss a rocky time for their kid during adolescence: they were "the lost years."

Eight years later, it is impossible to conclude that Tele-TV accomplished anything. The thing did have its ritual grand pronouncements, of course, such as the projection of reaching 25 million homes by 2000 with traditional video channels and newfangled interactive services. By the time its partners shut the venture down early in 1997, a humbled Tele-TV was talking about aspiring to 2.5 million homes by 2002, using the relatively unremarkable technology known as MMDS to beam wireless video signals. There was nothing new, interactive or revolutionary about it.

What doomed Tele-TV, though, wasn't so much a failure of will as the allure of a prettier maiden. In 1997, a new federal law promised that if telephone companies behaved nicely toward competitors, they could earn the prize of selling long-distance service. The phone companies dumped cable TV in about the same time it took Britney Spears to annul a Vegas wedding.

The history lesson to remember here is how quickly the telephone companies beat a path away from video and toward a much more familiar domain. In 2005, even as telcos avow that this time they really mean it, another siren song can be heard wafting through the industry's boardrooms. It's the call of the mega-merger. SBC-AT&T. Verizon-MCI. Sprint-Nextel. Whatever the combination, the immediate prospects for immediate growth in the telephony sector suddenly seem to be looking a lot more attainable the old-fashioned way: by buying it.

It was telling that in all the back-slapping and hand-shaking going on over the SBC-AT&T merger last month, all the talk was about cost savings and wireless possibilities and revenue from business customers. Nobody mentioned much about video. Which suggests that even in the modern, bundle-happy digital age, telcos and TV may remain anything but a twisted pair. ■

Stewart Schley writes about media and technology from Englewood, Colo.



wireless PDA (we'll overlook the whole 3-D business for now). Whether it's a marginally acceptable IP video stream over a DSL connection, or a full-fledged MPEG-2 video channel delivered by the likes of Qwest Communications in Phoenix, there's no question that souped-up phone networks can do the TV dance. The laborers now digging trenches on behalf of Verizon in the suburbs of Boston are working to produce an even more prodigious "telco" network boasting downstream data rates of a heady 30 Mbps or more. Industry titans like SBC pledge to devote billions of dollars in capital this year to build out TV-capable networks that will fill in the final piece of the phone-wireless-data-video bundle. These are heady times in telco-TV land, to be sure.

But a short walk down memory lane reminds us there were similarly grand ambitions stirring in the mid-1990s. And the economic forces that ultimately sidetracked the telco-TV effort then still sound a meaningful echo now.

The most visible of the telco TV initiatives of the 1990s bore names that today seem quaint in a sort of Walt Disney-imagines-the-future way. "Stargazer" was the name for Bell Atlantic's Virginia-area trial of an on-demand TV service that fed movies

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DRILLING FOR BANDWIDTH

**A pipeline full of
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MSOs keep pace**

**with the
spectrum
demands of
HDTV, VOD,
'channel
bonding,'
and digital
simulcast**

Depending on who you talk to these days, cable operators—if they hope to keep up with the demand wrought by new services—can either continue to pump bandwidth from their existing wells, or drill even deeper to uncap that next, big “gusher.”

As one might surmise, those who are selling the drills and bits believe cable is better off taking the latter path.

The good news is that there's bandwidth aplenty in those HFC networks if operators want to drill for it. But how much bandwidth they obtain depends on how deep they want to go and how much they want to spend.

There are several key drivers impacting cable's need to either add bandwidth or to be much more efficient with the bandwidth it already has.

Chief among them is high-definition television (HDTV), a rapidly growing service that gobbles up bandwidth at about four times the rate of standard-definition.

Video-on-demand (VOD) is also poised to take a big bite out of cable's bandwidth as operators expand their libraries well beyond the 3,000-hour range,

customers increase their usage of on-demand fare, and MSOs introduce more bandwidth-stretching HD-VOD titles.

Another bandwidth sponge is digital simulcast, an all-digital migration technique that, at least in the long run, will enable cable operators to reclaim analog bandwidth. The irony, of course, is that digital simulcast actually costs more bandwidth upfront because it calls on the operator to replicate its entire analog lineup in the digital tier.

Yet another trend that could apply pressure on cable's bandwidth is a technique called “channel bonding.” Expected to play a central role in the forthcoming DOCSIS 3.0 specification, channel bonding (also known as the “wideband protocol” in some vendor circles) virtually fuses together multiple 6 MHz channels, thereby enabling cable operators to offer data speeds that rival or perhaps surpass those offered by fiber-to-the-premise (FTTP) network operators.

“Wideband is certainly nice if I can expand the digital spectrum to reclaim the analog spectrum, which is the master plan down the road,” says John Mattson, director of cable products for Cisco Systems Inc.

By Jeff Baumgartner, Editor



DRILLING FOR BANDWIDTH



Comparing costs: According to CableServ data, expanding bandwidth via “drop-in” amplifiers can be cost-effective on a cost-per-mile basis. Source: CableServ

Although conventional wisdom holds that bandwidth pressure will come from narrowcast services such as VOD and high-speed data, those two potential problem children can be pacified through node splitting.

“All of the bandwidth pressure is coming from broadcast services such as HDTV and digital simulcast,” says Mark Palazzo, vice president and general manager of access networks for Scientific-Atlanta Inc.

Several tools have emerged to help operators, and each one has its good sides... as well as possible side effects.

Skimming the surface

In systems below 750 MHz, a technique that’s gaining traction is the “drop-in” amplifier, which can beef up bandwidth to 750 MHz or even 860 MHz without the massive construction and expenses associated with a full upgrade.

Companies like CableServ Inc., for example, are seeing plenty of activity in urban systems that are experiencing a bandwidth crunch, but still need to remain competitive by launching new services such as telephony, HDTV and VOD.

“The benefit is that it’s significantly cost-effective if you need more bandwidth, because you’re using equipment you’ve already paid for,” says CableServ President Audley Alexander.

In addition to saving money over traditional upgrades (see chart, above), the technique also saves time. CableServ, Alexander notes, upgraded a “major” cable system in Canada with 10,000 miles of plant in about six months. A full build, he points out, could take three to five years.

Although an amplifier upgrade in 550

MHz is a known path with known costs, it’s not the only path.

“If we haven’t upgraded those [550 MHz] systems, there’s probably a good reason—either it’s too costly or there’s low [subscriber] penetration,” says David Fellows, executive vice president and chief technology officer of Comcast Corp. He estimates that 1 or 2 percent of Comcast’s footprint falls into the two-way, 550 MHz category.

Comcast is considering cutting everything to digital virtually overnight during the next year or two in such systems. In those situations, an operator like Comcast might also maintain a “lifeline” analog video service that offers just the over-the-air broadcast networks and must-carry channels.

Another bandwidth-saving tool available to operators is switched broadcast.

Like VOD, streams of networks in the “switched” tier are only activated when requested by the subscriber. While that technique has been discussed as an option for cable for about three years, only recently has there been any trial activity to point to. At the SCTE Conference on Emerging Technologies in January, BigBand Networks shared the results of two trials: one with Cox Communications, and one with an operator yet to be named.

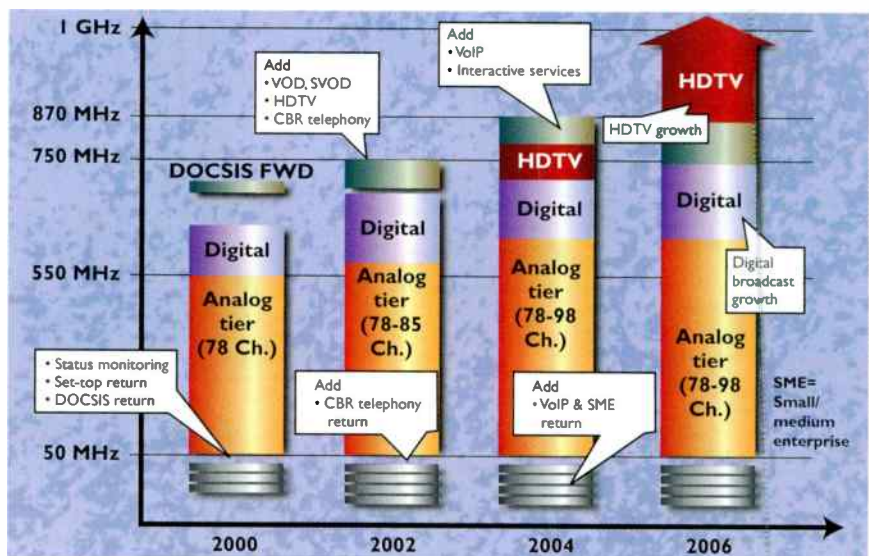
With some data to show how the technology works and how it applies to existing networks, the next question is how the technology shakes out versus other tools, notes S.V. Vasudevan, BigBand’s chief architect and vice president of systems engineering.

Whereas switched broadcast was seen as simply an interesting technology two years ago, those conversations have since grown to “more concrete actions,” Vasudevan says.

“As MSOs shift from what are the stats and technical familiarity of switched broadcast, the questions now seem to be more of an operational theme—how do I roll this out; what does the architecture look like?,” he adds.

Both Charter and Comcast have not announced plans to use switched broadcast technologies, however.

“I wouldn’t say switched broadcast is not attractive to us. I think it’s a migration



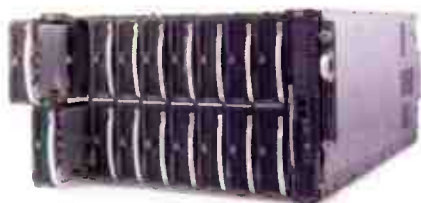
The bandwidth evolution: This representative system shows how spectrum has been expanded in recent years to accommodate new cable services. One idea on the board is a jump to 1 GHz, which would give operators more headroom for HD. One potential downside: existing cable set-tops do not tune above 870 MHz. Source: Scientific-Atlanta



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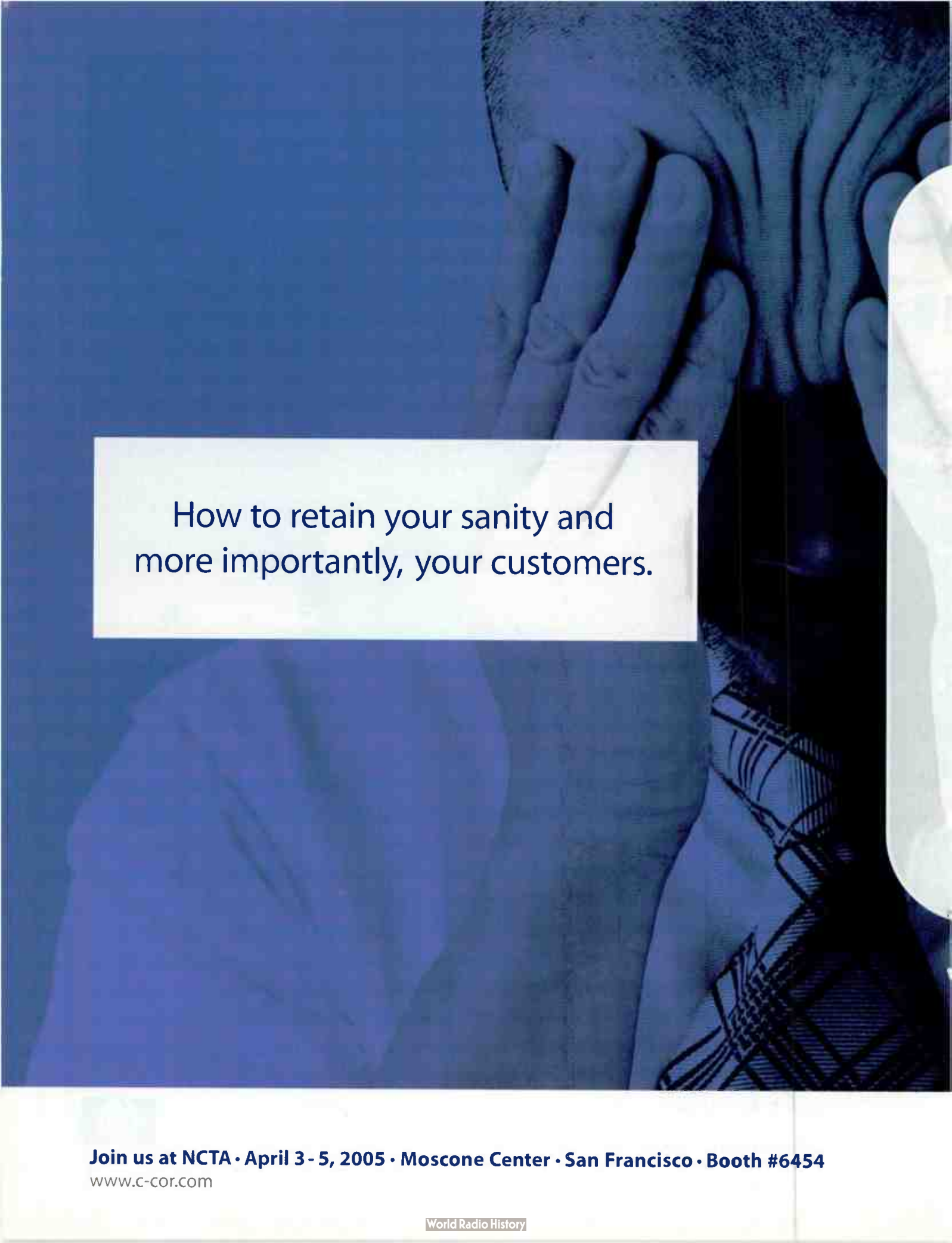


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DRILLING FOR BANDWIDTH

path that comes after digital simulcast," says Pragash Pillai, Charter's president, advanced engineering-digital video.

For Comcast, whether or not to do switched broadcast is a product of timing. "If no one was doing this today, then we might do it," Fellows says. "You have to go out of your way to do switched broadcast," he says of the added hardware and software required.

Instead, Comcast, as well as other operators, is actively adding downstream capacity by migrating from 64 QAM to 256 QAM, which expands the downstream from 30 Mbps to 40 Mbps.

"If I go to 256 QAM, I free up a third of my channels," Fellows says. "That is one of the things we're doing...and one of the reasons I say we're okay with 750 [MHz]." Shifting to 256 QAM is one of the steps Comcast is taking to help it prepare for forthcoming digital simulcast deployments.

Yet another tool in the toolkit is the advanced codec. Although DBS and the telcos appear to be moving faster with advanced compression deployments, cable, despite its

massive MPEG-2 legacy, will realize big benefits when it decides to pull the trigger.

"In terms of HD, [advanced codecs] will get the bandwidth monster back under control," says Mike Caldwell, senior director of multimedia products at ARRIS.

Drilling deep: Bandwidth expansion

Of course, another sure-fire way to control those monsters is to build more bandwidth. But that method is proving by far to be the most controversial.

Scientific-Atlanta, for one, has been out front with a strategy to boost existing 750 MHz and 870 MHz cable spectrum to 1 GHz. Like other amplifier upgrades, S-A's approach is purely an electronic upgrade, meaning it does not require operators to dig up yards, replace cable, and add power capacity.

Palazzo believes that the additional bandwidth will be needed to support new services as HD. But he sees digital simulcast as one of the key drivers because operators will have to grapple with the real value of an analog tier for some time still. That means

they'll still need access to that valuable chunk of spectrum to support analog services.

"Eighty analog channels will be here for a while," Palazzo says. "We believe to cut back on the analog offering is a negative from a marketing standpoint, and is something that does not play into cable's strength."

A move to 1 GHz just scratches the surface when one looks at the approach being marketed by Xtend Networks. Its overlay system raises the bandwidth bar to 3 GHz.

Xtend's technology initially was seen by operators as a method to offer commercial services over existing HFC networks. That discussion, however, has recently turned toward residential services, as well, according to Xtend CEO Bill Keating.

"The immediate traction was with installations on the commercial side, but all operators are thinking more deeply about medium-term needs on the residential side," he says.

Still, there's a big problem with overlays that offer consumer services in the higher spectrum range, as most deployed digital cable set-tops do not tune above 870 MHz.

Xtend tries to answer that problem via a customer-side device that converts the frequencies back to a level the existing CPE was built to understand.

S-A, meanwhile, has incorporated 1 GHz tuning capabilities on its set-top roadmap. 1 GHz tuning will be available in S-A boxes by the end of this year and into 2006, Palazzo says.

The legacy tuner boxes would be preserved, he adds, because only subscribers who are accessing services in the higher spectrum would require the newer boxes.

Despite the obvious capacity benefits of bandwidth expansion, not everyone agrees that it's a good long-run strategy. ARRIS' Caldwell, for example, believes that the so-called "bandwidth bubble" will exist for only about five years as more content is accessed on-demand and operators finally reclaim chunks of analog bandwidth during the all-digital transition.

Bandwidth expansion also carries with it a stigma on Wall Street, where "overbuild" and "upgrade" are treated like four-letter words.

Craig Moffett, vice president and senior analyst of U.S. cable and satellite broadcasting at Sanford C. Bernstein & Co. LLC,

Charter guides the field

Although cable operators have plenty of tools in the toolbox to increase bandwidth or to use it better, Charter Communications has established a best practices guideline of sorts concerning capacity allocation.

Charter sets aside eight 6 MHz channels for VOD upfront, but is using only four of them on average—a buffer that sets a "guard rail" on the system, notes Pragash Pillai, Charter's president, advanced engineering-digital video.

"On VOD [bandwidth], for the foreseeable future, I don't see any issues for us," he adds. "The great thing is that it's a narrowcast service. There are a bunch of tricks you can use...breaking nodes, for example, to manage the bandwidth."

Monitoring tools also help operators keep tabs on VOD contention. Some systems might be provisioned for 7 percent contention, while another might run at 5 percent. "We can then upgrade intelligently, instead of doing upgrades across the board," Pillai says.

For broadcast services like HD, Charter provides guidelines to the field designed to keep bandwidth efficiency in check. For satellite HD programming from premium networks such as HBO, Showtime and Starz!, Charter allows for three HD channels to squeeze into one slice of 6 MHz spectrum. For off-air broadcast, some networks require that Charter carry the full 19.39 Mbps. In those cases, the operator can put two feeds into one 6 MHz slot.

For systems looking at digital simulcast, Charter requires that they have VOD deployed. That way, they can drop the linear pay-per-view from eight to four channels.

"We get four channels back right away, and [that decision] drives VOD, which is a more efficient use of bandwidth," Pillai says.

—JB

acknowledges that cable operators are loathe to return to Wall Street about more capital.

"The market would almost certainly look unfavorably on another round of capital investment," he says, but is quick to point out that a bandwidth expansion in this day and age by a cable operator would be massively less capital-intensive than the last round of upgrades.

Of course, some operators don't have to worry about Wall Street dictating the strategy of the company. Cox Communications, for example, went private late last year, and could decide to expand bandwidth without having to worry about Wall Street breathing down its neck.

Still, cable can expand bandwidth despite the stigma—if the message is crafted correctly, Palazzo believes.

"Don't confuse [bandwidth expansion] with the upgrade," he says. "There's a negative connotation from Wall Street when you're talking about a multi-billion dollar investment."

He notes that a typical U.S. housing density (85 to 95 homes per mile) can be expanded from 750 MHz to 1 GHz for as little as \$30 to \$35 per home, electronics and labor included. Xtend, meanwhile, is not providing many specifics on costs, other than to say it provides good bang for the buck—upstream and down. Xtend expects to provide more financial details in a paper it will present next month at the National Show in San Francisco.

Boosting bandwidth beyond 870 MHz can give cable a solid return on investment and produce a superior platform that gives the industry "the ingredients to make a very nice story to Wall Street," Keating insists.

But it appears that operators are not ready to tell that story. In fact, many believe that the latest upgrade will give them plenty of bandwidth to fit the bill.

"The bottom line for Comcast is that our 750 MHz and above systems have adequate bandwidth and an adequate bandwidth management plan to handle all of the services in our foreseeable future," Fellows says.

"Right now, we don't have any plans to go to 1 GHz," Pillai says. "I don't think we can continue to upgrade our plant. It never ends if you keep doing that. I think we will need to use the best technology to

manage our bandwidth better. There are a lot of tools in the toolbox that we can still use to facilitate that."

But he does agree that bandwidth expansion is not just a capital issue. It also impacts operations. "It's a wider spectrum that you have to maintain," Pillai says.

Palazzo acknowledges that "operators

are currently looking at all alternatives to solve that problem. Bandwidth expansion is certainly one of the alternatives...but there's a reluctance to publicly or officially say what their plans are in that area." He adds that Scientific-Atlanta has already started shipping 1 GHz products to cable operators. ■

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By Karen Brown, Senior Editor

Technology arms MSOs to hunt bigger enterprise customers



In the hunt for more lucrative commercial subscriber business, cable operators are finding that the mid-sized enterprise animal is not just fair game—it's desirable game.

With estimates that mid-sized businesses make up a solid majority of the total enterprise telecommunications market, cable operators are starting to take notice and are targeting businesses beyond small office and home office within reach of their hybrid fiber/coax networks. While the goal may be to avoid costly new fiber lines, to extend services to this segment may require some turbocharging of the DOCSIS platform or, in some cases, other technology alternatives altogether.

It's not too hard to see why there is growing interest in enterprise's meaty middle. Echoing other studies, technology provider Narad Networks' market research indicates that 70 percent of the total po-

tential business market is in medium-sized businesses. In addition, these businesses are concentrated on 20 percent of the nodes and about 8 percent of the lengths of cable plant.

Most of the cable operators are now acknowledging this concept and are looking to refocus their commercial services strategy, according to Chuck Kaplan, Narad's chief operating officer.

"They have been operating on the fringes—meaning the low-end using DOCSIS, and the high-end doing the odd fiber run here or there, which in itself is not a particularly scalable business," Kaplan says. "So the question is, if you want to get serious about commercial, you've got to hit the sweet spot."

Targeting businesses beyond SOHO is not new for Cox Communications Inc. Arguably the most aggressive cable entrant in business services, it has been targeting medium business markets—defined as com-

panies with 20 to 100 employees—for several years, says Christine Faulkner, vice president of product development and management at Cox Business Services.

"That's been a longstanding goal and not a recent phenomenon for Cox," she says. "I think that we actually started in the business delivering more fiber, private line, transparent LAN-type services. But certainly there is a natural tendency to think that as the MSO community dives deeper and deeper in terms of their interest in capitalizing on the commercial space, that naturally we hover to that small (business) space because it is an easy jump from basic cable modem service."

While it does provide direct fiber-based service, the MSO is working to funnel more business services onto its coax last-mile lines. That is driven by sheer potential—its coax networks span 124,000 miles compared to just 25,000 in fiber line miles.

"The bottom line is we have five times



GUNNIN' *for big game*

the amount of coax in the ground than we do fiber, and thus we hit a lot more businesses with coax than we do with fiber," Faulkner points out. "And so a business has a demand for a T-1 and I hit them with coax versus building and having that investment and cost. I'd much rather serve them over the coax. So that's what we

are distinctly oriented toward, and I think we'll have activity there this year."

To do so, Cox is looking to DOCSIS-based technologies because they are a natural tie-in to existing network monitoring and backoffice systems, but it also is considering proprietary schemes, Faulkner says.

"We're nearing our final partners in our space. I think the key point is, there isn't one shoo-in vendor that's going to be able to do this. I think it depends on the service offering that you are trying to deliver," Faulkner says.

Out-of-band

Among the options Cox and other cable operators can tap are technologies offering an overlay of spectrum above the cable plant's existing range—a particularly useful option if the operator wants to upgrade only portions of the network but doesn't want to reshuffle the existing residential services spectrum to accommodate new commercial customers.

One such player is Narad Networks, which is hawkking a proprietary technology that taps spectrum above 860 MHz,

For business service, you must cross the 'T's

Aiming for the mid-sized business market these days is a matter of fitting the product literally to the "T."

The mid-sized enterprise market is dominated by T-1 business, with many of those customers opting for single or multiple T-1 connections. Scientific-Atlanta's research indicates that while fewer than 10 percent of the business connections are from T-1 type service, they account for 60 percent of the commercial connection revenue today.

At first, S-A thought this skew toward symmetric 1.5 Mbps T-1 services would be a boon to cable operators because they could go after the business with standard cable modem technology.

"What you'll find after you get beyond the SOHO market is most of those small-to-medium enterprises have an infrastructure built up, and those infrastructures are things like the public branch exchanges—the PBXs—and all of their voice calls, as well as key systems for doing just simple on-hook, off-hook voice dialing," says Mark Palazzo, vice president and general manager for S-A's access networks, transmission network systems. "And so those devices only historically came with TDM interfaces."

That reliance has created a problem for cable operators, according to Narad Networks COO Chuck Kaplan.

"What the cable operators have done for lack of having a technical solution on their own network is that they have been leasing T-1 lines from their competitors and then trying to resell them," he notes. "And that is not a good business."

Even worse, they realize the money they are paying to the telco may well be used to fund fiber-to-the premise (FTTP) initiatives that will only erode their competitive stance.

"That light bulb has come on in the industry," Kaplan says. "Most cable operators just haven't played in the midsection, and the ones that have played have been using telco facilities, and that is a problem."

Narad's fellow out-of-band technology provider Xtend Networks also sees the dominance of T-1 connections in the mid-sized business market, so last year it rolled out a product offering that option.

Driven by an Xtend modem termination system in the operator's headend—similar to a cable modem termination system (CMTS)—the product supplies a maximum of 24 T-1 connections per unit.

The Xtend product works with any existing T-1 switches the business may already have, according to company CEO Bill Keating. "They simply add our T-1 modem," he says.

But the T-1 domination may be coming to an end. Christine Faulkner, vice president of product development and management at Cox Business Services, says the enterprise reliance on T-1 lines also may be shifting, particularly as businesses look to consolidate their voice and data services on one pipe with options to change the amount of bandwidth on the fly to suit their needs.

"That's a different concept than your typical channelized T-1 that doesn't utilize and maximize your efficiency. [but] requires some more IT management complexity at the customer end versus the one-pipe scenario," she says. "So I think a lot of our development effort is focused on the theme of convergence, the advantages of IP and how can we serve those customers from a one-pipe, dynamically allocated offering where we are delivering a combined data and voice experience as well as other layered-on, value-added solutions."

For now, Cox is aware that many businesses will be reluctant to junk their existing T-1 based equipment.

"I think that is a valid concern, so I think we are going to have to straddle this area for a while," Faulkner says. "I think we'll especially see this in our mature market where we traditionally had circuit-switched voice, and as we begin enabling the advantages of IP moving forward, it will be a straddle. We know customers well enough to know that shifts do not occur drastically, and, depending on the segment, it will take some time, depending on their needs and when they are willing to make that shift, and when it makes sense for them."



Faulkner

—KB

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providing 400 Megabits per second upstream and downstream on each fiber node. It runs underneath the level of the taps, so much of the network physical element doesn't need to be disturbed, Kaplan says. Ethernet switches set up alongside the existing amplifiers on the critical lines provide the bandwidth boost, able to supply about 80 T-1 connections per node, with half of the bandwidth still left over for Ethernet-switched service.

It does require installation of new gear in the cable network, but not everywhere. The fact that commercial areas tend to be clustered near specific nodes means operators don't necessarily have to look at wide-scale plant upgrades to reach them, Kaplan notes.

In return, the cable operator can offer T-1 based service, and that is important, given the large base of existing T-1 termination gear in place at these target businesses.

"So when the cable operator comes to them, they don't have to just throw that out," Kaplan says.

Narad also offers a wireless last mile extension option, for areas where the operator's HFC plant is separated from a target business by a road or other unmovable infrastructure.

"It is yet another tool in the toolkit of the MSOs. They'll use cable where they can, but we'll pop on the wireless where we need to, and we can backhaul all of that stuff over the existing HFC plant," Kaplan says.

The upgrade cost varies somewhat, but it averages out to about \$5,000 per potential customer. That may seem steep, but Kaplan argues each customer can supply \$1,000 in revenue monthly, meaning the

payback is in less than six months.

"This is why the cable operators are getting excited about the mid section of the market," he says. "These are not the \$300-a-month customers; these are the \$1,000- or even \$3,000-a-month customers."

So far, Narad has landed seven deployments, six of which are in North America with mostly unnamed cable operators. One that is announced is Vancouver provider Delta Cable, which is using the Narad technology for a commercial voice-over-IP service.

Narad also has about a dozen more operators that are planning field or market trials, Kaplan says.

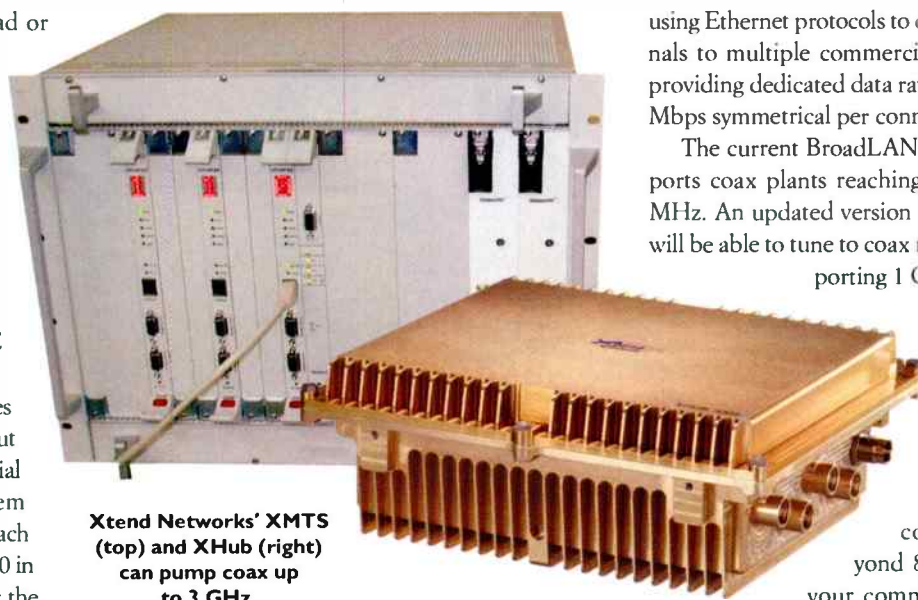
But not all of the out-of-band players leave the DOCSIS platform behind. Xtend Networks, an Israeli startup recently ac-

quired by Vyvo and an announced technology provider for Cox, offers a block division multiplexing technology that can boost total plant bandwidth to 3 GHz and multiply the upstream bandwidth tenfold. It still funnels this bandwidth through to standard DOCSIS-based cable modem equipment, but unlike most residential services, it offers dedicated bandwidth and quality-of-service guarantees.

Xtend's XNode architecture adds amplifiers on the network to provide a spectrum overlay from the top end of the existing plant capacity—say 750 MHz to 3 GHz.



Kaplan



Xtend Networks' XMTS (top) and XHub (right) can pump coax up to 3 GHz.

As with Narad's product, these overlay amplifiers and associated headend equipment can be added to specific nodes in the network where the capacity is needed.

MSOs "can go city-by-city, network-by-network, leg-by-leg," says Bill Keating, CEO of Xtend Networks. "They have more than 6 million businesses, and they can take them one by one."

The Xtend equipment can generally be installed without interrupting the existing plant traffic, Keating says. Although the actual cost per node depends on the number of splitters, amplifiers and customer premise equipment a given network leg will need, Xtend's technology will generally pay for itself within six months, he adds.

In-band

Out-of-band technology isn't the only way to create higher-bandwidth, QoS-based business services. Scientific-Atlanta Inc. markets BroadLAN, which uses technology that carves out dedicated bandwidth within the existing HFC network. Able to link to a customer premise device via a coax drop, it uses a dedicated bandwidth channel to the business.

It's an architecture akin to a standard cable modem service. A Transport Modem Termination Unit is placed at the headend and a specialized modem unit is placed at the customer premise. One or two 6 MHz channels are set in the forward path using Ethernet protocols to deliver the signals to multiple commercial customers, providing dedicated data rates of up to 28 Mbps symmetrical per connection.

The current BroadLAN product supports coax plants reaching 860 or 870 MHz. An updated version now available will be able to tune to coax networks supporting 1 GHz.

"If you decide to do a 1 GHz expansion, one of the products that you could put beyond 870 would be your commercial traffic

and leave all of your residential stuff below 870," says Mark Palazzo, vice president and general manager for S-A's access networks, transmission network systems.

Unlike much of Scientific-Atlanta's cable technology product line, BroadLAN is not based in DOCSIS technology. The reasoning behind that lies in the peculiar economics of the DOCSIS platform—while it can be upgraded to provide higher data rates and even quality-of-service guarantees, the media access controller scheme used was never designed with dedicated bandwidth in mind.

"That technology was developed with statistical multiplexing or over-subscription, where you can have a maximum of 100 people on it at a time, but you will sell that to 1,000 people, knowing full well they will never all be on it at the same time," says Todd McCrum, director of the commercial services business unit within S-A's transmission network systems group. "If you amortize that over 1,000 users, the cost works out quite well."



Narad Networks' access switch can boost connections on coax lines.

But when an operator looks instead at offering dedicated bandwidth to business

customers, over-subscription goes out the window. Given a handful of customers providing revenue against that same expensive MAC technology and "the economics do not work out at all," McCrum says.

DOCSIS also is finicky about its reverse path. Set up in the 5 MHz to 40 MHz range, the 3.2 MHz reverse path channels are usually limited by noise requirements to the upper end of that range.

"The reality is DOCSIS can probably only reside in the 22 MHz to 40 MHz [range]," McCrum says. "So you may be able to get three channels there. One of those channels is going to be dedicated to voice-over-IP. One is dedicated to residential customers today, and you then may have one more channel that you might be able to deploy to go after commercial, if that was the case. That is insufficient bandwidth to go after many

commercial customers."

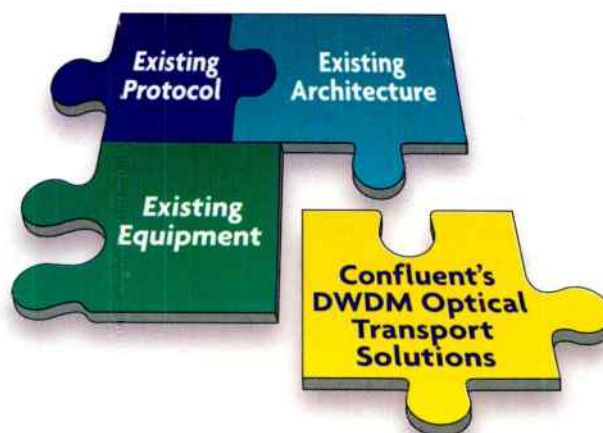
In contrast, BroadLAN "kind of takes the best of DOCSIS—from being a coax-based solution—and also pulls in technology that you need to do nailed-up TDM-type services such as T-1s. And you can do that over HFC plant," Palazzo says.

While there still may be debate over

whether DOCSIS or proprietary technology fits better for this business middle-of-the-road, there isn't much doubt among the players that the interest among cable operators is accelerating.

"It's happening," Narad's Kaplan says. "I would say we are in the period just preceding the hype." ■

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Headends: The next generation

IP support with a modular CMTS architecture maximizes flexibility

By Gerry White, Senior Director of Advanced Technology, Motorola

Next-generation IP headends will be expected to support the profitable delivery of data, voice and video services. But operators face a number of major challenges. High-speed data services are under pressure from DSL and fiber deployments. This pressure is felt on two fronts, as operators are driven to lower pricing while offering increasingly higher-bandwidth products. To compete successfully, operators must deliver significantly higher-speed services.

While that data bandwidth is expanding, the migration of services toward IP will require more video services to be delivered to IP devices in the home, thus driving even greater bandwidth needs. The next-generation headend will need to provide much more bandwidth in both upstream and downstream directions without compromising the Quality of Service (QoS) and availability levels needed for successful voice-over-IP delivery.

The current HFC network has been designed for efficiently delivering broadcast video service, but service delivery requirements are evolving rapidly. A significant percentage of traffic will shift from broadcast video to per-user streams as deployment of network video-on-demand (VOD) services enable consumers to move to a user-controlled viewing paradigm—"my content at my convenience." These services may initially be delivered using existing MPEG transport but will eventually move to IP.

The Next-Generation Network Architecture (NGNA) project was started by a consortium of leading cable operators, and is now being advanced by CableLabs. NGNA is focused on developing a new IP platform for the digital headend that offers support for both current and emerging technical specifications. A major aspect of this

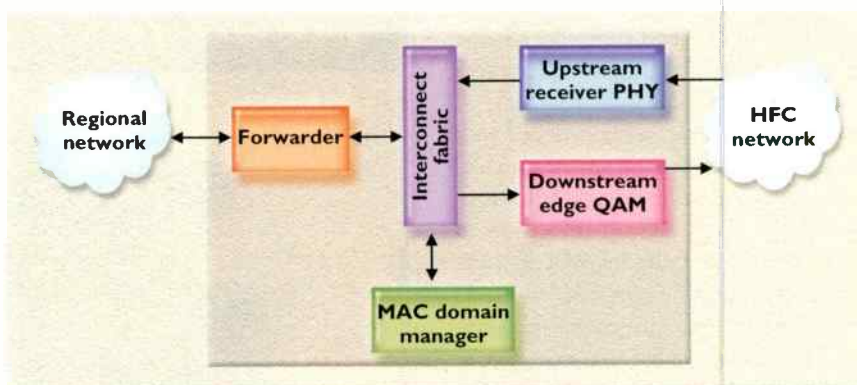


Figure 1: A logical view of a decoupled CMTS architecture.

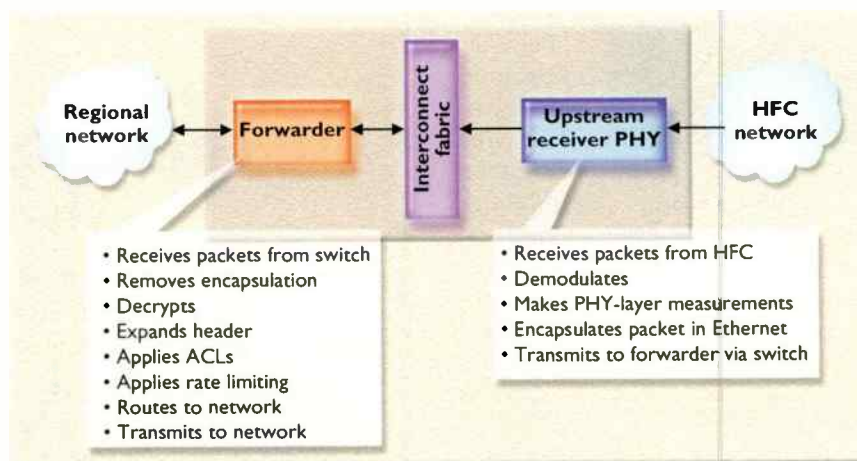


Figure 2: A logical view of an upstream packet flow.

program is the definition of a cable modem termination system (CMTS) architecture that provides maximum deployment flexibility and scalability potential. The focus of this project is to meet the need for additional bandwidth and enable cable operators to implement the third phase of service convergence as they add IP video services to existing data and voice offerings.

In today's product architectures, traditional CMTS functions are largely deployed in integrated systems that offer the reliability and manageability demanded by real-time services. As networks evolve toward end-to-

end digital services—and as operators increasingly support growing demands for video and other services—CMTS architectures are also evolving to provide increased modularity and flexibility. This architectural concept being studied by the NGNA initiative is often referred to in the industry as a "decoupled CMTS," because major functions of traditional CMTS platforms are decoupled into logical components.

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Traffic forwarding

Integrated CMTS platforms today already can provide high-performance traffic forwarding for data and voice services. In this context, high performance means not just a high packet-per-second forwarding rate, but also the ability to differentiate between traffic classes and provide the correct QoS level to each traffic type. Voice traffic, for example, has strict latency and jitter requirements and is typically given priority over data traffic. Performance also implies providing isolation between different customers and classes of traffic to deliver a consistent user experience even as loads vary on the shared network. When video is added to the service mix, the need for QoS, isolation and high packet throughput increases significantly.

In current-generation architectures, all CMTS functions reside within a single chassis under control of a single vendor. But in a decoupled architecture with multiple elements, this is no longer the case. As traffic flows move between multiple stand-alone devices—instead of across a shared backplane—the difficulty of providing high-performance, low-latency services becomes more pronounced. In the decoupled system, all components must work in unison to ensure QoS commitments, but these commitments can only be reached if all components operate correctly. Insufficient performance of any single element in the chain will result in failure to deliver against QoS commitments.

Operations and availability

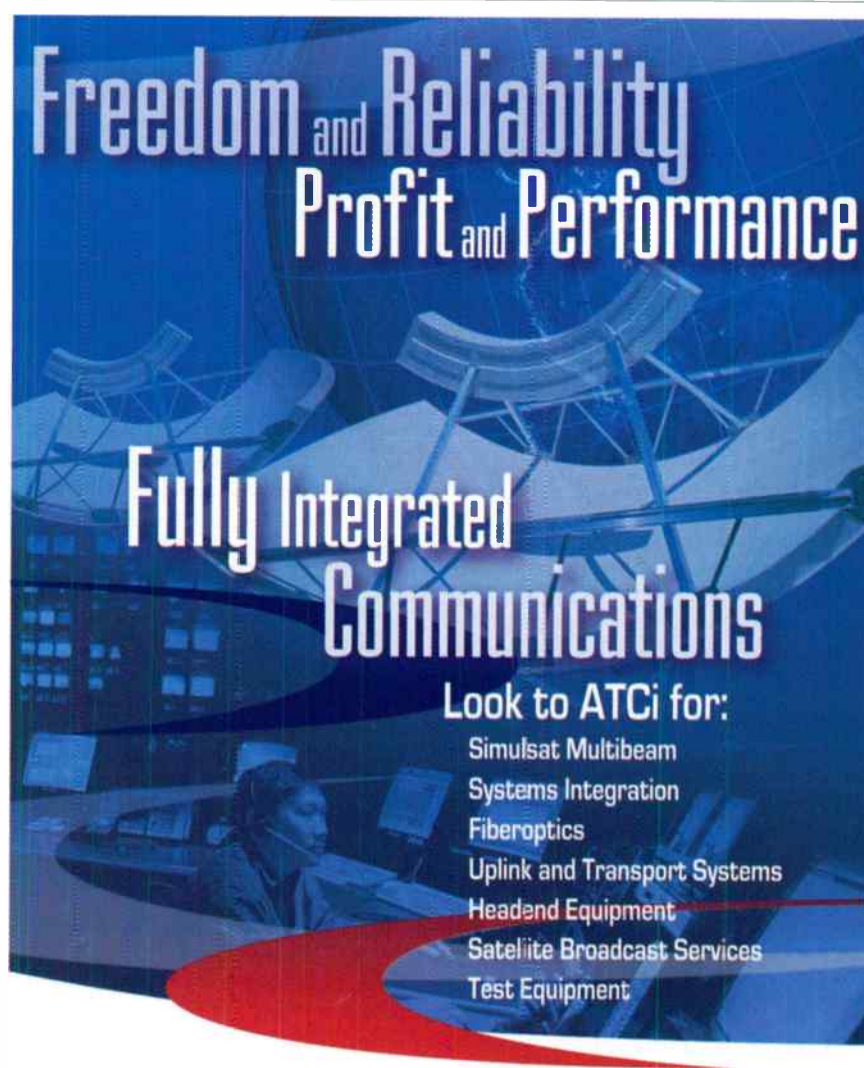
Significant work has been done by system operators, CMTS vendors and the standards community to provide a rich set of management tools for today's systems. This toolset needs to be replicated in the decoupled approach. As functions are segmented, management becomes more challenging because centralized data must now be retrieved from multiple sources and then reassembled. Care must also be taken that the modular approach does not lead to cabling and deployment complexity.

Another major operational issue is managing network evolution. With an integrated system, the operator only needs to worry about a single software upgrade at a

time; but with a decoupled CMTS architecture, managing software upgrades and any unplanned interoperability side effects will be an ongoing challenge.

Reliability is perhaps the greatest advantage of an integrated system. With a decou-

pled CMTS architecture, operators must ensure that each element offers the reliability necessary for voice and video services. This includes ensuring redundancy of elements and having the flexible management and provisioning tools necessary to ensure



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uptime of each element and prevent service downtime. Rapid failure detection and service restoration becomes more difficult in any multi-platform, multi-vendor environment.

Scalability

As more services are deployed and bandwidth increases, the system must be able to scale to meet the new requirements in a flexible manner. In an integrated system, this expansion is constrained by the limits built into the system by the vendor (e.g. backplane capacity, card sets available). A modular approach can have a major ad-

- Media Access Control (MAC) domain manager
- Forwarder.

The function of the interconnect fabric is to provide flexible connection for the other CMTS components in as transparent a manner as possible. It does not implement any of the intelligence in the system, and for the purposes of this description, it can be considered to be a set of "dumb pipes" connecting the other modules.

In order to achieve the required transparency, the interconnect fabric must support line-rate switching with minimum la-

quency offset and power information that it forwards to the MAC domain manager. The MAC domain manager uses this information to implement the ranging protocol and provides the PHY module with the necessary offset parameters to compensate for plant differences between modem locations. In order to increase upstream bandwidth, it will be necessary to increase RF performance. Thus the upstream receiver PHY must support advanced spectrum management by capturing metrics on the physical layer signal attributes. It takes the measurements, records the data and forwards this information to the MAC domain manager, where the spectrum management analysis is performed.

The downstream edge QAM takes DOCSIS IP traffic flows from the Forwarder and MAC domain manager modules and converts them to RF for transport to subscriber homes. These DOCSIS packets, which are encapsulated in an appropriate format for forwarding over the interconnect fabric, contain a control header that tells the downstream edge QAM the appropriate interface port to which the packet should be directed.

The downstream edge QAM also:

- Implements the DOCSIS transmission convergence function to map the DOCSIS packets into an MPEG transport stream;
- Adds the timing information to the DOCSIS header as required; and
- Combines the DOCSIS MPEG streams with video MPEG streams received directly by the downstream edge QAM from VOD servers.

The MPEG data is then modulated into QAM signals, upconverted to the appropriate frequency, and transmitted onto the HFC plant.

The MAC domain manager handles the control protocols for the DOCSIS cable modems. It responds to the ranging requests as cable modems join the network using data from the upstream receiver PHY to determine the timing, power and frequency adjustments needed for optimum performance. Periodic maintenance intervals are scheduled for all active modems to ensure performance is maintained as network conditions change.

It processes the registration requests from

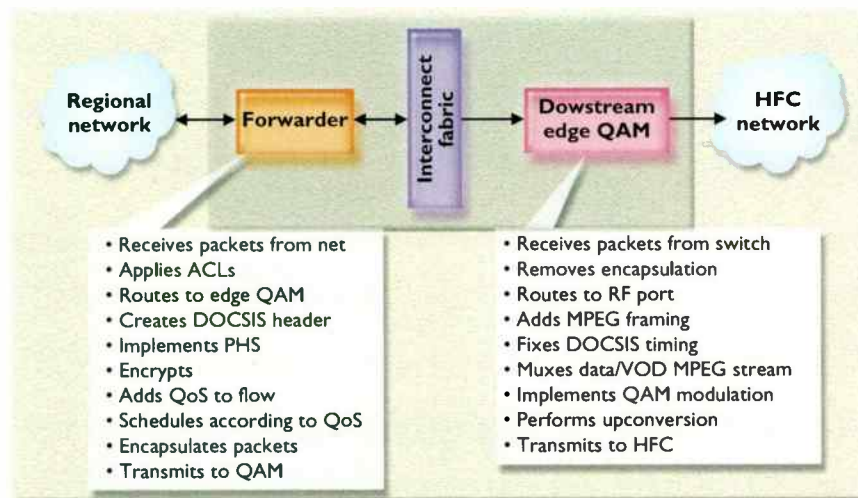


Figure 3: A logical view of a downstream packet flow.

vantage here in that it should be possible to add upstream capacity, downstream capacity and processing engines as required.

A closer look

There are five major elements of a decoupled CMTS. By exploring the functions of each of these modules and their interworking, one can understand architectural tradeoffs and deployment alternatives.

The definition of each of these logical elements continues to evolve, and some capabilities may move from one element to another as the industry refines its definition of an NGNA decoupled CMTS architecture. But the following serves as a brief description of the major elements:

- Interconnect fabric
- Upstream receiver PHY
- Downstream edge QAM

tency to enable the effective delivery of real-time services. In practice, this will typically be based on a Gigabit Ethernet switch fabric, and will of course require redundancy to support high availability levels.

The upstream receiver PHY module receives packets transmitted from cable modems and converts them into the appropriate format for transmission on the interconnect fabric. It implements the RF front-end receiver functions and demodulates the upstream QAM and QPSK RF signal bursts received from the cable modems into packets. It sends the data packets to the Forwarder and the DOCSIS control packets to the MAC domain manager via the interconnect fabric.

The upstream receiver PHY also implements the physical level measurements required by the DOCSIS ranging process. For these control packets it collects timing, fre-

cable modems, including the authorization of QoS parameters requested. It processes the DOCSIS 1.1 MAC messages to enable additions, deletions and changes to QoS-enabled service flows to support changing service requirements. The MAC domain manager also creates the map messages used to tell the cable modems when they can transmit. It schedules the upstream traffic based on the QoS parameters required for each service flow and forwards the messages to the edge QAM for transmission.

The MAC domain manager runs the Basic Privacy Interface (BPI) protocol, which is used to update the encryption keys. It must keep track of which cable modems are on which CMTS port interfaces, which becomes more complex in a decoupled CMTS architecture because of the greater flexibility to allocate upstream and downstream resources.

The Forwarder is responsible for routing traffic between the HFC network and the regional IP network. Its primary function is to forward packets to the correct interfaces, but it also implements other key functions:

- The addition and removal of DOCSIS headers;
- The application of forwarding policies such as access control lists;
- Providing the downstream scheduling and queuing algorithms required by DOCSIS 1.1;
- Implementing packet header suppression and BPI encryption/decryption according to rules provided by the MAC Domain Manager;
- If wideband downstream channels are required, the Forwarder supports inverse multiplexing, allowing the operator to aggregate multiple channels for transmission to a single cable modem.

Conclusions

The decoupled CMTS can provide major benefits for cable operators in terms of flexibility and scaling. Conversely, the choice of an integrated approach may be more manageable and reliable, at the expense of greater flexibility. Vendors are likely to evolve today's CMTS architectures to support both deployment models, leaving operators with maximum flexibility for evolving the IP digital headend—but also with serious decisions

to make about architectural tradeoffs.

While the modular approach can reduce initial capital costs due to its better scalability, it inevitably results in higher operating expenses. Operators are therefore faced with whether to focus on re-

duced capital expenses, or lower ongoing operational expenses. ■

Editor's note: Concepts for this article were originally presented in January 2005 at the SCTE Conference on Emerging Technologies.



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TV-to-Go

Cable, satellite providers put in order for portable DVRs



Delphi Corp.'s existing DVD video system for automobiles may eventually turn into a DVR video system through a joint partnership with Comcast Corp.

By Karen Brown, Senior Editor

Martha Cable Customer is in a hurry, and her two young children are fussy. So to make her trip across town easier, she fires up her digital video recorder (DVR) in the living room, accesses the video-on-demand (VOD) menu and tells it to transfer the latest episode of "SpongeBob SquarePants" to the DVR unit in her minivan.

In 10 minutes, the video content has flowed across her home Wi-Fi network to the van and is ready for play, so as she drives through traffic-clogged streets of Any City, U.S.A., her kids in the back seat are happily pacified by the colorful cartoon.

That scenario may well be the basis of the "Next Big Video Service" in cable TV. Cable operators and their satellite com-

petitors are already starting down the development road to portable DVR services aimed initially at the automobile, but to reach that destination, they will have to navigate the difficult terrain of technology options and consumer demands.

Probably the first portable DVR device to hit the market from a U.S. video service provider will come from EchoStar Communications Corp. At the January Consumer Electronics Show in Las Vegas, the DBS provider demonstrated a prototype portable DVR it is planning to roll out later this year. Dubbed "Dish to Go," the device is based on a player developed by Archos and modified to link to EchoStar DVRs. Customers can transfer standard-definition digital video from their DVR to the portable player via a USB port connection.

"The benefit to what DishNetwork is

doing is that it will be a high-speed transfer to the portable DVR—it won't be a real-time transfer," says EchoStar spokesman Marc Lumpkin, adding the DBS provider is working with Archos now to come up with the necessary software. "It will allow you to download a two-hour movie onto the portable DVR in 10 minutes."

EchoStar is looking at versions of the player with two-, four- and seven-inch screens and hard drives ranging from 20 to 40 Gigabytes. EchoStar has not yet set a price, but Archos markets its 80-Gigabyte, 3.8-inch AV480 model on the Web for \$799.95.

"It's a retention tool, and it could be a new subscriber acquisition tool as well, because new customers will find out the 'cool factor' and want to become a Dish customer just because of it," Lumpkin says.

CES also saw one of the first steps toward portable DVR on the cable side, with Comcast Corp. announcing a formal partnership with automotive entertainment systems specialist Delphi Corp. to develop a portable DVR player system. The car was the first target because there were already vendors in the space including Delphi that offer back-of-seat video systems, and it will provide a good test of the challenges in offering portable video, says Jonathan Palmatier, Comcast's director of strategic planning.

"If we are able to define an architecture to be able to prove to ourselves that it effectively works, that we can do it in a seamless way, that we can do it in a high-quality way, that we can do it in a secure way to respect the content rights, then we'll be able to accurately decide whether there is a business there," he says.

With people often spending more time in their cars these days, rear-seat DVDs are a popular auto accessory, but they require the user to buy or rent the disks. For that reason, Delphi is quite interested in the

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Copy controls key to portable TV

The greatest hurdle looming in front of portable DVR technology is not in creating the systems to transmit the content, but rather, the safeguards to protect it.

It's a critical issue for the fledgling technology—without copy controls to keep DVRs from becoming wellsprings of pirated video, movie and television studios will never allow their titles to be distributed on such devices. But choosing a digital rights management scheme to enforce those rules won't be easy, given the myriad contenders.

When it comes to the portable DVR copying philosophy, the prevailing idea centers on limiting the content file transfer to only approved devices. For example, EchoStar's Dish to Go content will be encrypted as it transfers from the home satellite box to the portable device. Customers will be able to link the portable DVR to television monitors for playback, but they will not be able to transfer that content to a compact disk or other storage device, according to EchoStar spokesman Marc Lumpkin. "We think we will satisfy any concerns, because it will be self-contained, and all of the information for the shows will stay on this portable DVR," he notes.

Elsewhere, the greater challenge will be choosing the digital rights management scheme from a decidedly fragmented field where no one technology has emerged as the clear front-runner. Under the portable DVR development deal forged between Comcast Corp. and automotive entertainment systems provider Delphi Corp., that task falls to the MSO.

"We're exploring all of the digital rights hurdles and the current options out there in trying to figure out what works for us," says Jonathan Palmatier, Comcast's director of strategic planning.

As fragmented as the field is, there are some strong contenders. Jeff Ayers, general manager of embedded players and technology at Real Networks Inc., strongly backs a standard that actually comes out of the mobile phone world—the Open Mobile Alliances' DRM 2.0 standard. While it might sound unlikely that a rights management scheme created for content flowing to mobile handsets could be used for massive digital video transfers, Ayers

argues the process of transfer is the same for both.

"It's got some architecture that ensures that it fits with mobile architectures, but in a lot of cases, those architectures don't so much have to do with the fact that you are going across a radio network to a handset, but have to do more with the fact that you are going from a managed network infrastructure to a subscriber, and there is an ability to have a billing and QoS and other types of relationships with the carrier provider," he says. "And that's what I think works out well taking this approach with cable."

The standard also finds backing from Motorola Inc., which has been developing DRM technology not only in cable conditional access systems, but also in its mobile phone business, says David Grubb, vice president of business development for Motorola's newly created Connected Home division. But while DRM schemes such as OMA DRM 2.0 may gain support, the likelihood is greater that portable DVR services will have to deal with multiple schemes to please the wide array of content owners, he notes.

"I think maybe a year ago people thought there might be one DRM and that it would win and that would be that," Grubb adds. "But now I think people are realizing there will be these islands of DRM, and to really provide a valuable experience for the consumer, we are going to need to find ways to bridge across those."

That, in turn, would require an overarching bridge technology that would allow content to funnel through via the DRM scheme the content owners approved. Motorola is working on such technology, drawing from its work in mobile phone DRM through OMA, cable-side conditional access, and IP rights management.

In the end, putting DRM systems in place to protect content may be as much marketing as it is technology.

"We have the technology to do acceptable security. And it's really a matter of putting it all together into products that consumers understand and want to buy, and that the content holders are willing to allow their licensees to create," Ayers says. "I don't think it is a problem with security."

—KB



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In the loop

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The smallest of things

BY THOMAS G. ROBINSON, EXECUTIVE VICE PRESIDENT,
CBG COMMUNICATIONS INC.

The upcoming remake of the 1952 movie based on H.G. Wells' "War of the Worlds" made me think of how, in that film, it was the smallest of things that ultimately took down the murderous monsters from the Red Planet. Also, it is still amazing to me even today how splitting the smallest particles can create the greatest of energies. Or, how even as we continue to upsize our SUVs, it is the miniaturization of components in these giant vehicles that provides more and more convenience and safety features, such as GPS-based mapping systems and critical system sensors.

For the last decade or so, the world of science (and science fiction, for that matter) has been increasingly enamored by the microscopic world of nanotechnology. Many believe that nanotechnology, essentially the science of creating, manipulating and manufacturing materials on an atomic and molecular scale (approximately one-billionth of an inch) will provide the next great leap in telecommunications technology, through a variety of initiatives.

One of the key emerging disciplines is nanophotonics and nano-optics. Basically, nano-optics deals with the properties of light when it interacts with structures far smaller than a wavelength of light. This creates a whole world of optical subcomponents known as SOEs (Subwavelength Optical Elements). The research to date on the usable properties of such SOEs has shown that it is possible to develop nanostructures that reliably replicate these properties. Because of this, optical components can be devel-

oped with greater capabilities than currently available, in much smaller dimensions, with far less power consumption, and ultimately at significantly less cost.

The implications are staggering when you consider how such technologies can be applied to fiber transport systems. In fact, work is already underway at a number of companies focusing on nano-optics to apply such technology to polarization, detector and filter components. These nanostructures are destined to enable more and more information to travel greater and greater distances on a single strand of fiber. Additionally, nanostructures will be able to be applied to end user components that will facilitate low-cost, low-profile and high-capacity optical transceivers and switches for customer premises optical devices. Initially, these devices will likely be optronic (optical and electronic) equipment that will enable, in a size and cost less than today's set-top gateways, the transmission and reception of multi-gigabits worth of information. Ultimately, it is forecast that the use of nanostructures and nanomanufacturing techniques will result in the complete end-to-end optical transport of signals that are connected to optically driven appliances in the consumer's home.

Another key area is the manufacture of nanocomposites. For a long time, high-frequency inductive components that are used to enable high performance in telecommunications and information technology equipment have had significant limitations concerning power con-

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concept of DVD players that can receive files from a home DVR or a computer.

Backseat DVD players take "a lot of extra timing and planning, and it is less convenient," says Bob Schumacher, business line executive for integrated media systems at Delphi. "We find that particularly around entertainment communications productivity, people, when it comes to cars, love to have a very high level of convenience."

The transport

Getting to that convenience will require some technology decisions, and among the first will be how to move around the content. Comcast and Delphi are considering several strategies there, with one strong possibility being a wireless transfer over a home network system.

For the past four years, Delphi has been working on concepts using Wi-Fi, or 802.11x, to transfer audio files, Schumacher says. The auto industry has taken notice of this idea, and at present, Delphi is working with four manufacturers on such Wi-Fi enabled systems. Last year, Delphi staged a marketing demonstration with Ford Motor Co., where it outfitted a Lincoln Aviator with a radio embedded with a Wi-Fi node and a hard disk drive.

In partnership with Comcast, Delphi is now working on an extension that would draw video content as well.

"With high-speed Internet cable already there and Wi-Fi getting into the home, all you need to do is put in a Wi-Fi node and a hard disk drive in the vehicle and, presto—you've got the whole solution to seamlessly share entertainment files back and forth," Schumacher says.

Wi-Fi is a strong contender for this wireless scheme, but Comcast also is not ruling out other home networking schemes.

"Whether that is pure Wi-Fi from the access point to the house or whether you are going to go HomePlug power line to the garage and then Wi-Fi—to some extent the service doesn't care about that home networking topology," Palmatier says. "It could support any of those."

One critical element to this wireless transfer is the download time. Schumacher

notes it is likely the system will use advanced codecs such as MPEG-4 Part 10 or Windows Media 9 to whittle down the file size. Moving over 802.11g networks with a theoretical maximum 54 Mbps downstream data rate, "we are talking about, at most, probably 10 minutes to transfer a movie," Schumacher says.

Even farther down the road, entertainment could be delivered directly to the vehicle without a home download. Under that scenario, drivers would tap into Wi-Fi hotspots to download content via Internet entertainment portals.

"You [could] roll into a gas station, and while you sit there for five, seven or 10 minutes going into the convenience store and filling up your gas tank, simultaneously, you could fill up your bit tank—which is your hard drive—over Wi-Fi," Schumacher says.

Also a possibility is an auto DVR player with a removable hard drive. Under that scenario, the user would pull it out and plug it into the DVR in the house via a USB port to download content, and then take the drive back to the car.

At this point, Delphi is working on designs that include wireless and removable hard drive options. "The final decision hasn't been made, but obviously with 802.11 it is simpler and more seamless, and that's probably really more of the future," Schumacher says. "But if you go with just 802.11, you restrict your market because not everyone who has a Comcast set-top box has Wi-Fi."

Other early design decisions include how the device will be configured. The idea is to create a product that is easy for the customer to use, so Comcast envisions a video service with user interfaces modeled on the existing video service the MSO offers.

"It's a very simple interface where people are selecting their content and saying, 'hey, I'm ordering this,' or 'I'm selecting this and I want to watch this in my car'," Palmatier says. "The details—does it stream it there immediately, does it need to establish a connection there or not, does it cache it and then wait until the car comes home and then send it—those are the precise details that we need to work out."

Given the multitude of questions,

Comcast isn't rushing the development of its portable DVR system. Internally, Comcast has set a six- to 18-month development time frame, "so it's too early to say when we would have a product ready for market—if we would even have a product ready for market," Palmatier says.

Still, partner Delphi is hopeful that its first foray into video-on-demand for car systems will result in a revolutionary product

not only for Delphi, but for cable operators, Schumacher says.

"It puts the cable providers much more in the middle of the entertainment business," he says. "It's no longer just cable to the set-top box to the TV in the home—it's that now, over that cable, I can distribute almost anything of an entertainment nature real-time, non-real-time, and use it in the house, out of the house and in the car." ■

In the loop

Have a comment? Contact Tom by e-mail at: robinson@cbgcommunications.com

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sumption and further miniaturization. Moreover, the metallic alloys that would counteract these problems could not be used at high frequencies. However, developing composite materials on a nanoscale results in the production of magnetic particles small enough to enable the newly-created materials to work effectively at high frequencies. Ultimately, the use of such nanomagnetic materials will result in high-frequency inductive components that will not only be smaller and allow for increased miniaturization, but will cost less, improve performance and lower power consumption.

An important concept to understand related to nanomagnetics is electron spin current. All of us are familiar with the role charge current plays in the field of electronics, but on a nanoscale, electron spin can also be harnessed and the energy utilized. The field of spin electronics, or "spintronics," has been around for about the last decade as well, but has seen much more play recently as scientists develop techniques to employ electron spin, utilize spin current and create new mechanisms by combining the effects of charge current and spin current. As this science is applied to telecommunications, it will mean vastly increased capabilities while continuing miniaturization of a wide variety of telecommunications systems including satellite, cell phones and wireless computing, significantly increasing our ability to access and provide high-capacity communications from anywhere

we happen to be.

Another term to get to know is "dynamic self assembly." Specifically, consumer products, medical, food and other companies have known the potential uses of fluids based on nanostructures since the early days of nanotechnology research. More recently, though, there have been significant developments in the area of self-assembly within such nanostructured fluids. Specifically, scientists have observed that molecules in such fluids exhibit the ability to assemble themselves into new nanoscale materials. If this property can be properly harnessed and directed, it opens a whole realm of possibilities for the development of new and powerful materials and the advent of incredibly efficient and cost-effective nanomanufacturing.

The real science of dynamic self-assembly makes me think of the science fiction of Michael Crichton's book "Prey," where nanoparticles were set to take over the world. That thought is enough to invoke a sense of wary caution when pursuing nanotechnological innovation. However, if we look at our experience with nuclear energy, for example, there has always been a fine balance between seeing it as a clean, near limitless energy source with great hopes for an evolution from fission to fusion, versus the dark projections of nuclear winter. Similarly, if we can keep nanotechnology's potential evil twin in check, there are many who believe (including me) that it will drastically enhance our telecommunications future.

Counting on content

The Walt Disney Internet Group has its hands and brands in just about everything broadband

As President of the Walt Disney Internet Group (WDIG), Steve Wadsworth helped steer the company through the bursting of the dot-com bubble and now helms a division that turned the financial corner in 2003, thanks to its rapid development and rollout of a spate of Internet-related products and services that include everything from Disney's ToonTown Online, ABCNews.com, FamilyFun.com, and ESPN.com, to name but a handful. CED Editor Jeff Baumgartner recently caught up with Wadsworth to discuss how WDIG has been able to use broadband to keep consumers engaged and their wallets open, but also build a growing advertising segment. An edited transcript follows.

CED: Content has always been known as king, but speed and pricing have been dominating the cable modem and DSL discussion lately. From where you see things, how will content, specifically, unique content, become a determining factor?

Wadsworth: I think we're definitely seeing that the [cable] operators really would rather not get into a pricing battle with their service and would like to be in a position to showcase the capability and value of their service. From our standpoint, content is becoming increasingly important and much more of a leading [facet] of what they're selling to the end consumer than just basic service statistics like speed.

We're continuing to increase our investment in content for broadband in several ways in order to support that. We've been creating broadband content that we embed in our core Web sites that's available to those people who have a broadband connection so that their broadband experience—even in our freely-available Web sites—is more com-

PELLING to them. That just draws people back to our content directly and to our Web sites directly, independent of the operators. Separately, we're working more and more closely with the operators to produce content specifically for their platforms that they can market to their end consumers as part of the proposition, and to help improve retention with those end consumers and to make it a key compelling factor for consumers to sign up for broadband.

CED: Can you give us some examples?

Wadsworth: In the early days of broadband...there were a lot of early adopters in the game who were really looking at it. The parallels in the cable industry are striking. The early adopters were largely people looking for more reliable high-speed connections. They tended to be early adopters in the technology period...not too dissimilar from those people who had bad reception in the early days of cable.

We had plenty of dialogue with the various operators, but during the very early days, while we were producing content both for core sites and going direct to the consumer, they were very focused on de-

livering on the early adopter demand. Now they're very focused on high penetrations in the mass-market consumer [arena]. In order to do that, the selling proposition has to be much more focused on the experience they have over the broadband connection. And that starts shifting into content, again not too dissimilar from the early days of cable. We're seeing a very similar dynamic happening, and we're seeing it in relationships with those operators.

CED: How does your revenue break out today and how has that changed in the last five years?

Wadsworth: We have two categories of business: the media businesses and the e-commerce businesses. On the media side, we produce content and distribute it either through narrowband or broadband...and to mobile devices, which is becoming more and more interesting. We have two revenue streams in that media category: one is advertising that we use to support our freely available content, and we have premium content fees that we get direct from the consumer or syndication fees from our operator partners. For e-

commerce, it's largely a marketing and sales channel for existing products across our company, whether it's merchandise or theme park tickets and resort packages and stuff like that.

Our revenue is fairly evenly distributed across those categories if you ignore the theme park and packages piece. We're well into the several hundred million range—\$330 million-plus in revenue last year for our fiscal 2004, and growing at a pretty healthy clip.

The dynamic that has changed in the last five years is a substantial turnaround in advertising revenue where there was a stretch there



Thanks to a batch of popular content and services, WDIG has been in the black since 2003.

post the bubble bursting, when it was a shrinking category. The industry in 2004 grew about 30 percent in advertising revenue.



Wadsworth

The premium content piece is another one that's been a very interesting turnaround in the last five years. We were fairly early players for premium content for the Internet. Now as we see broadband opening up, the consumer's getting much more comfortable and wanting to go deeper. And they're getting over the hurdle of transacting for content over the Internet, which we are certainly seeing. We're also seeing that category growing in a very robust way. We're also seeing the operator interest in our content increasing.

CED: How does your proprietary "DIG Motion" technology play into your advertising strategy?

Wadsworth: About three years ago...we thought it would be great if we could use broadband to deliver video embedded in our basic Web sites. We worked with the Walt Disney Imagineering research and development team, and then our engineering team basically took some of those ideas and started to build practical applications. The application we came up with was DIG Motion. It was first launched on ESPN about two years ago...and the concept is that if someone comes to our sites, it's great if we can deliver nice, rich static images, but, boy, if we could instantly play a high-quality, no delay, no buffering video, it would be great for the user and it would be great for advertisers, because one of the issues for advertising has been and continues to be that they have to create entirely new creative for the Internet.

CED: How have the demographics changed? Who was coming to you in 2000, and who's coming to you now?

Wadsworth: I'm not sure the profile of the people who come to Disney.com has changed radically, but the number of

people who come has increased dramatically, and the amount of time they spend there has increased dramatically. With the advent of broadband, people spend more time online because that time is more productive. They are also more comfortable transacting online, whether it's e-commerce or a content transaction.

Certainly, the ESPN demographic of men 18 to 39 has been big from the beginning. We've seen more growth in some of the other places where the demographic did not have as much broadband as they have now, such as Disney.com or maybe FamilyFun.com or even an ABCNews, where it's an older demographic generally that we're appealing to on-air.

CED: How do you expect to see your iTV activities ramp up as cable gives interactive television more attention, and organizations like CableLabs launch initiatives specifically tied to "enhanced" television?

Wadsworth: The reason we got into two-screen iTV is because we knew eventually it would go to one-screen. We're certainly focused on engaging with the cable operators to enable both single screen iTV...but also continuing on our own to pursue two-screen eTV [enhanced television]. There are some shows that are better suited to it than others. Sports events are pretty well suited to it, or highly popular things like *Extreme Makeover: Home Edition*, where we can come up with a range of applications that are interesting for that show. The more we see programming that fits eTV, the more we'll do. We're certainly seeing increasing advertising interest in the category. A lot of the advertisers feel if they can reach them on television, they want to reach them [with interactivity], because the people who are engaged with the eTV application are the most engaged viewers out there. ■

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newproducts

PRODUCT REVIEWS

Splice closure kits

DOVER, N.H.—Uraseal Inc. has introduced its Shake N' Seal splice closure kits for protecting connections and underground repair splices. "Uraseal has designed the CT series of closures specifically to meet the demands of the cable industry at a time when network integrity is coming under ever-increasing scrutiny," said Bill Mann, VP of sales and business development. "Our financial analysis of repairing underground cable cuts versus replacing the cables, both drop and hardline, shows that significant savings can be achieved at the system level."

CT products allow for speedy installation in demanding field environments. The permanent seal eliminates the need to return at a later date for span replacement.

The CT products exhibit low viscosity for quick penetration that ensures splice protection and bonding to the cable jacket and connector during cable repairs. The products exhibit fast gel time, making them suited for field applications. The Shake N' Seal kits eliminate mix ratio errors and minimize waste, according to Uraseal.

Visit www.cedmagazine.com/products

Receiver/decoder

SIOUX FALLS, S.D.—Sencore has introduced the Atlas MRD 3187, a new concept in receiver/decoder technology. The system is comprised of a hardware platform that is configurable to specific applications. In addition, the system features remote access capabilities and multi-unit management software, making system integration simple, according to the company.

The modular design of the MRD 3187 allows the user to customize a modular



Sencore's Atlas MRD 3187

chassis to fit particular needs by choosing from a variety of input and output possibilities, including RF inputs, transport stream inputs and outputs, video decoding, and audio decoding. The unit can be configured either as a 1 x 6 or a 2 x 3, and can provide up to two independent or redundant outputs, saving rack space.

The MRD 3187 is capable of decoding MPEG-2 Main Profile @ High Level (4:2:0), Main Profile @ Low Level, and

Simple Profile @ Main Level. The MRD 3187 provides all the ATSC formats including: 1080i, 720p, 480i and 480p. The unit also provides analog output options that include: NTSC, S-Video, and RGB/YPbPr. The digital video options include SDI/HDSI. The Atlas MRD 3187 has a variety of applications, including: high definition TV contribution, cable headends, terrestrial signal contribution, and remote monitoring.

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MPEG advanced coding analyzer

SINGAPORE—Pixelmetrix has introduced full support for H.264 (also known as MPEG-4 Part 10) via its VISUALmpeg product family of analysis tools for evaluating and testing MPEG-based advanced coding. With a flexible software application, models are available for MPEG-1, MPEG-2 and H.264. All MPEG parameters are extracted and displayed in a clear format while allowing the user to drill-down to all areas of MPEG stream and image analysis.

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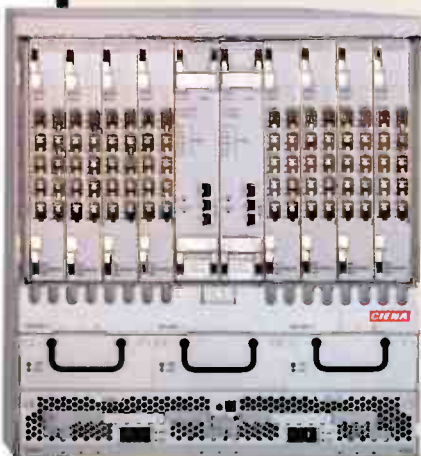
Ethernet services provisioning switch

LINTHICUM, Md.—Ciena Corp. has announced the CN 4350 Ethernet services provisioning switch. The CN 4350 is a carrier-grade Ethernet platform specifically designed for telco and cable service providers to deliver triple play services to residential and commercial customers over a converged packet network, including high-value Ethernet private line and local area network (LAN) services.

Designed specifically to deliver voice, video and data over a converged packet switched network, the CN 4350 enables providers to broaden their services portfolio without increasing operating expenses, and to improve service margins without complicating the network, according to the company.

The CN 4350 combines full mesh 160 Gbps fabric, VirtualWire VLAN switching, GbE and WDM transport interfaces, and carrier-grade reliability to provide the same service performance and operational simplicity of time-division multiplexed and Gigabit Ethernet multiplexing, but with the cost-effectiveness and bandwidth efficiency of Ethernet switching, according to the company. The CN 4350 delivers QoS and assigns each service its own "virtual wire" with guaranteed end-to-end bandwidth and performance. This is critical for concurrently switching and transporting best effort and QoS-sensitive services at 100 percent utilization.

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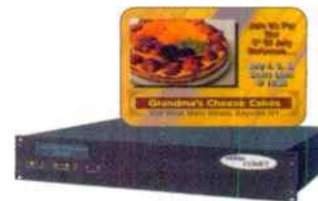
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ARTICLES

CED's April issue examines DOCSIS 3.0 technologies, investigates the status of OCAP (and OnRamp), and presents the annual CTO Roundtable.

Channel bonding or wideband—Which has the right stuff for DOCSIS 3.0?

In terms of raw speed, DOCSIS 3.0 will blow away its predecessors. But what underlying technologies will form its foundation? The leading contenders are shaping up to be "channel bonding" and "wideband protocol." Some see the two as interchangeable, while others vigorously disagree. CED's editors examine their similarities and differences—and investigate how well each is doing at navigating CableLabs' DOCSIS 3.0 minefield.

OCAP applications—Who'll be first in line?

It's agreed that U.S. cable operators must migrate to a world where OCAP middleware reigns supreme. Several MSOs plan to test or deploy it sometime this year. Others are eyeing the "lighter" OnRamp version for a less demanding hardware transition. But where are the "killer applications" needed to justify the full stack? Who's taking the development risk?

INDEPTH CTO Roundtable—What's on the horizon?

CED assembles the industry's best and brightest to hash out everything from digital simulcast and bandwidth management to advanced services and applications—VOD, VoIP, iTV and more. Which will have banner years and which will languish?

Plus: The latest edition of CED's VOD Deployment Wallchart

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TV anytime, anywhere

One thing that caught my eye at the recent Consumer Electronics Show (CES) was a flat satellite antenna—one that mounts on a car or SUV roof, so your kids can watch DirecTV in the back seat. And then I saw several other antenna manufacturers with similar products. And then I heard about other products and services also aiming for the untethered TV market. This is a new market segment, and from the scope of offerings out there, a very real one.

The satellite antennas are flat, not concave like a dish. They use a technique called a phased array of multiple antennas. A single antenna on the top of a car would have a pattern that is omni-directional—the same gain in all directions. That's fine for narrow-band mobile communications, because licensees are given exclusive assignment of a frequency within a geographical area. Even though an omni-directional antenna "looks" in all directions, it won't see interference from any other licensee. But broadcasting

video to cars, working with automotive electronics manufacturer Delphi. Details were sketchy, but it will probably involve video that is first stored in a Digital Video Recorder (DVR) in the home, then later downloaded to a DVR in the car. The download path will be wireless, based on Delphi rear-seat video systems that already have WiFi capability.

But there's more. Sony has come out with a product called LocationFreeTV (see <http://12.155.226.67/>). This product consists of two pieces, an untethered 12-inch or 7-inch LCD screen, and a "base station." The LCD screen displays video programming that it receives over a WiFi link from the base station. That's fine if you want to watch TV out on the patio.

But wait, there's more. Both the base station and the display have Internet capability, with the base station streaming out video that it can get from an attached cable box or DVR. So let's say there's a snowstorm in Denver, and you're sitting for hours in the airport Red Carpet Club. You can connect your display to the airport HotSpot, and watch stored movies...or local TV programming streamed over the Internet. Hold on! Wasn't this what the Broadcast Flag was all about?

The Sony product is a little pricey. Sony is selling it for \$1,100, but you can find it available on the Internet for as low as \$840. But wait, there are cheaper alternatives.

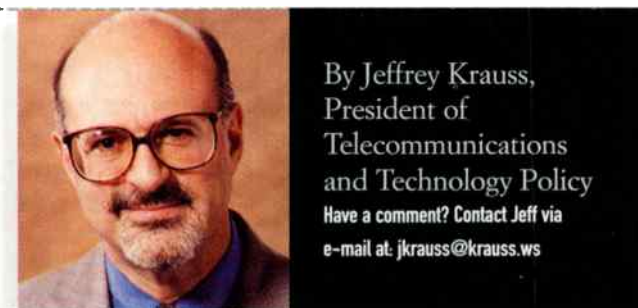
If you're more interested in using it at the Red Carpet Club than on your patio, you don't need the untethered display because you already have a laptop computer. In that case, get yourself a Slingbox Personal Broadcaster (www.slingmedia.com/). It provides the same sort of capability for streaming video from your home DVR or cable box, but the video is displayed on your laptop rather than a separate display. Just link up to any HotSpot or other high-speed Internet access. You've heard of timeshifting. Slingbox calls this "placeshifting."

So, how does this all relate to copy protection and the Broadcast Flag? For now, there's no problem. Right now, both the Sony product and the Slingbox accept only analog video inputs, and the controversies deal with digital video.

For digital broadcast programming that contains the Broadcast Flag, TiVo seems to have set a precedent by getting FCC approval to distribute TV broadcast programming over the Internet to up to nine remote locations. Your laptop or Sony LocationFree display could be one of those locations.

For copy-protected digital cable programming, the cable box would encrypt the programming for transfer to the Delphi rear seat system or LocationFree base station or Slingbox, so your car unit or laptop or LocationFree display would have to use a CableCARD to decrypt it.

It may be a few years before we actually see those products, but it is clear that the industry has recognized the public's demands to watch TV anytime, anywhere. ■



satellites are spaced every 9 degrees across the orbital arc, and they all use the same 12.2-12.7 GHz frequency band.

You need a directional antenna to pick out the signals from the desired satellite and reject signals from other satellites. By using an array of small antennas, and combining them in a particular fashion, high gain can be achieved in one direction, and negative gain in other directions. And the direction of the high gain antenna beam can be changed, or steered, as the car moves. The military has used this technology for years (see, for example, www.pavepaws.org/), but only recently has it reached consumer products.

Receiving a satellite TV signal from satellites that are spaced at 9 degrees is a piece of cake compared to working with satellites spaced at 2 degrees. But that's what it takes for two-way communications. It's not impossible for a phased array antenna to achieve such a narrow beamwidth, because that's what Connexion by Boeing does. A phased array antenna mounted on a commercial aircraft is hardly consumer technology. But at least one of these consumer antenna manufacturers was talking about two-way communications in the future.

But that's not all. Comcast announced its own plans to send



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