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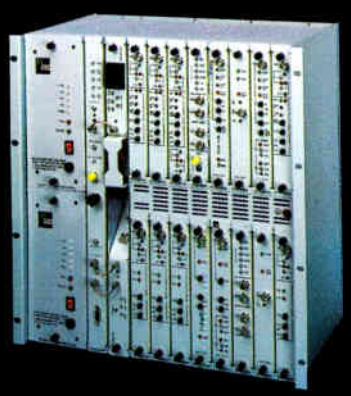

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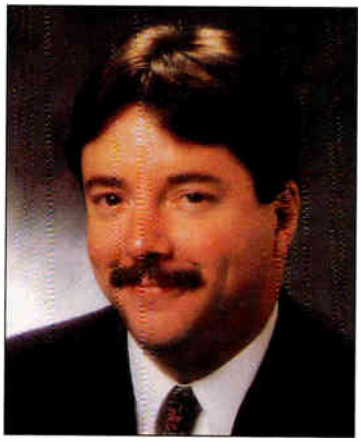

How do you replace an industry icon?

Know anyone who has a technical background, and is good at explaining complex subjects to non-technical people? Ever run across anyone who could comfortably meet with members of Congress, take some heat, and stay sharp enough to hold their own? What about effectively communicating with foreign dignitaries? Ever known someone who was so effective at negotiating that the other side didn't even realize it was giving something away? Or, does anyone you know enjoy sitting through long, complex meetings to make sure your points-of-view are articulated properly and understood?

If you do, the National Cable Television Association wants to hear from you–now.

You'd have to be living under a rock not to know that Wendell Bailey, who held down the top engineering job at the NCTA for the past 16 years, has departed. Some even feared that the NCTA was considering not replacing him, opting instead to let Cable Television Laboratories and the Society of Cable Telecommunications Engineers take over the bulk of those duties.

As it turns out, that's not the case. Last month, the NCTA Engineering Committee met as a whole with NCTA Executive VP and COO June Travis to espouse its reason for existence and reiterate its commitment to being the top engineering think-tank in the industry.

The committee's value cannot be overstated. Unlike CableLabs, it's open to programmers and equipment manufacturers alike. It attracts only top-level engineering minds. It thrives on unbiased technical conversation. It identifies, discusses and often solves problems before they become major, catastrophic issues.

But perhaps most importantly, it gives the technical community a Washington presence. While technical nitty-gritty gets performed within the SCTE, the NCTA is setting national policy, fostering relationships with the Electronic Industries Association, the National Association of Broadcasters, the Federal Communications Commission and others. It regularly interfaces with other key Washington-based associations with which the industry crosses paths.

In replacing Wendell, the NCTA has a real challenge on its hands, and the recruiting effort will reportedly take a very deliberate pace. The world is much different than it was 16 years ago–there's precious little time to allow a person to "grow into" a job like Wendell did. The technical community should be searching for a person with a technical mind, a diplomatic persona, a confident demeanor and enough name recognition that he gets his telephone calls returned.

It will probably be 1998 before a replacement is announced. In the meantime, Andy Scott and Katherine Rutkowski will capably keep the engineering department at the NCTA humming along. After all, another set of Technical Papers–the industry's recorded technical history–has to get out on time.

Roger J. Brown

Roger Brown
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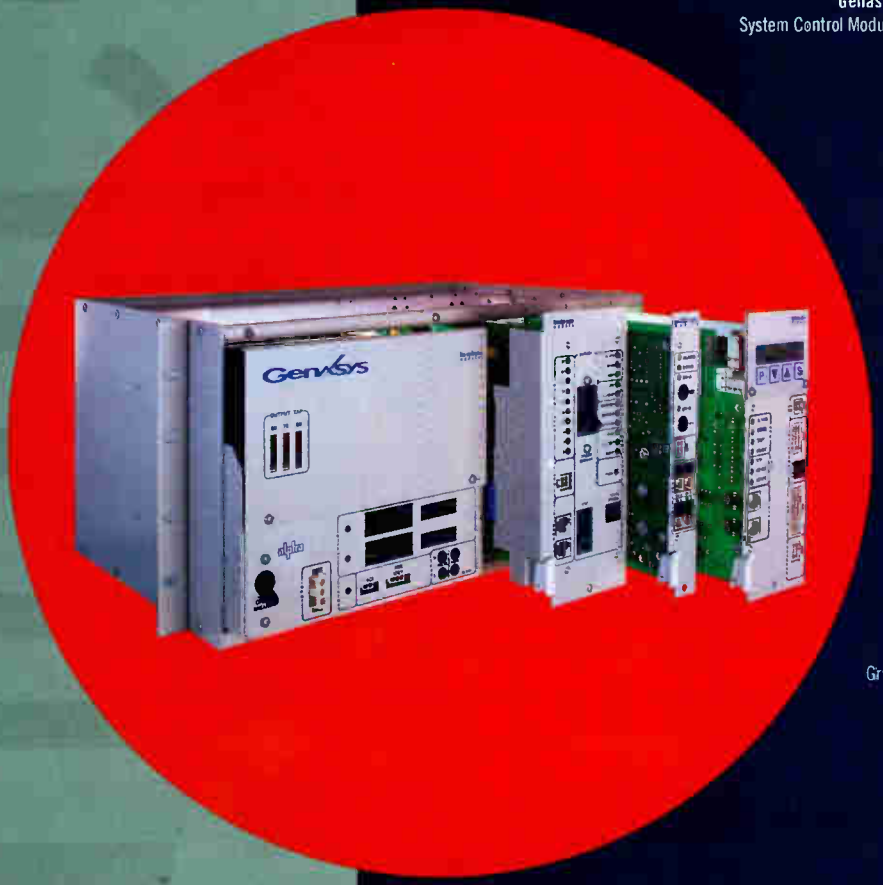

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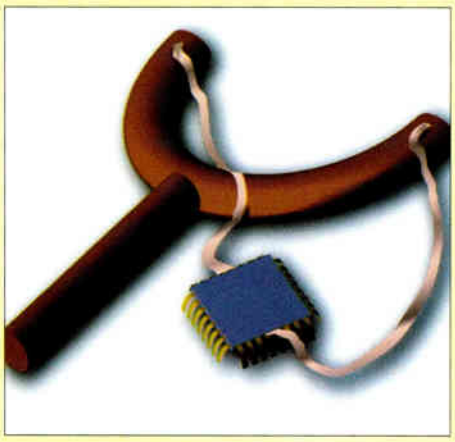

44 Friends of Bill? Or, Gates as Goliath?

By Michael Lafferty

Will Bill Gates and Microsoft prove to be a friend to the cable industry's OpenCable initiative? Or will it be a twist on DAVID vs. Goliath, with Gates stamping his brand on all future operating systems?

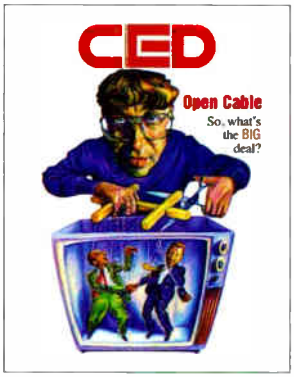

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Illustration by Jay Lincoln

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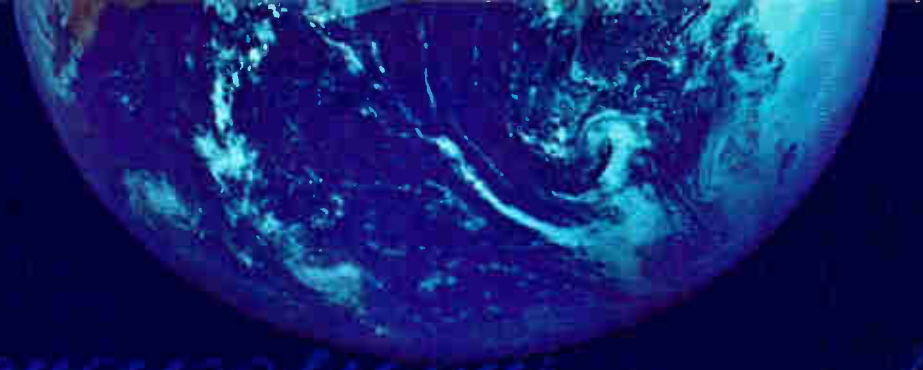

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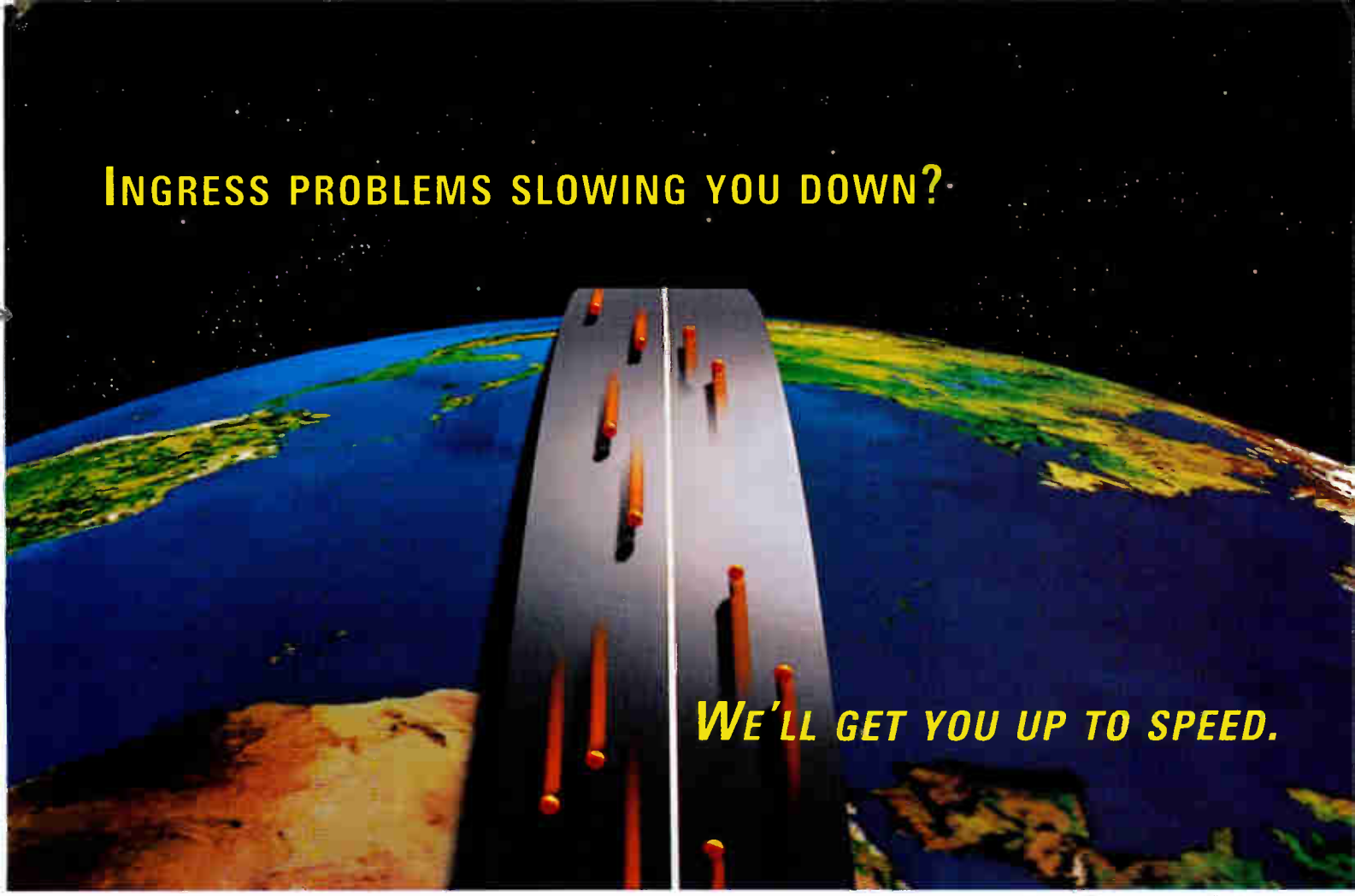

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WebTV debuts next-generation receiver; Internet TV efforts get boost

While data-over-cable seems to be at the forefront of most cable operators' thinking these days, there is probably just as much effort being put forth to make the TV the data display device of choice.

WebTV and NetChannel both recently made splashes with new product introductions as well as announcements regarding new partners, all in an effort to redefine and capitalize on the Internet TV craze.

WebTV Networks Inc., which is owned by software behemoth Microsoft, unveiled the WebTV Plus Receiver and WebTV Plus Network service as a way to increase viewer interactivity with the TV. Specifically, the new system features an advanced cable-ready tuner that allows viewers to quickly tune to cable and broadcast channels, while bringing picture-in-picture capability to standard televisions so that audiences can now view TV and Web programming at the same time. The system also provides Web content directly linked to TV shows for a seamless integration of TV and Web programming.

The new receiver will be distributed initially in the U.S. by the company's manufacturing licensees, which include Sony Electronics Inc., Philips Consumer Electronics Co. and Mitsubishi Consumer Electronics America.

Also included are two key new features: TV Home and TV Listings. TV Home, as the launch point for the WebTV Plus Network service, gives viewers a way to find descriptions about shows as they flip through channels, or they can quickly see what is playing on a collection of their favorite channels. TV Listings gives viewers a way to plan their TV viewing, scroll through TV channels and watch the currently selected program, all at the same time.

The system includes a 1.1 GB Seagate hard drive for local storage of multimedia content with full-motion video and symphonic sound. Viewers have immediate control and access without having to wait for downloads. Retrieval time of Web pages is speeded through a Rockwell K56flex modem. The new receiver also includes the company's VideoModem technology, which can receive high-bandwidth data (1 Mbps) embedded in a conventional television broadcast signal without disturbing the video content.

The picture-in-picture capability is made possible by a 3D-graphics engine, resident on a new chip designed by WebTV Networks called "Solo." Viewers can instantly switch among full-screen TV, full-screen Web and the combined picture-in-picture TV and Web displays. Viewers will also experience dramatic 3D special-effects transitions with live video and graphics.

Also entering the fray is NetChannel, which touts itself as the first Web-enhanced television service personalized to each viewer. The service is now available nationwide on the RCA Network Computer, with other consumer electronics partners to be announced.

NetChannel uses the Internet to deliver a personalized television experience for up to six individuals as well as a channel for the whole family. The NetChannel service features unique on-line programming from popular television sources, an electronic program guide for tuning to the Web and TV, password-protected e-mail, complete access to the Internet and parental controls.

NetChannel's unique personalization is made possible by personalized information delivery software from Autonomy Inc. that learns viewers' interests over time. Whereas other Web television services use "push technology," which enables advertisers and others to force feed content to viewers, NetChannel works like a "personal assistant" directed by the television viewer, say NetChannel officials.

The integration of television and Internet programming is made possible by a new EPG that was developed by NetChannel, RCA, GIST Communications and Spyglass Inc. It provides a comprehensive 48-hour listing of all local broadcast and cable programming that is updated every night, without requiring viewers to dial up and go on-line to look up what's on TV.

And finally, even the advertisers are getting into the act. A new technology which enables advertisers to run television-quality commercials on the World Wide Web was introduced and demonstrated recently.

Called Sesame-Ad, the new technology delivers an advertiser's commercial to millions of users' computer screens in full color, with all of the live-action, animation, drama and sound associated with regular TV commercials. It handles the scheduling automatically and also captures the detailed end-user demographics and advertising impressions on a "real-time" basis, generating a customized on-line report for the advertiser.

The technology was developed and showcased by echoMEDIA, which specializes in providing interactive, multimedia advertising services to companies and Web sites.

Sesame-Ad activates the advertiser's commercial when a Web user initiates the download of a graphic field or document, and the commercial appears on the user's screen without any noticeable interference with the download.

Small telco finds cablephone answer

While many of the biggest cable companies have put their telephony-over-cable plans on hold, at least one small cable/telephony company has found a way to use the technology while saving money and boosting revenue.

Independent wireline, cellular and cable service provider Oneonta Telephone Company (which goes by the moniker "Otelco"), located near Birmingham, Ala., plans to use equipment provided by Philips Broadband Systems to deliver lifeline telephony service over a hybrid fiber/coax network to its customers.

Otelco service technician William Blythe examines an HFC telephony subscriber interface unit (SIU) in the central office. This SIU is connected to the HFC network, enabling Otelco to use the in-house unit to test the telephony system's performance.

Otelco officials say the company will initially deploy upwards of 200 broadband telephony lines this fall, with plans for rapid deployment once the system's return path is

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The new MAXLink HLT 7709 improves upon Harmonic's current 1550 nm transmission system by increasing the dual complementary outputs to 9 dBm, without requiring optical amplifiers. This means new solutions to both old and new system topologies. Who says you can't have it all?

The high combined output power of the new MAXLink enables efficient 1550 nm distribution. The high signal output allows for remote location of the optical amplifier, producing high signal quality in the new fiber-to-the-node transport architectures. In supertrunking applications the new transmitter increases efficiency and improves CNR due to elimination of the optical amplifier. And no matter how you look at it, this all means better economy–in either long-distance or fiber-dense environments.

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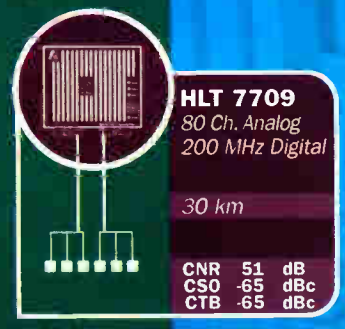
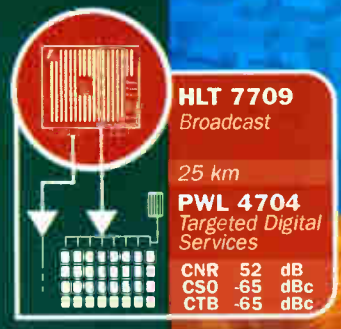
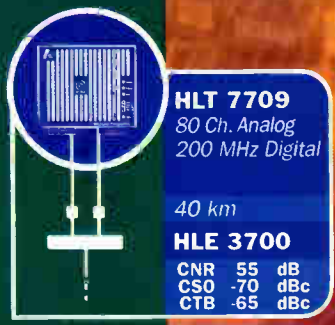


Efficient Distribution



1550-to-the-Node with Digital Narrowcast



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Reader Service 7

fully upgraded. Otelco, which has 7,100 telephone subscribers, 2,500 cable TV subscribers and 200 new data customers, operates both a traditional, twisted-pair telephone network and an HFC video distribution network.

But with the growth of the Internet, as well as fax machines and other technologies that demand additional telephony lines, the company's twisted-pair network was nearing capacity, which forced the company to turn down new requests for service.

To counter that problem, Otelco decided to test HFC technology in outlying areas to see if it could be used for telephony, which would allow the copper cable to be "pulled back" toward the central office and redeployed to serve additional lines. HFC telephony is being deployed in areas where the coax plant either exists or would need to be constructed in the future.

"Not only have we saved tens of thousands of dollars on installation costs," says Otelco plant manager Charles McBrayer, but also, "we'll continuously save money on truck rolls and overall maintenance costs because we're providing video, voice and data to our outermost customers with one plant, rather than two."

Otelco, which installed Philips' Crystal Line system this June to field trial the new technology, recently upgraded its HFC network to 750 MHz and made appropriate enhancements to portions of its return path. "This part of the country regularly experiences lightning strikes, so it is very critical that our HFC telephony system be robust and reliable," says Otelco President Bryan Corr.

A driving force behind Otelco's decision to pursue HFC telephony was the ability to add data services to its plant without the need for expensive cable modems. "The Philips system has a unique data provisioning feature that will enable us to provide 128 kBit connections to on-line services without cable modems," says Corr. "We are also pleased that (the technology) is equipped with an RF switch that allows us to remotely activate and deactivate CATV services, saving a great deal on truck rolls and routine maintenance costs."

Data-over-cable consortia formed

Now that a second round of high-speed data modem interoperability tests has been performed at Cable Television Laboratories, equipment manufacturers who smell a huge opportunity are aligning themselves to make sure their equipment does, in fact, work with gear made by other manufacturers.

Hayes Microcomputer Products Inc. says it will team with Cisco Systems Inc. to develop interoperable cable products that support the Multimedia Cable Network System (MCNS) standard. Hayes, Cisco and other companies have agreed to build cable modems and other products based on Data Over Cable Service Interface Specifications (DOCSIS), which define technical specifications for equipment used at subscriber locations and cable operators' headends.

Likewise, 3Com Corp. and Bay Networks separately announced they had signed a memorandum of understanding that will allow them to collaborate at the engineering level to ensure that both companies interpret the DOCSIS specifications the same way.

Agreements like these are intended to ensure that equipment is truly "plug-and-play," which allows consumers to purchase a modem from any manufacturer and have it work on an MCNS-compliant cable system.

"We want broad-based interoperability between our equipment," says Karl May, VP and general manager of Bay's Data-Over-Cable Division. He also says the two companies have had several discussions with "up to 10" consumer electronics manufacturers in an effort to drive the market, and drive down costs.

Furthermore, Lavent Gun, VP of engineering at 3Com, says that other manufacturers are being invited to join in the effort, which includes interoperability testing at CableLabs. "We want to grow this business from a $150 million business to a several billion-dollar business," he notes.

Hayes says its MCNS-compliant cable modems will be available sometime in the second quarter of 1998, with availability at retail outlets as early as late 1998. For cable operators, this collaboration means they could support the headend Internet-via-cable connection without purchasing and leasing cable modems to subscribers.

"This collaboration enables low-cost MCNS modems to be available at retail outlets. Hayes' strong brand name and quality image, along with the company's established distribution channels, enable a retail infrastructure to be quickly set up," said Sebastian Pereira, Hayes cable product manager, Broadband Business Unit, in a statement.

Hayes launched its first cable product in April 1997, and officials with Hayes say the company has received orders for more than 10,000 units. 3Com just announced it is shipping MCNS-compliant telephone-return modems, and two-way iterations should be coming in the first quarter of 1998.

Final EAS rules softer on cable

The cable TV industry collectively sighed with relief last month when the Federal Communications Commission finally issued its new Emergency Alerting System rules. That's because the second report and order gives smaller cable operators more time to comply with the program.

Ever since the first report and order was issued, cable operators, national associations and even the Society of Cable Telecommunications Engineers have been meeting with the FCC to soften the rules. At issue was the level of participation and how fast smaller cable operators would have to comply. At least one estimate was that small cable systems would have to spend upwards of $100 million on new equipment that would allow them to override video and audio on all channels.

But now, cable systems with more than 10,000 subscribers will have until Dec. 31, 1998 to install that audio/video override gear.

Systems with more than 5,000 subs, but fewer than 10,000, must also install equipment that overrides video and audio on the entire channel lineup, but have until Oct. 1, 2002, to do so.

Operators with fewer than 5,000 subs have two choices: provide an audio override on all channels with a video alert that instructs viewers to tune to a specific information channel; or rely on national EAS messages from programmers (assuming that all programmers actually carry the EAS info). This, too, must be done by Oct. 1, 2002.

Wireless cable (MMDS) operators were also brought into the EAS fold and given until 2002 to comply. Other service providers, including DBS and SMATV operators, are not required to comply.

Libit debuts cable modem chip

Libit Signal Processing Ltd., an Israeli silicon chip manufacturer, is making the rounds among cable modem vendors and MSOs touting the availability of its LBT 4030, a standards-compliant cable transceiver chip for cable modem applications.

For those vendors and operators who might be reticent about having all their eggs in one basket by having a Broadcom Corp. single-source scenario for modem chips, the announcement by Libit is being met with relief. The chip has been designed to comply with the DOCSIS (Data Over Cable System/Interoperability Specification) and car-


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ries a $30 price tag for quantity orders.

Company officials say that Toshiba has already committed to purchase the chip, and samples were scheduled to be shipped last month. Early production volumes are expected in December, and higher-volume shipments in the first quarter of next year. The company also announced that its manufacturing effort will be assisted by an agreement it has reached with Analog Devices Inc., a large semiconductor-chip-fabrication company.

Approximately one square inch in size, the 166-pin chip features a downstream and upstream PHY layer, as well as an IF (intermediate frequency) conversion that precludes the need for an external downconvertor. The chip also contains on-board digital-to-analog and analog-to-digital convertors.

MediaOne simplifies Web video creation

MediaOne has introduced Streamcast (http://www.mediaone.com/streamcast), a turnkey solution that allows computer dweebs and dilettantes alike to add streaming video to their Web sites.

The system is an integrated software and hardware package that utilizes parallel processing to automatically encode and compress standard analog video for use via the Internet in a faster, more efficient manner. Developed to take advantage of the bandwidth available through MediaOne Express, the company's high-speed Internet access service, the Streamcast technology has been designed to help break the broadband content logjam many high-speed service providers are experiencing.

The first implementation of the patent-pending technology is New England Cable News' "news-on-demand" service (http://www.necnews.com), which has been optimized to take advantage of MediaOne Express' high-speed data rates. With this service, users can access and search daily-archived newscast clips by topic.

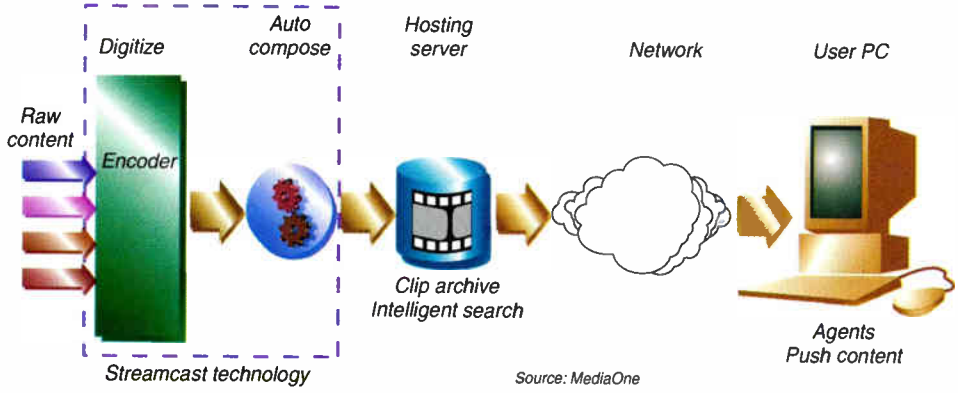
Other Internet video applications that could use the fast turnaround technology include such things as real estate sales services that feature video tours of properties, training-on-demand services, home and car repair or do-it-yourself services, or even music and movie CD-ROM sales featuring music video or movie clips.

Kip Compton, MediaOne's director of Internet systems and services, and a select crew of talented computer code writers, developed the system to "help create a video-intensive Web by enabling video content producers, like television stations, to distribute and archive broadcasts via the Internet," says Compton.

Working at a Streamcast workstation, one person begins the process by taping any program targeted to be published on the Web. While this is happening, the person notes and enters headlines, keywords and time codes into the computer in order to break up the broadcast into segments for searching and later access.

Once the tape begins playback, the computer begins a video capture/digitizing process. The captured files are then automatically composed using any of the standard commercial codecs, such as VDO's VDOLive, RealNetwork's Real Video, or Microsoft's NetShow. A thumbnail of the video can also be created for use as a hyper-link on a site. Once composed, the files can be published directly to a Web site's host server with a click of a button.

Video streaming made easy.



Source: MediaOne

Ex-Standard execs form digital firm

Three former executives with Standard Communications have exited that company and have started a new venture that focuses on headend solutions for cable systems and broadcasters that will soon be deploying digital video.

Mason Truluck, Clayton Dore and Warren Davis, all of whom had key positions at Standard, have formed "DigiTrans," a company that intends to design and engineer digital video reception and headend products. DigiTrans has already forged a manufacturing agreement with Alps Electric Co. of Japan for off-shore fabrication of the company's products.

Specifically, DigiTrans intends to manufacture digital satellite receivers, HDTV satellite receivers, DVB-compliant satellite receivers, digital modulators, digital broadcast processors and conditional access encoders and decoders, says Davis, VP of engineering and technology at DigiTrans.

Products are already currently in development, and will be shown for the first time next year at the National Association of Broadcasters' show, as well as at the SCTE's Cable-Tec Expo, says Dore, who has been named VP of sales and marketing for the company.

By focusing on headend gear, DigiTrans intends to fill several product voids that will exist when broadcasters and cable operators begin to deploy digital service, says Truluck, president of DigiTrans. A couple of immediate needs include an 8-VSB to QAM transcoder and a dynamically scalable digital receiver for both standard- and high-definition TV signals.

The new company will be based in Huntington Beach, Calif.

Jottings

HDTV is finally beginning to show up, albeit not to the public yet. The latest sighting occurred last month during coverage of the American League Championship Series, when HDTV signals were sent by **Harris Corp.** over **MCI Communications Corp.'s** fiber optic network from Camden Yards in Baltimore to WHD-TV, a test station in Washington, D.C. From there, the game was broadcast through a Harris digital transmitter to the National Press Club, and viewed by an invited audience of broadcast industry executives and government officials . . . **Scientific-Atlanta** will supply Multicanal Telecomunicacoes S.A., Brazil's largest cable operator, with 30,000 addressable analog set-top terminals. Multicanal, which operates two-way, 550-MHz HFC cable networks serving 600,000 subscribers in Brazil through 11 headends, selected Scientific-Atlanta to supply set-tops for two of its four major regions. Key cities in those regions include Belo Horizonte, Campo Grande, Anapolis and Goiania . . . . CED

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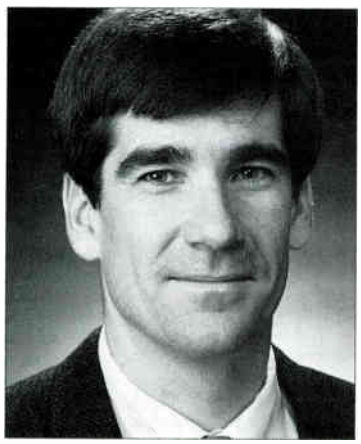
Applying technology for people's sake

The next time you step onto an elevator, breathe a silent word of thanks to Bob Cruickshank's great-grandfather, James, who invented an active elevator braking system which he later sold to Otis Elevator company. Before Cruickshank's invention, braking systems were passive, and sometimes, not inspected, with unfortunate results for passengers.



Robert Cruickshank III

Robert Cruickshank III (Bob), who joined Cable Television Laboratories in 1994 and now serves as director of digital network technologies, knew from a young age that he wanted to follow in the footsteps of his passenger-saving great-grandfather, as well as his grandfather and his father–all of whom were engineers. From studying his great-grandfather's patents, he became interested in the fact that "many technological advances can help people, can help change things," he explains.

These days, as Cruickshank spearheads CableLabs' MCNS DOCSIS (Data Over Cable Service Interface Specifications) project, he believes that the project's goal of making cable modems standardized and available at retail to everyone could influence the evolution of society. "This whole project is about bringing residential connectivity with decent bandwidth to a mass market," he says. "Anything that (helps people communicate), that gets them to think about each others' problems a little more, is a good thing in the end."

Cruickshank is pleased that the modem project has just turned a critical corner: the vendors are interpreting the specification and are starting to build to its parameters. CableLabs' staffers actually have their hands on working prototypes and are hooking them up to each other in order to uncover any potential interoperability issues. "We have been working on refining the spec as people find things that need to be clarified," he explains.

Cruickshank's role revolves around evaluating the testing process and resulting data, as well as plotting the timelines and figuring out the next steps to take. He's also responsible for writing the interoperable cable modem specifications. The vendors, he says, have cooperated to an unprecedented degree, and are now collaborating to write a test spec, each using their expertise to draft a specific section. "In 100 days, we have written a test spec that has 580 procedures, and is about 500 pages in length–it's about 70 percent complete," he notes.

To get the modems to be available at retail, there is a lot of interoperability and commercialization work for Cruickshank and his team to do. After that, he's also interested in exploring IP telephony and packet cable technologies.

Finding the airport

While earning an M.S. in mechanical engineering from Worcester Polytechnic Institute in the early '80s (where he was named a WPI Presidential Scholar), Cruickshank set his sites on AT&T Bell Laboratories for his first job out of college, because the organization had a reputation for "pumping out meaningful patents." A member of the technical staff from 1985 until 1991, Cruickshank developed ISDN-based energy monitoring products and applications for large buildings; coordinated R&D for AT&T's largest digital voice and data Private Branch Exchange; and developed automatic manufacturing process control reporting tools to bridge disparate computer systems.

His next career move was an abrupt departure from the lab: Cruickshank took a military leave of absence to join the Air National Guard, mainly to hone his flying skills via supersonic jet and fighter trainers. Strangely enough, it is that stint in the military, he says, which best prepared him to take on the role of project head and mediator at CableLabs. "As a jet pilot, you're going to be at the airport in two or three minutes, you are flying in at 500, 600 miles-an-hour–and you don't know where the airport is yet," he explains. "But you have to figure it out. And that's a lot of what we deal with everyday (at CableLabs). I may have this big problem, and I have to solve it in a certain amount of time. Having the ability to take a deep breath and be confident that I will get through it, that helps me get through conflict-intensive things."

Cruickshank returned to the world of high-tech communications when he joined CyberLYNX Gateway Corp., a company involved in developing energy management applications, as its VP of energy management. At CyberLINX, he was responsible for the architecture, prototyping and field trials of information gateways for energy demand-side management and automatic meter reading.

Eventually, Cruickshank wound up at the University of Colorado at Boulder, where he could "dig into the fundamentals of communications" while pursuing a doctorate. That move also led to a position in CU's Telecommunications Systems Laboratory as ATM coordinator in 1994, when he founded the ATM Research Group and established the lab as a facility for ATM testing, simulation, research and applications development.

A legacy of change

Cruickshank is connected to CU in another way–his wife, Calandra, studied journalism there. The couple has two boys: Aidan, age four; and Rowan, age one; and are expecting their third child in May. Cruickshank likes to take them up flying in their Cessna, and in fact, he and Calandra spent their honeymoon flying and camping in Maine.

Given his fondness for taking risks and embracing ambiguity, it's no wonder that Cruickshank has fearlessly thrown himself into the cable industry's modem standardization effort. But like his great-grandfather, he knows that technology can make a difference in people's lives, and he has made it his own life's work to be an agent of that change. *–Dana Cervenka*

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Reader Service 11

It still comes down to the lowly set-top

By Wendell Bailey, President, Strategic Technology International

About this time last year, I was asked by Char Beales (president of CTAM) if I would be willing to be the co-host of a presentation by Nicholas Negroponte.

Well, I was somewhat reluctant, to say the least. The MIT guru is fairly well-known to the technical intelligentsia of the cable television world, and many had become a bit disenchanted with what they took to be his unkind and sometimes unfair criticisms of the things that we do. Ever game, I told Char that I would do it if I could have a private meeting with the professor before the actual presentation. This was agreed to by one and all (not easily, because as it turns out, Professor Negroponte has homes in several countries, as well as business reasons to visit them). Pinning him down to a date and time took several dozen e-mail messages, but e-mail, after all, is one thing that Professor Negroponte pays attention to. In the end, a breakfast was arranged, and Char Beales, Nicholas Negroponte and I sat down to a private and quiet meal in lovely downtown Anaheim.

I was somewhat nervous because I was about to talk "digital" with the world-famous author of "Being Digital," a person who has a reputation for being quick-witted and a bit acerbic. Talking to a famous person was not a new experience. I have conversed with hundreds, but it was almost always "cocktail chatter." This was to be an actual attempt at communication (in analog) with an honest-to-goodness guru. What would he ask me? What would I say? Would I sound dumb?

Much to my delight, I found Professor Negroponte to be a charming dining companion. He was witty (no more acerbic than yours-truly), soft-spoken, attentive and informative. We discussed a variety of cable and digital issues, and (I hope) each taught the other a thing or two about our respective areas of expertise. The one thing that we ended up discussing more than anything else was the subject of the set-top box. The set-top box? I'm enjoying breakfast and the company of a world-renowned expert on all things future and digital, and we are discussing the lowly set-top box! I could hardly believe it, but it's true. Today, of course, set-top boxes are all we seem to be working on in the cable television business.

Interoperable and transportable

The U.S. Congress passed a bill to deregulate almost everything that has to do with telecommunications in any form–except for the set-top box. A special provision was inserted that called on the FCC to issue regulations for the commercial sale of "navigation devices" (this is a legislative word that means set-top box). This action by the FCC is to coincide with the long-delayed but useful work on the decoder interface. Into this fray comes the idea that set-top boxes should not only be available at retail, but that they should also all be interoperable and transportable.

Meanwhile, the cable industry is doing its level best to deploy digital set-top boxes, and new services and features abound not only for digital boxes, but for advanced analog devices as well.

Consider the problem. Cable operator A offers its subscribers a program guide service from company X. The system operator downloads the needed data to activate the program matrix in the set-top box. This same subscriber decides to move to the next town over, which is owned by cable operator B. The subscriber takes his box with him from system A, and also asks his new supplier for the program guide service. Operator B, however, uses the guide from company Y. The data that it downloads to the subscriber does absolutely nothing for his old set-top box. The device is interoperable and transportable only to a certain, very specific degree. So what can we do to make the forces who think that an interoperable and transportable set-top box is the answer to America's problems happy? The work that CableLabs has recently announced may provide the answer.

Read the fine print

Set-tops boxes are already seen by many as special computers that are capable of much more than they traditionally are called on to do. Many of the new ones have a respectable amount of memory installed (for a variety of reasons), and if the service or feature providers could be convinced that they could make their product available as a self-executing file that could be downloaded to any set-top box, well then, we would have something. All it takes is a set of standards for the memory configuration in the box and a set of operating protocols for the service provider to adhere to. It seems, however, that there was another small item in the 1996 telecommunications bill passed by Congress. Nestled in the fine print was a requirement that the FCC make sure that no one adopts any protocols that are not absolutely necessary for the most basic of operations. Sometimes the regulators (or deregulators) hand the people at the FCC assignments that are just about impossible to reconcile.

What I find most fascinating about this, is recalling that breakfast last year with the good professor. I wanted to talk about the conflict between atoms and bits, and he wanted to talk about set-tops. It would seem, in retrospect, that he demonstrated to me why he is called a "visionary," and I'm just an engineer. If Congress and the FCC have their collective ways, the set-top box will be the single most important appliance of the 21st century. I hope that I'm still smart enough to use one when that time comes. CED

Have a comment?
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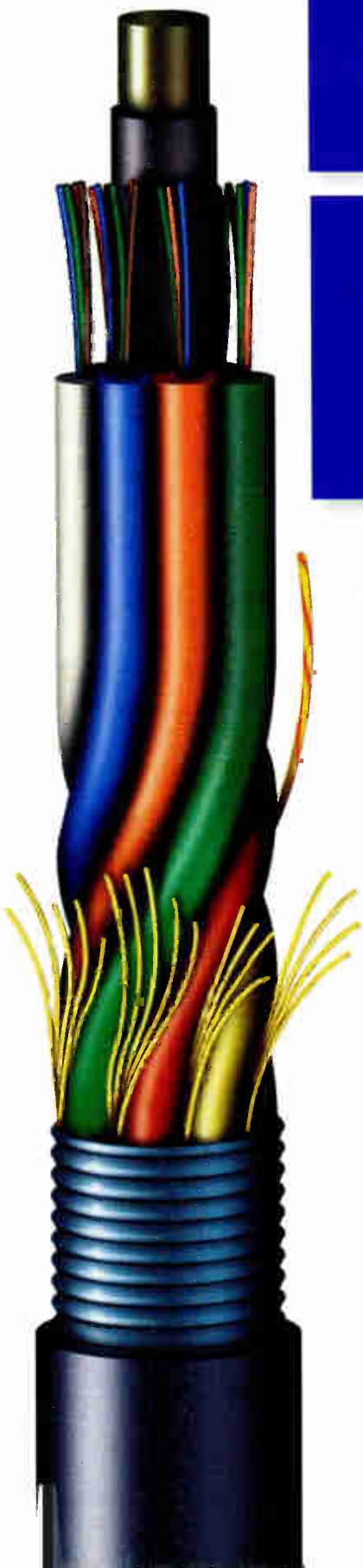

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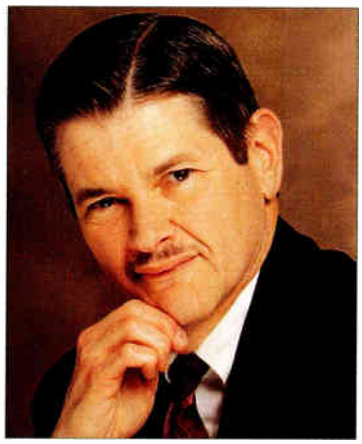
When it's simply too good to be true . . .



By Jim Farmer, Chief Technical Officer, Antec

Have a comment?
Contact Jim via e-mail at:
jofarmer@mindspring.com

My front lawn is pretty much back to its normal, weedy self. You can hardly see the place where the plumbers had to trench it up last spring to lay the new water pipe. But I'm getting ahead of myself.

It was more than a year ago when I came home one weekend from a company retreat, only to find the water pressure in the house to be pitifully low. I walked around to the low side of the house, and found a sheet of water streaming across the yard. After shutting off the water at the street and doing a little shovel work, I found both pieces of the water pipe. A couple of hours later, as the plumber was computing the size of my new mortgage, he explained what happened.

Seems that a few years ago, before my house was built, ReallyBig Chemical Company had introduced this really neat new material for making water pipe. Polybutelyne was easy to work; it was strong; it expanded, so freezing was not much of a problem; and best of all, it was cheap.

I wasn't around the company, and I don't know what happened, but I can guess:

Management: "This is really hot stuff. Let's get it on the market quickly, before someone else does."

Engineering: "But we have a few months of testing to do first."

Management: "Aw, what could possibly go wrong? Why, with all these good qualities, it will revolutionize the industry. And just think how our stock will move!"

One thing was overlooked in the process. Very few chemicals attack polybutelyne, but one which does is chlorine. And guess which chemical disinfectant is used by almost every water utility in the free world. It takes about 10 years for the chlorine to degrade the pipe to the point where you have trouble. I got an extra six months.

ReallyBig Chemical has reimbursed me for that extra mortgage I had to take out to cover the emergency repair, and last spring, they paid for a new water line. The have been doing this all over the country for a lot of homeowners, which attests to the efficacy of their marketing program of a dozen years ago. As a result, their stock has moved, but not necessarily in the direction favored by management.

Little problems add up to wad of cash

So what does this have to do with the cable industry? No manufacturer in the cable industry would ever rush a product to market. Of course not (grin). I was consulting some time ago with HopelesslyOptimistic Manufacturing, which had really big problems with a particular piece of gear it had rushed to market. The problems were not big in themselves, and when they were discovered, they were easy to fix. The problem was, by the time the defects were discovered, there were thousands of little problems in a whole bunch of different locations. So fixing a little problem took a wad of cash. Every time I talked to HopelesslyOptimistic's bossman, he reminded me about how fast they had gotten the product out the door, when a customer insisted on fast delivery of a new product.

Somehow I have a problem understanding how either party benefitted from a product that was rushed to market and had to be reworked later. Oh, yeah, I know about franchise requirements, competition and all that stuff. But who wins when a product doesn't work right?

InYourDreams Manufacturing has a pretty good approach to the problem. They carefully define a product before they begin working on it, and they review it frequently with key customers to be certain they are on the right track. They make sure up front that they know how the product will be used, and what the expectations are for it. They do plenty of testing during the development process, and they field test with customers. Their Timbuktu manufacturing plant is involved from the beginning of the design.

Now comes the problem. HopelesslyOptimistic, with its rush-it-to-market approach, often takes the orders away from InYourDreams, because HopelesslyOptimistic promises something faster than InYourDreams will commit to deliver it. So the customer orders from HopelesslyOptimistic because of the faster delivery, and by the time he finds out he isn't going to get it on time, or the product is not quite right, it's too late for him to change suppliers. So the customer grits his teeth and works through the problems with HopelesslyOptimistic.

Healthy skepticism

So how does the customer protect himself? One thing that helps is a skeptical attitude. My Daddy once told me that if something seems too good to be true, it probably is. At one time, delivery penalties seemed to be effective. The problem there, though, is that salespeople don't seem to talk to engineering, and promises get made anyway. You'd probably rather have gear on time, working, than to get it a little cheaper, late, and have to fiddle with it for the next two years.

If you're buying something new, and the manufacturer is not interested in field testing with you, that runs up a red flag. Reviewing the product with the engineers will help, too. Get schedules with frequent milestones. Make sure the milestones are being met. If they are slipping, then the product will probably slip, too. Most importantly, do not, and don't let the manufacturer, keep changing the specs or features. That tendency has sunk a lot of great ideas.

Oh, ReallyBig Chemical is a real company. Any resemblance between HopelesslyOptimistic and InYourDreams to any real companies is purely coincidental. CED

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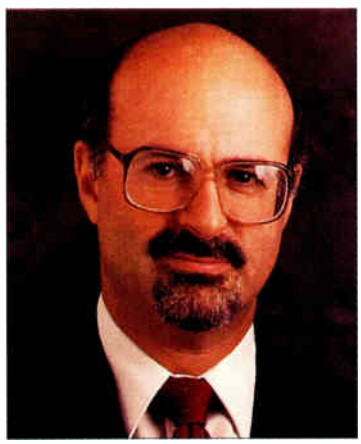
Reader Service 14

Singing the digital must-carry blues



By Jeffrey Krauss, pushing the cable signal carriage and President of Telecommunications and Technology Policy

Have a comment?
Contact Jeff via e-mail at:
jkrauss@cpcug.org

Among other sticky problems facing the new FCC commissioners is the question of "must-carry" in a digital world. In an analog world, where one 6-MHz channel equals one video program, it has been easy to understand what is required. But with TV stations now thinking about carrying multiple standard definition programs within their digital channel, some of which might be scrambled, or some combination of video and data broadcasting, all bets are off.

But one thing is certain—the industry is relying on the NCTA to take the lead in lobbying these important techno-political issues at the FCC, but I've heard disturbing rumors that the NCTA is thinking about eliminating its Science & Technology Department. That would be a mistake.

When Congress amended the Communications Act in 1992, it required most cable systems to allocate up to one-third of their capacity to carry broadcast signals. And it established "retransmission consent," which allows TV stations and broadcasters to negotiate a private deal for carriage. The idea was that cable would have to pay for access to these TV channels; either cash or non-cash deals are permissible. But only commercial stations can choose to negotiate a retransmission consent deal; non-commercial stations must be carried under the must-carry regime.

You remember that in 1993 some TV stations chose retransmission consent, but couldn't reach agreement with cable operators, and were dropped from some cable systems. Temporarily. Eventually, all the stations that demanded retransmission consent payments, and all the cable systems that refused to pay, were able to come to some agreement.

The digital difference

Starting in 1998, TV stations will begin broadcasting a second channel, using digital techniques. They may decide to broadcast a single high definition (HDTV) program, or a multiplex of four to eight standard definition (SDTV) programs, or some combination of video broadcasting and data broadcasting. For some period of time, probably 10 years or more, TV stations will continue transmitting their analog programming on one channel while they simultaneously transmit digital programming on another channel.

Broadcasters will use a digital modulation method called 8-VSB, while cable systems will use 64-QAM. Products have been announced that will convert ("transcode") from 8-VSB to 64-QAM, so compatibility isn't an issue. But 64-QAM allows a higher data rate to be carried in a 6 MHz channel than 8-VSB, which is consistent with the more friendly propagation characteristics of a cable system compared with over-the-air broadcasting. So the simple and inexpensive approach of transcoding a broadcast signal from 8-VSB to 64-QAM might result in wasted capacity.

Remultiplexing

Under existing analog must-carry rules, the cable operator is required to pass the video and audio through to subscribers without degradation. The data signals in the vertical blanking interval that are associated with the video programming, such as closed captioning, must also be passed through. But the cable operator is permitted to strip out other VBI data signals and replace them with different data signals. The same concept would apply to digital video.

Digital TV signals are very flexible. They consist of one or more video, audio and data streams multiplexed together. And the different program streams can be broken apart and recombined. In order to capture the benefits of 64-QAM modulation, a cable operator can pick out parts (maybe just a single SDTV stream) and can remultiplex these parts together (maybe four different SDTV streams from four different broadcasters might wind up as part of the same 6 MHz channel), and then apply 64-QAM modulation. Remultiplexing is not only technically feasible, but in fact, it makes efficient use of channel capacity. But I imagine that broadcasters will complain. The big techno-political question is whether the FCC can be convinced that it's a good idea.

And then there is scrambling. Fox Broadcasting asked the Advanced Television Systems Committee (ATSC) to develop standards for a scrambling system for broadcasters. It clearly wants to broadcast some premium programming on an SDTV program stream and charge money for it. Fox envisions a smart card or PCMCIA card slot in the TV set, and wants standards so that viewers won't need to swap cards as they change channels. (Unfortunately, a standardized scrambling system creates a more inviting target for piracy. And a plug-in card, as opposed to embedded circuitry, makes vulnerable signal paths more physically accessible.)

In the early years, most TV viewers won't have digital TV sets–they'll still be using their analog NTSC TV sets. Cable subscribers will be able to use a cable box to convert the digital signal to analog. The cable box will play an important role in speeding the transition from analog to digital, because it will make the digital programming available to a larger audience than those few who have purchased new TVs. And the cable box will be particularly important for feeding the second TV set in a home. So in addition to the policy question of whether must-carry rules will apply to scrambled SDTV programming, there are technical and operational questions about compatibility between cable boxes and broadcast scrambling.

Should cable operators be forced to carry scrambled broadcast programming? No. Should cable operators and broadcasters negotiate private deals for carrying scrambled broadcast programming? Yes. Will there be big fights over digital must-carry policies? You bet! CED

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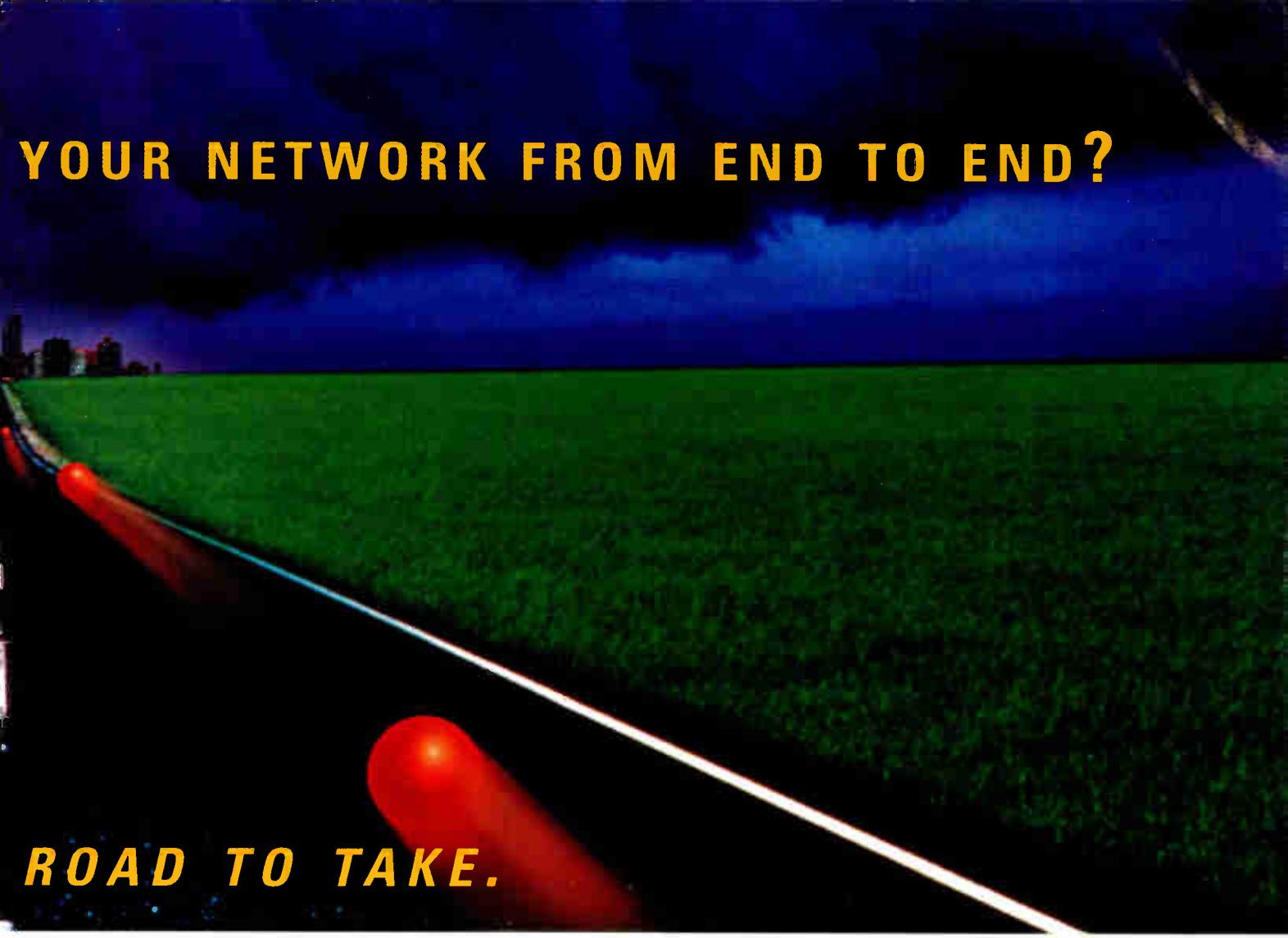

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How to locate nodes with high return ingress

A new test method

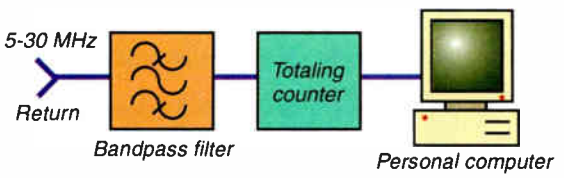
By Tom Williams, President, Holtzman
thwill@concentric.net

This article discusses test methods for monitoring cable return systems for noise. After a discussion of the most commonly found impairments, the conventional methods for detecting impairments are compared. A new test method is proposed that uses a bandpass filter with a high-speed counter and an optional trace acquisition unit. The new method allows the estimation of the bit error rate for an N-QAM modulation scheme, where N could be 4, 16, 64, or 256. The method can also be used for obtaining time domain samples of the impairments. Uncorrectable packets can also be counted. The test method can also be used to test vacant downstream channels.

Table 1

Test method	Strength	Weakness
Bit error rate testing with a QPSK carrier	Catches additive and multiplicative impairments; produces representative, quantitative data for QPSK.	Energy of modulation hides impairment; test QPSK carrier uses dynamic range and bandwidth.
Carrier wave testing	Catches additive and multiplicative impairments; reveals source of impairment; produces representative, quantitative data.	Test CW carrier uses dynamic range and bandwidth; understanding test results requires training.
Sweeping spectrum analyzer with a computer	Understandable results; accurately quantifies static or slowly changing additive impairments only; has large dynamic range.	Poor response to impulsive impairments because of sweeping and slow impulse response of filters; expensive test equipment.
Frequency hopping scanners	Ditto	Ditto, but not as expensive.

Figure 1: A new method to measure impairments.



The problem

One of the problems facing cable operators running hybrid fiber/coax (HFC) two-way plants is knowing when the return system on a particular node is down because of ingress. There is a need to determine which nodes have high levels of ingress without relying on subscriber complaints. If a subscriber's complaint is received, data about the reverse performance is needed to help resolve the customer's problem, because the return plant is only one element in the total network. The reverse monitoring problem is not a simple one because the 5-40 MHz output from each return fiber receiver may contain many frequency bands that need to be monitored. Additionally, there may be many return fiber receivers in a headend or hub site.

Additive or multiplicative

The nature of a return interferor can be additive or multiplicative. An additive impairment means that the desired data signal is present and unimpaired, except for the noise that has been summed on top of it. Most reverse impairments are additive impairments, and examples include burst noise, composite triple beat (CTB), random noise, and ingressing broadcast carriers. A multiplicative impairment is one that modifies the signal path. Examples of multiplicative impairments are hum modulation, transient hum modulation, mechanically intermittent connections, and multipath distortion (echoes). The test of whether an impairment is additive or multiplicative is simple: if you remove the carrier and the impairment can still be seen, the impairment is additive. A strong additive impairment can create a multiplicative impairment if the return actives are driven into a non-linear operating region via a third-order distortion mechanism known as cross-compression.

Many types of return impairments have been observed. Some of them, in approximate order of nuisance level, are:

1. Burst noise. This impairment is both severe and hard to discover with conventional test equipment. It is commonly created on the power grid by the switching of loads. Typically, this impairment lasts less than 10 microseconds, but has been observed at levels easily capable of briefly saturating amplifiers and extinguishing laser diodes. This impairment is carried on to the cable sheaths at common bonding points with the power systems, and travels on the cable sheath until a sheath break is reached, where the impairment enters the inside of the cable. The effect of a brief burst of noise can be multiplied if it causes an entire packet to be re-transmitted because the cyclic redundancy check (CRC) has failed at the reception point.

2. Ingressing narrowband broadcast signals. These consist of Ham and citizens band radio transmissions, as well as continuous broadcasts.

3. Misbehaving transmitters. The problem has been observed in many systems and has been traced to polling responses from set-top boxes that are transmitting with too much power. The high level transmissions generate distortion products, including cross-compression of other carriers.

4. Common path distortion. This impairment is created when forward signals hit a joint that is acting like a diode. The diode mixes the forward signals, and some of the difference products land in the return frequency band and head back upstream. The diode can be created by corrosion between dissimilar metals. With a standard downstream frequency plan, the impairment shows up as a set of three beats every 6 MHz in the return band. The beats at 6 MHz increments from zero are created by second-order distortion terms. The beats that are offset by +/- 1.25 MHz from the 6 MHz beats are created by third-order distortion terms.

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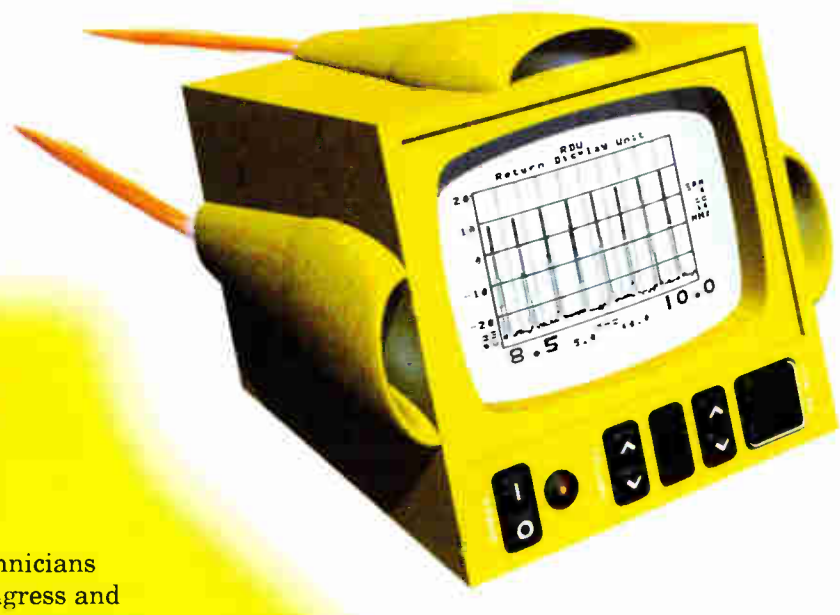

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The RDU is a new piece of test equipment. It allows technicians to monitor the return system from any point in the cable system without the traditional and cumbersome HE spectrum analyzer / camera setup.

The RDU allows system installers and technicians to view on any TV screen, the RF levels, Ingress and Noise present back at the HE from a subscriber's home, system amplifier, feeder tap or fiber node.

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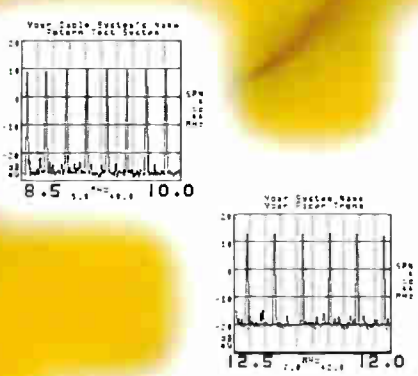

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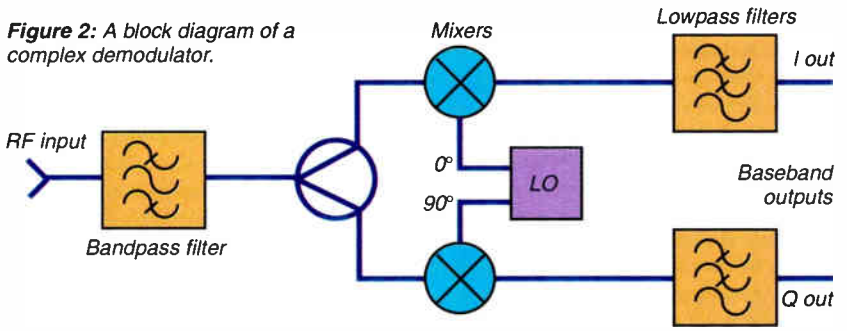


Figure 2: *A block diagram of a complex demodulator.*

Figure 3: *A baseband vector diagram with impairments.*

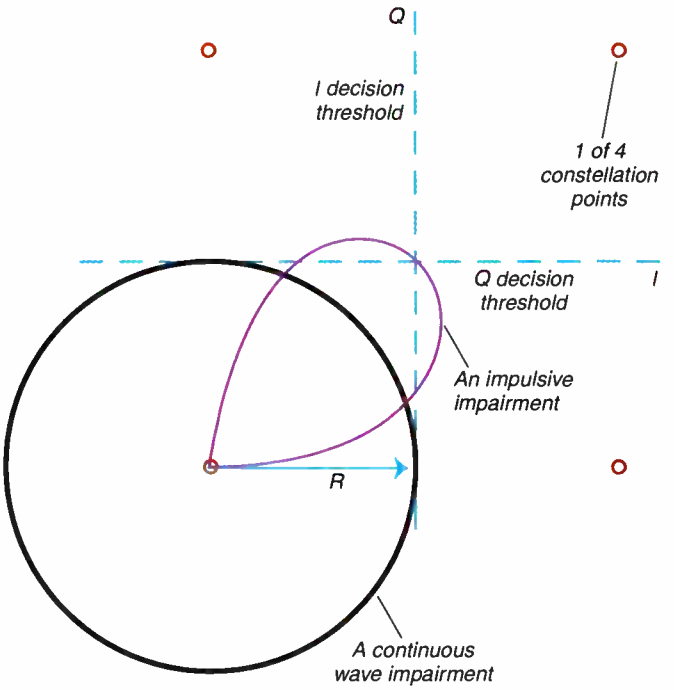
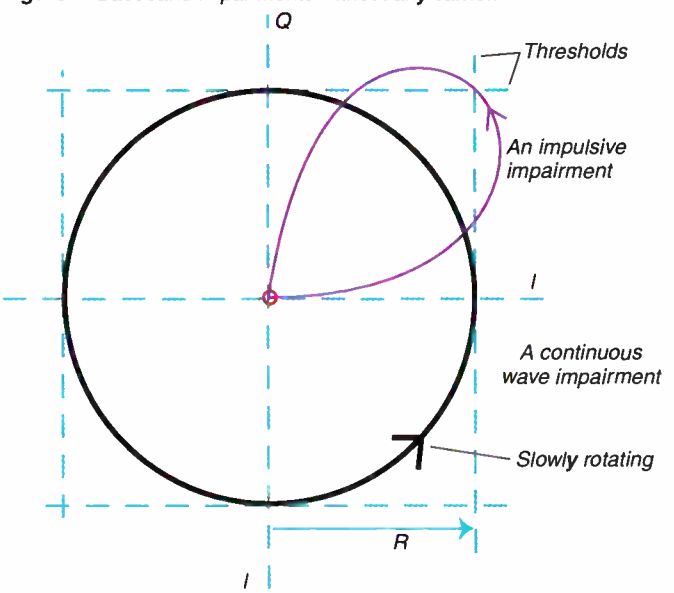


Figure 4: *Baseband impairments without any carrier.*



5. Arcing connectors. This problem has been traced to mechanically mismatched connectors on the hard line.

Perhaps the biggest complication for testing is the use of different modulation systems by different modem vendors. This means that an impairment that could stop a data transmission with one type of modem may have only a minimal effect on another type of modem. The common return transmission systems currently under consideration utilize quadrature phase shift keying (QPSK), orthogonal frequency division multiplexing (OFDM) and synchronous code division multiple access (S-CDMA). Once the decision about which modulation scheme to use is made, the testing ideally should be based on impairments at levels that affect the transmission system chosen.

If the impairment is caused by a cable shield break, the technician's focus should not be on the impairment, but on the underlying cause of the interference, which is the cable sheath break. This is because the next interfering appliance to be turned on may have different electrical statistics than the one before it, but the underlying problem is still the cable sheath break.

Monitoring system requirements

The challenge when designing a data collection system is to collect valuable data. The valuable data is data that, when analyzed, allows the return services to be operated with greater efficiency. Greater efficiency implies that it takes fewer resources to raise the quality of the return transmission system to a desired level. The return monitoring system should be able to:

1. Report if a node had a noise problem at a certain time past.
2. Provide information that may assist the troubleshooting process by reporting about the nature of the problem, including the spectrum and duration.
3. Interface to a network management system.
4. Provide an immediate alarm if a node falls out of specification.
5. Provide evidence that the problem has been fixed.

Because of the intermittent nature of ingress, the testing must be done in an automatic and unattended fashion. Because there are so many nodes, and because continuous monitoring is desirable, test equipment should also be compact and inexpensive to see widespread use. The return monitoring method needs to respond accurately to burst impairments as well as continuous impairments. The test method also needs to be conceptually simple for technicians without extensive training to set up, utilize and maintain.

Testing for multiplicative impairments is a logistical problem because the source of the multiplicative problem will be somewhere on the path between the transmitter and the headend. Testing from a fixed transmit location does not prove all paths are impairment free.

There are a number of testing methods that have been employed in the past. All have strengths and weakness, as summarized in Table 1. One problem common to all of the systems that can detect multiplicative impairments is that some sort of transmitting device must be located in the field. The most standard testing method will most like-

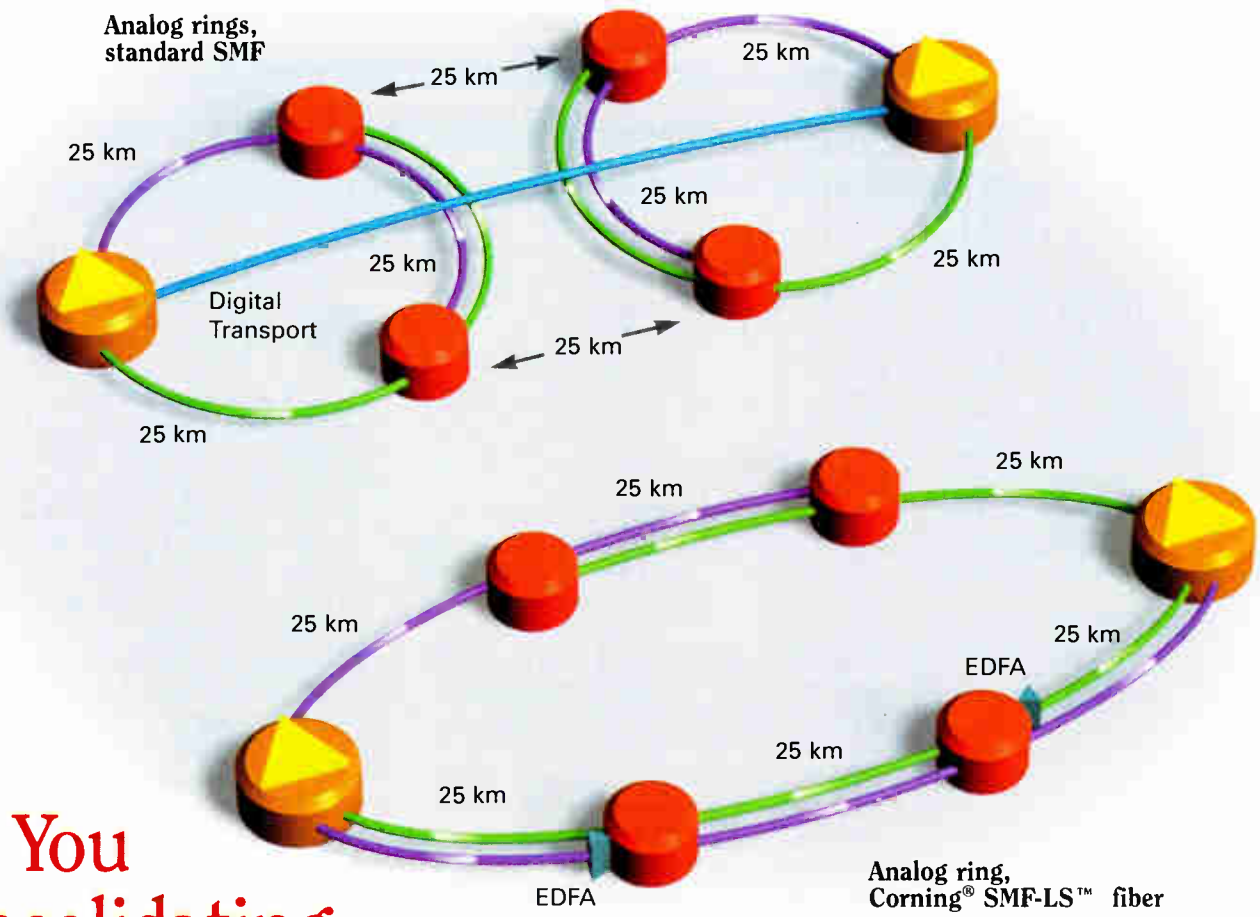


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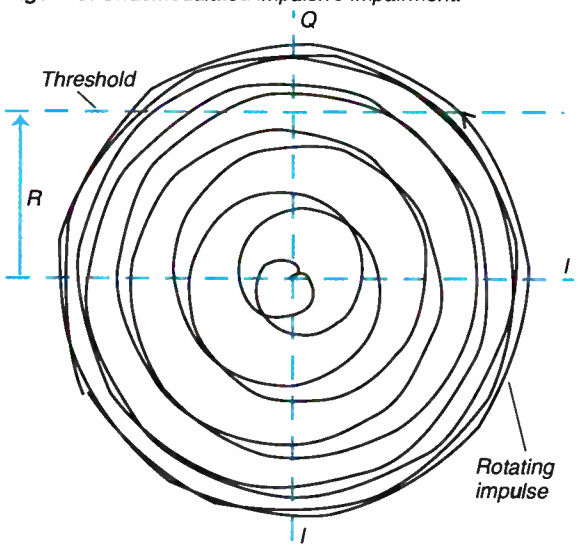
Figure 5: *Undemodulated impulsive impairment.*



ly utilize the modems already deployed in the field. This will have similar strengths and weaknesses as bit error rate testing with a QPSK carrier. If the modems can transmit a continuous wave, testing capabilities will be expanded.

A new method

A unique new method for unattended testing of additive impairments is done by passing the broadband return output of a node from the laser receiver through a bandpass filter into a high-speed totaling counter, as illustrated in Figure 1. This testing method is deceptively simple and can be used to test upstream or downstream vacant channels for additive impairments. By properly choosing the filter's bandwidth and center frequency to match the data service, and by accurately setting the threshold voltage on the counter, testing results with equivalency to N-QAM can be achieved. N might be 4 or 16 for return use, and 64 or 256 for forward use. The bandpass filter passes impairment noise energy in an unoccupied frequency band of interest, such as 20-22 MHz. The trigger voltage on the counter is adjusted to trigger on an impairment level that would cause a data transmission, such as QPSK, to be in error. The count on the totaling counter will increase according to the level and duration of the impairment. The personal computer (PC) is used for data logging. The following discussion explains the theory of operation.

Figure 2 is a conventional complex demodulator with an input bandpass filter, a local oscillator with a quadrature output, a pair of mixers, and a pair of low pass filters. If the local oscillator is locked to an incoming QPSK carrier, it produces baseband I and Q signals which can be observed on an oscilloscope (in the X-Y display mode) as a vector diagram.

Figure 3 is an I-Q vector diagram of a QPSK signal that has been demodulated by the complex demodulator to an in-phase baseband signal and a quadrature baseband signal. It shows the four constellation points, associated with the four states of the QPSK carrier and the decision thresholds for the I and Q baseband signals. Information is conveyed on a QPSK carrier as the phase jumps between the four points. The trajectory point of an unimpaired QPSK carrier must be sampled at the correct time instant to obtain samples at the constellation points. An interfering signal in the frequency band of the carrier will cause the correct constellation point to be misread if the interfering signal pushes the trajectory point across a decision threshold line at the instant the trajectory point is sampled. The magnitude of the noise voltage that is just sufficient to cause an error is R. Figure 3 shows two additive impairments, an impulse and a continuous wave.

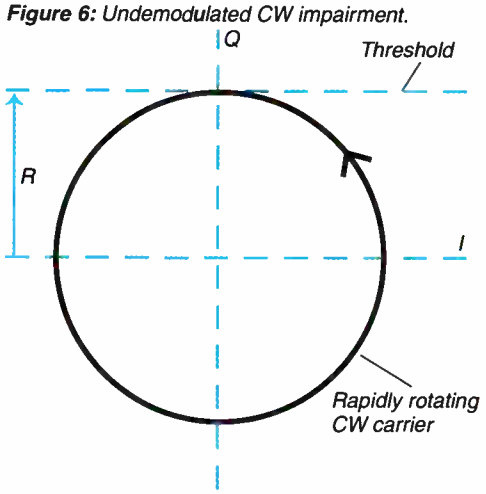
There are several types of impairments that all cause errors. Gaussian or random noise will cause the constellation points to spread and appear as "fuzzy snowballs." A continuous wave interferor will cause the points to become donuts, as illustrated. Impulsive noise will produce ovals, like erratically-spaced petals on a flower.

If the QPSK carrier is removed, the four-point constellation is collapsed down to a single point at the origin, as shown in Figure 4. Figure 4 also features the single noise impulse, which appears as an oval, and the continuous wave interferor, which shows up as a slowly-rotating circle. It is possible to detect noise that could cause an error if there were a QPSK carrier present. This can be done by establishing thresholds around the origin with a voltage threshold R in the positive and negative I and Q directions, as illustrated by the dotted lines. By measuring the amount of time that the trajectory point has moved outside the threshold regions, it is possible to estimate the bit error rate of an equivalent QPSK signal. This can be done by gating a high-speed clock into a totaling counter when the signal is outside the threshold region. This is a good method to get a handle on how a QPSK signal would fare in the channel. The information obtained by this method can be exploited to obtain statistics other than error rate, such as error free seconds, degraded minutes, severely errored seconds etc. There is, however, an easier way to perform this test.

The I-Q constellation comprises a pair of baseband signals that were generated by a complex (I and Q) demodulator utilizing a local oscillator. If the local oscillator running the complex demodulator is decreased in frequency until it is almost at DC, the net effect on the I-Q diagram would be to make any noise or signal trajectory spin rapidly about the origin. (The low pass filters must also be tuned to a higher frequency.) Hence, the single noise impulse in Figure 4 becomes the rotating noise impulse in Figure 5, and the slowly rotating continuous wave carrier in Figure 4 becomes the rapidly rotating continuous wave carrier in Figure 6.

If just the Q portion of the signal in Figure 5 were observed as a function of time, the waveform would be as shown in Figure 7. Likewise, the Q portion of the continuous wave interferor in Figure 6 would be a high frequency sine wave (not illustrated). These waveforms are available at the output of the bandpass filter in Figure 2. The balance of the complex demodulator is not needed. If a threshold detection circuit feeding a counter were placed on the signal of Figure 7 with a voltage trigger level of R, then threshold crossings at five points will be counted. A

Figure 6: *Undemodulated CW impairment.*



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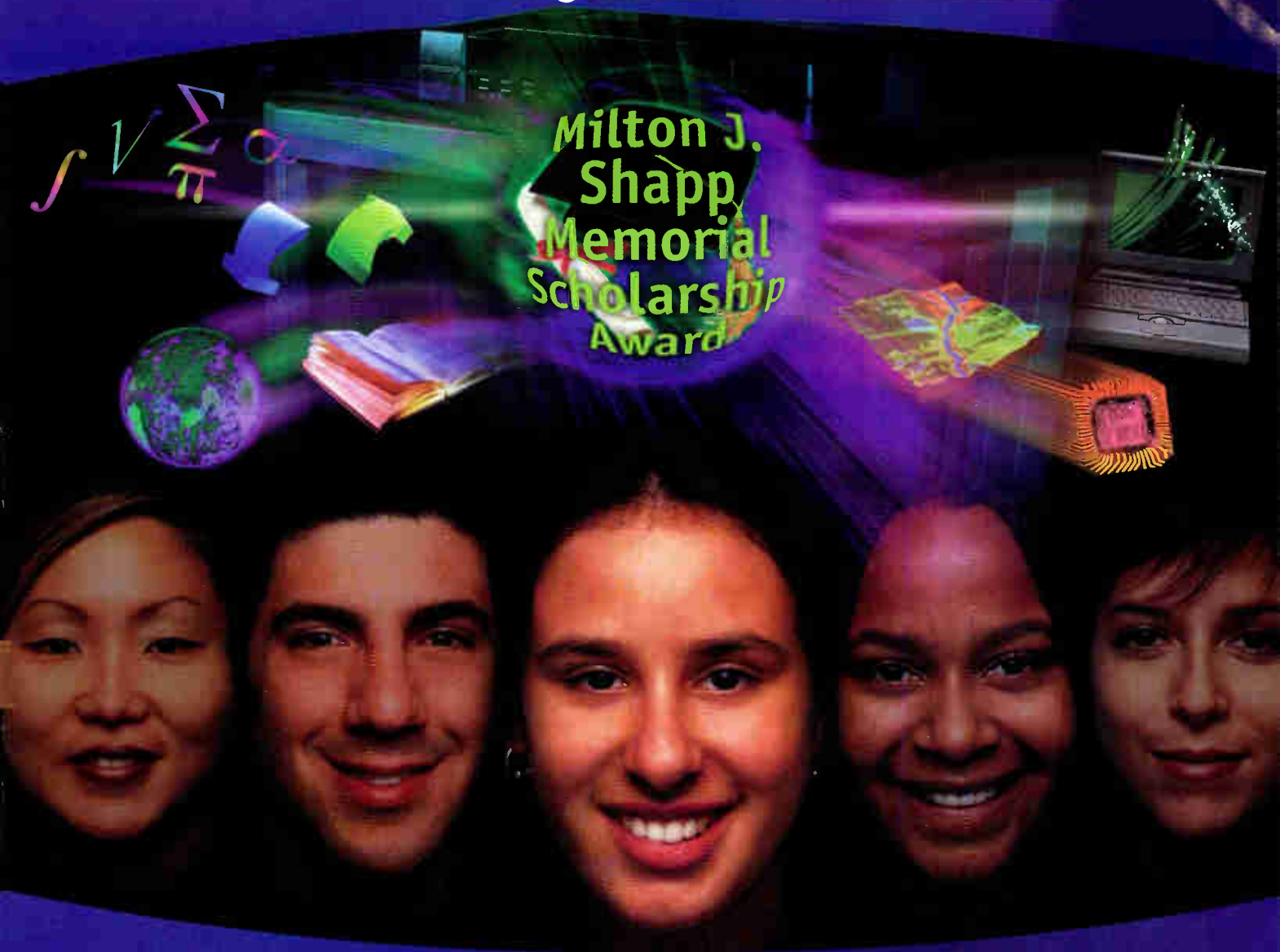

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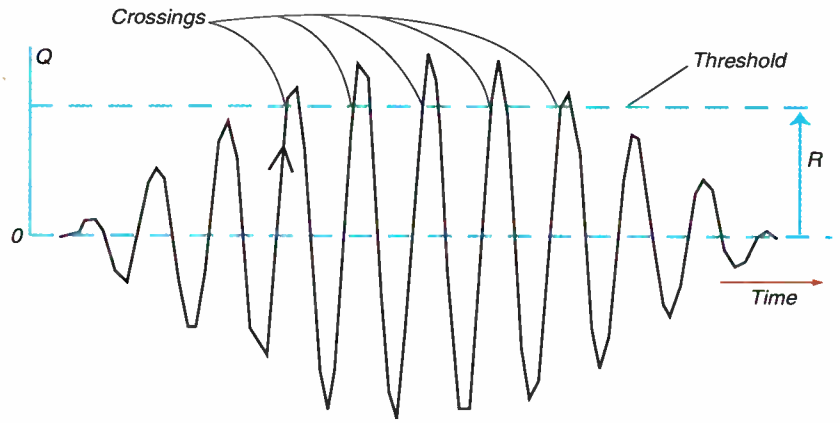
Figure 7: *Q component of undemodulated impulsive impairment.*



commercially available high-speed totaling counter can perform the precision trigger threshold and totaling counter functions. The QPSK equivalent error ratio can be computed from the number of threshold crossings.

For this system to work reasonably, the rotation rate in Figure 5 must be fast with respect to the rate at which the impairment can change its distance from the origin. In other words, the bandpass filter's frequency should be high relative to the bandwidth of the filter.

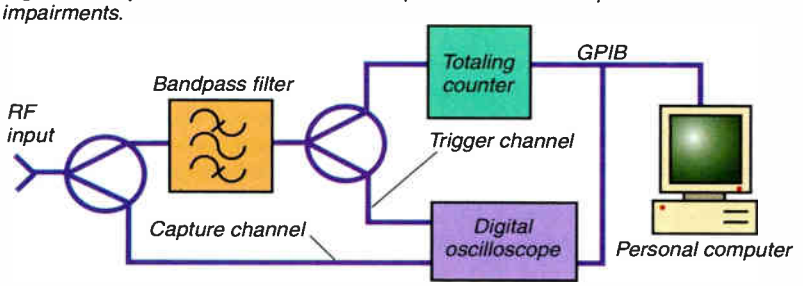
After a test period of some number of seconds, the effective error ratio can be determined by dividing the totaling count value by the product of the center frequency of the filter by the number of seconds. For example, if the test was run for 60 seconds, and a count of 2.0 x 10^6 were totaled, *and* the center frequency of the test filter was 15 MHz, the error ratio would be:

$$error\_ratio = \frac{2 \cdot 10^6}{(15 \cdot 10^6) \cdot 60} = 2.22 \cdot 10^{-3}$$

In other words, the trajectory point was pushed outside the threshold region 0.222 percent of the time by additive impairments.

The greatest strengths of this new testing method are the quantitative results it produces, as well as the low equipment cost per channel for a filter, triggering circuit, and totaling counter. The low equipment cost suggests this technique may also find applications in line equipment for status monitoring vacant downstream channels, as well as return path monitoring at the fiber node in the field before all the return branches are summed. A patent is pending on this idea.

Figure 8: *A system to count errors and acquire broadband samples of the impairments.*



Calibration

As mentioned earlier, the threshold levels on the counter must be set precisely. This can be accomplished by computation or empirically. The empirical method uses the following procedure:

1. Apply a test data signal to the channel at a normal operating level.
2. Add a jamming continuous wave carrier to the test data signal and elevate the jammer's level until it impairs the test data signal.
3. Remove the test data signal, leaving the jamming continuous wave carrier.
4. Set the trigger threshold on the jamming carrier.
5. Remove the jamming carrier, reset the totaling counter to 0 and start testing.

It may be necessary to compensate for thermal drift in the plant by modifying the trigger voltage if the return plant is not stable.

Another useful function that can be performed with this testing method is to simultaneously trigger a digital trace acquisition unit, and capture time samples of the entire return frequency band. A block diagram of a system to do this function is shown in Figure 8. The filtered RF input signal is split and applied to the trigger inputs on both the totaling counter and a digital oscilloscope. Both triggers are set to trip at the same voltage. The full return band signal is captured on a second input channel. The return band can be acquired with an analog-to-digital convertor (A-D), sampling at a rate of 100 megasamples per second, using a data acquisition device such as the digital oscilloscope or a scope card that plugs directly into a PC. The captured time trace can be further analyzed with digital signal processing techniques, such as digital filtering, a histogram, and the Fast Fourier transform (FFT) to reveal information about the nature of the interferor. The PC performs the dual function of running the test and analyzing test results. Perhaps the most useful time plots are ones that are captured in times of high counts on the totaling counter. The totaling counter can be used to enable the trace acquisition unit so that the stored time traces will represent samples of severe impairments.

Errored packets

If a packet of data uses forward error correction (FEC), the effect of a brief burst of noise may be correctable by the FEC circuit, if the number of symbols in error is not too numerous. This test method can be adapted to test for corrupted packets by employing dual counters. One counter is read and reset at the packet rate, while the other counts high totals.

Conclusion

There is a need to monitor nodes for return noise to determine which ones need service. This article discusses additive and multiplicative impairments and compares currently-used test methods. A new method is introduced that uses a filter and a totaling counter to measure additive impairment in a vacant frequency band, and optionally capture sample traces. CED

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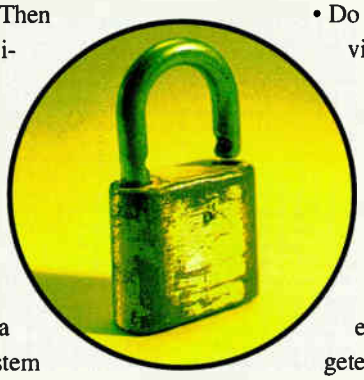

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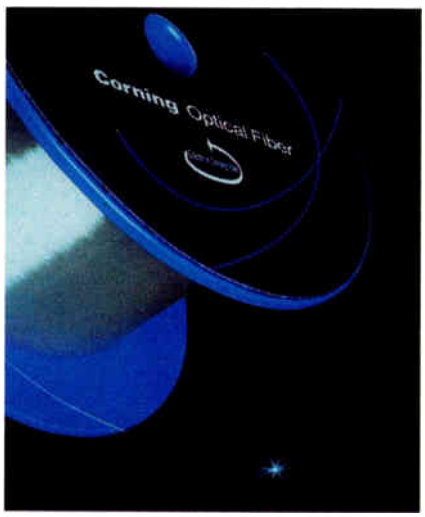

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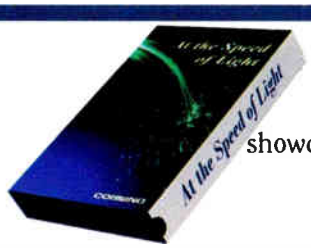

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Reader Service 21

NCTA

cable '98

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CALL FOR TECHNICAL PAPERS

Synopses for proposed papers due at NCTA by December 16, 1997

NCTA invites you to submit one-page* abstracts/synopses of proposed technical papers–on any communications engineering topic of interest to the cable television industry–for consideration by the Cable '98 technical program subcommittee. Thirty or so paper ideas will be selected in December for placement in eight technical sessions. Judges look for reference value and originality in papers that solve engineering problems through new designs or improved operations. Product pitches and "recycled" papers are not acceptable and will not be judged.

To qualify for consideration as a technical session speaker, send a one-page synopsis of your paper/speech idea to:

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Director, Technical Services
National Cable Television Association
1724 Massachusetts Avenue, N.W.
Washington, D.C. 20036-1969
Fax: (202) 775-3698; e-mail: KRUTKOWSKI@NCTA.COM

*With your synopsis, include a draft paper title, complete name, job title, work address, telephone number and fax numbers for the primary author and any co-authors. Provide the judges with enough specifics about the planned (never-before-published) paper to show its premise, reference value, content and intended audience.

Dates to remember:

Call for papers deadline–December 16
Authors notified of accepted papers–by January 5
Completed papers due at NCTA–February 25
Cable '98 in Atlanta–May 3-6

Accepted authors must send completed, camera-ready manuscripts (hard-copy and disk in specified formats) to NCTA by February 25 and present a 15- to 20-minute oral presentation based on the paper at Cable '98. Speakers are responsible for their own travel and registration fees.

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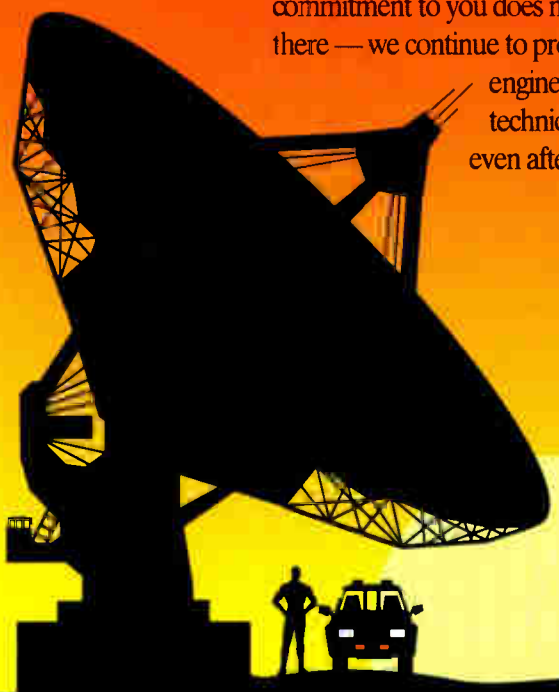

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Reader Service 22

The OpenCable deal:

Software giant looms in the background

Are there strings attached?

By Michael Lafferty

Tom Elliot

Alex Best

Up until just a couple of months ago, the cable industry seemed to be the butt of a well-worn Rodney Dangerfield joke–the industry just couldn't get no respect. It's amazing what $1 billion here and $1 billion there can do to change people's perceptions practically overnight.

Suddenly this summer, cable operators were touring the Silicon Valley. Bill Gates and his Microsoft minions were making house calls to MSO headquarters around the country. Gates plopped down $425 million to acquire WebTV, and then stunned many when he cut a $1 billion check and handed it to Comcast Corporation.

In fact, at press time, reports and rumors were swirling both in and out of the industry that Microsoft and Tele-Communications Inc. are close to a deal worth $600 million to $1 billion. Word on the street has it that Microsoft's most recent foray into cable (see "DAVID vs. Goliath for OS supremacy," page 48) could involve Microsoft taking TCI's digital set-top burden literally and figuratively off the MSO's shoulders, and more importantly, off its ledgers.

In exchange for supplying TCI the digital boxes it desperately needs, possibly through some sort of OEM or outsourcing arrangement, Gates and company get a major on-ramp into a market they have publicly staked a good part of their future on–the 66 million cable TV homes in the United States. Yet the deal is not the slam-dunk or one-sided affair that is usually associated with the software giant's financial largesse.

Cable operators, as Gates has reportedly found out in his Comcast deal, play hardball when it comes to who controls access to and influence over its broadband pipe. Similarly, the supposed TCI/Microsoft deal would hinge on the MSO's stipulations that the boxes be available in a timely manner, that they be multipurpose in functionality, that they be inexpensive *and* that they be based on the pending OpenCable platform (http://www.opencable.com). Apparently, contrary to Microsoft's corporate druthers, proprietary software solutions would *not* be a part of the deal.

According to some, even the OpenCable effort itself has been influenced by the presence of the Redmond, Wash.-based behemoth. David Robinson, vice president/general manager of NextLevel's Digital Network Systems group, considers Microsoft's influence "seminal" in getting the industry up and running toward an open, standard, digital platform.

"The Microsoft investment in Comcast," says Robinson, "sparked an acceleration of (a) desire to really understand that middleware/software solution. This is especially true given that NextLevel and Scientific-Atlanta and the rest of the industry have pretty much nailed down the hardware-physical layer stuff. It highlighted that there is a lot of uncertainty left in the software stack. And with Microsoft saying it has a lot of confidence in the (cable) platform with its $1 billion Comcast investment, it got people moving and saying, 'Hey, we've got to move faster on this'."

The "physical layer stuff" Robinson refers to was covered by the recently-announced "Harmony" agreement between NextLevel and Scientific-Atlanta. In that cross-licensing agreement, the companies agreed to use NextLevel's data encryption standard (DES), while NextLevel has the option to license S-A's DES. In addition, they agreed on five transmission-related building blocks that will be included in their respective digital set-tops. This includes: MPEG-2 audio and video decoding and transport; quadrature amplitude modulation; Dolby AC-3 audio; and ATSC system-information tables.

Now comes the *really* hard part. To accomplish that task, CableLabs and its members established its OpenCable initiative both in an acknowledgement of recent and ongoing technological advancements, and to further Congress' and the FCC's mandate of retail availability of set-tops in the not-too-distant future. In order to tap vast stores of software expertise in the computer and consumer electronics industries, CableLabs issued a request for information (RFI) a little more than a month ago that sought input into the open specification process and the creation of a draft specification for advanced set-top boxes.

'Microsoft has been maneuvering furiously to influence the design of the new set-top boxes that will help bring the Internet to the nation's living rooms through cable wires.'

–The Wall Street Journal
October 15, 1997

ILLUSTRATION BY JAY LINCOLN

'We see . . . a real movement and interest to develop applications the way they are developed for the Internet.' – Bob Van Orden

"It was a pretty broad request for information," says Tom Elliot, vice president technical projects at CableLabs. "We did ask for a lot of detailed information. But we also asked for concepts. We're intentionally looking for innovative, creative approaches."

By the time the deadline had expired, 15 companies or groups of companies had submitted a variety of seemingly musical-chair proposals. Joint filings included ACTV Inc. with Sarnoff Laboratories Inc.; Scientific-Atlanta Inc. filed with IBM Corp., Pioneer New Media Technologies, PowerTV Inc., Sun Microsystems Inc. and Toshiba Corp.; Intel Corp. joined with Cisco Systems Inc., Netscape Communications Corp., Network Computers Inc. (NCI), Oracle Corp. and Thomson Consumer Electronics; and Thomson also filed separate comments with NCI.

Individual comments were received from NextLevel Systems Inc., Oracle, Thomson Sun Interactive, Cisco, S-A, Samsung Information Systems Inc., WorldGate Communications, Criterion Software Inc. and Pioneer. Bringing up the rear, with last-minute individual proposals, were Intel and Microsoft Corp.

"The ultimate objective," says Alex Best, senior vice president engineering for Cox Communications, "is to be able to offer a standards-based product that is capable of being sold through retail stores." That kind of approach, which removes a huge capital item off their balance sheets, would, overnight, create a new financial model for cable operators

According to Elliot, work began almost immediately on evaluating the proposals. Barring the emergence of a clear "home run" approach, this summary stage will be followed up with an iterative stage where OpenCable personnel will go back and ask questions and get clarifications.

While there are literally hundreds of details to be worked out to develop an open-standards digital set-top, there is near unanimous agreement on the two key sticking points this consensus-seeking effort faces. The question of which operating system and which APIs (application program interfaces–essentially the software tool kits used to develop content) will be used in future set-tops has brought software-savvy heavyweights like Microsoft, Oracle, Sun Microsystems and Intel weighing into the fray, which is further complicated by the fact the two factors are closely linked, because APIs are usually OS-sensitive.

The battle over these two crucial aspects revolves around their operational efficiency, flexibility, and most importantly for a potential consumer electronics product, cost. "You have to have a set of standards that the OS could write or modify to," says Bowmar (Bow) Rodgers Jr., chief operating officer at PowerTV Inc. "The operating system written to the APIs will have to be small enough, use memory efficiently enough, and be able to give you such things as VOD, NVOD, resident applications like electronic program guides, etc., in a redundant, robust way.

"The devil, as they say, is in the details. You could probably have a great big OS doing a lot (of) functionality, but if it blows the cost of the box because it starts demanding more memory, it starts demanding a faster processor, then you start changing the business model. And that's a key part of getting these digital boxes into consumers' homes."

While the operating system question has a common sense solution, that logical solution will have to overcome both technical and "political" roadblocks. "From an operating system standpoint," says Jim Slade, vice president of business and product development at Pioneer New Media Technologies, "the ideal solution is operating system independent. But it's not clear whether that's achievable or not.

"Of course, the political side of that is Microsoft and Windows CE, and what role does it play? As it stands right now, I think most of the players in OpenCable would say Windows CE doesn't play a role.

"I think those of us who can take a step back from it and look at the broad picture, understand that Windows CE is going to play some sort of role somewhere by the mere fact that Bill Gates wants to do something in cable. And Windows CE is his bread-and-butter for the future."

Because content is king, and promises to be even more so in the future, APIs that are ubiquitous, relatively easy to use and affordable are an absolute must for the growth of digital television. The phenomenal growth of the Internet offers a perfect model, if not at least a partial solution itself. "I can't speak for CableLabs or OpenCable," says Bob Van Orden, director of Digital Video Systems for Scientific-Atlanta Inc., "but one of the things we see going on in the industry is a real movement and interest to develop applications the way they are developed for the Internet.

"Look at Web pages today, which are a highly successful model for application development. It's all HTML, and typically Java scripts. It certainly seems to me, personally, and a lot of people we talk to in the industry, that it makes a lot of sense and it's a really good model. It's a relatively low-cost, low training format to develop content.

"If the power of that could be leveraged into this environment, that would be a good thing. You know, I've heard quotes that there are already 400,000 to 500,000 HTML developers in the world today. So, they are pretty well-known applications." Van Orden, in fact, admits he is one of them, having developed a couple of HTML presentations that were piped through S-A's digital set-top.

How long is this OpenCable effort going to take?

Most of those involved are reluctant to venture a guess. Of those who did, a two- to three-year timeframe was suggested. But, given the fact that there are already literally millions upon billions of dollars being spent (by insiders and outsiders) to speed up, if not influence, the outcome, that lengthy timeline could already be a thing of the past.

That timeline could be even further telescoped if Microsoft accepts the industry's insistence on open standards, joins the effort as an enthusiastic partner and puts its vast software development expertise to work on the OpenCable platform.

After all, stranger things (Remember Microsoft's investment in Apple?) have happened.

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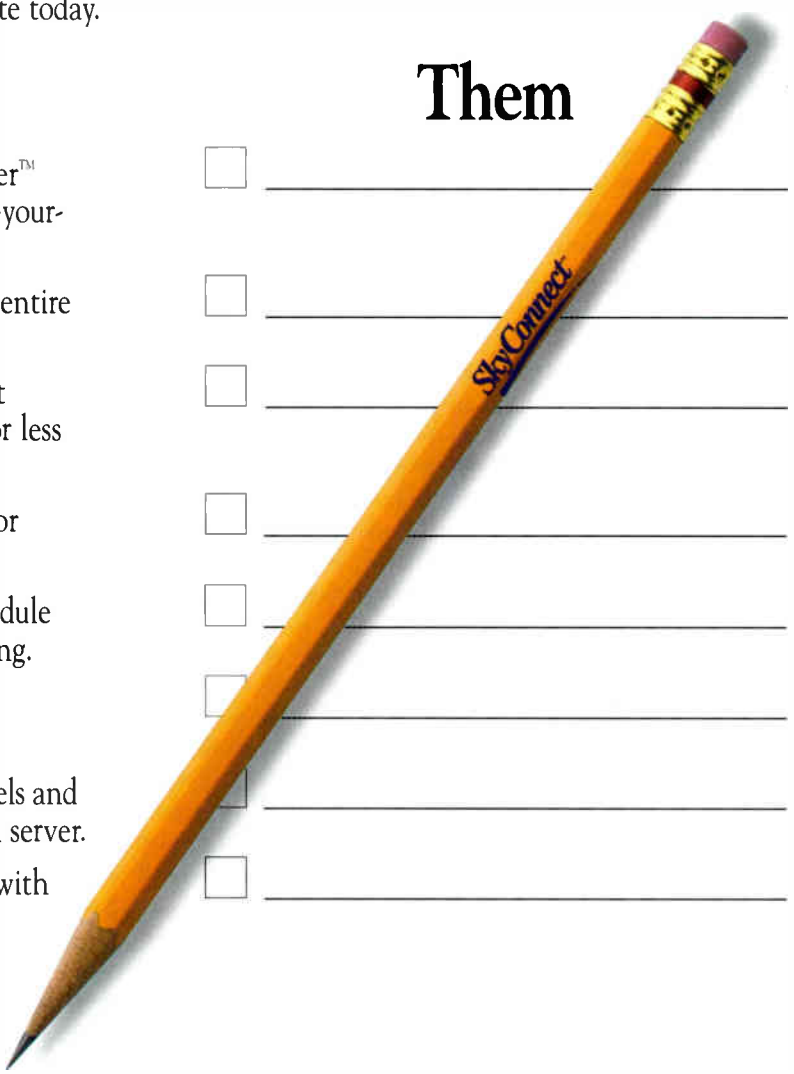

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Reader Service 23

DAVID vs. Goliath for OS supremacy

Depending on your view, anytime well-heeled Microsoft gets involved in a new market or new project (analysts predict it will post fiscal first quarter revenues of $3.1 billion, up 35 percent from the year-earlier period), certain images almost automatically come to mind. Words like "predator," "evil" corporation (Jim Clark, Netscape's chairman) and "choke hold" (Phil Monego, chief executive of NetChannel Inc.) start popping up in conversations.

When it comes to determining the operating systems (OS) for future digital set-tops, the David vs. Goliath scenario is particularly apt, no matter where you're standing. On one side, you have the behemoth from Redmond, Wash. looking to expand its Microsoft brand to all corners of the telecommunications world. Across the field of combat, you have established, albeit smaller and possibly more agile, competitors like Cupertino, Calif.-based PowerTV Inc. and Des Moines, Iowa-based Microware Systems Corporation.

Microsoft's most recent foray into the cable industry, according to Arthur Orduña, Microware's director of marketing/consumer products group, is really the dropping of the last veil on Microsoft's true intentions with its Windows CE platform. "This handheld PDA (personal digital assistant) stuff is bull," says Orduña. "This is (a) testing ground, as far as we're concerned. The real target has always been the television set and the telephone. That's the war.

"Their market is beyond the desktop, beyond the PDA, beyond the PC. Their market is the embedded marketplace, where there are just some little players right now like Microware. They're going after that marketplace because the TV and the telephone are going to get smarter.

"How are they going to get smarter? They're going to stick more powerful microprocessors in there. And memory is going to go down in price. And so, they'll be able to put it (Windows CE) in there, and they will be able to dominate those platforms. Software is going to

be the bridge between the computing world and the consumer world. That's an incredibly powerful argument."

Orduña believes that Microsoft's sights have been aimed in television's and cable's direction for a long time. "Well, we know this has been their intent for a hell of a long time," says Orduña. "Let's put it this way. Before the competition at Bell Atlantic four years ago was modular Windows. It was Microsoft taking their Windows technology for the PC and trying to cram it into a set-top box environment."

He says Microsoft's logic then was that with modular Windows, companies could leverage all the Windows developers. But the problem, says Orduña, was that the modular Windows effort failed on purely technical issues. Simply put, "They couldn't get it to work," says Orduña.

The next Microsoft push, he says, occurred about three years ago when the company developed its Tiger server and a set-top operating system for digital, interactive set-tops. That effort failed, says Orduña, because "it was still essentially a PC disguised as a set-top, and it cost like a PC." The Tiger line was eventually repackaged and redirected and became a part of Microsoft's Netshow suite of streaming-media products for the Internet.

Since that time, Orduña believes the folks at Redmond may have learned a few things, as evidenced by their development of Windows CE. "They couldn't fit the entire 32-bit Windows API in there. They decided to 'fake' it by creating an API subset that people could use Windows-based tools for.

"Windows CE is essentially their attempt to go back and say, 'We understand it's got to be smaller. But we still need Windows in there (set-tops, consumer electronics, etc.), and it's going to look like Windows'."

Orduña believes that it's this insistence on the Windows "look and feel" that is another potential stumbling block for Microsoft. "You have to remember," says Orduña, that "these people make their money off brands. You can't screw with their brand. And part of the brand and branding is 'look and feel.' You have to know it's Microsoft.

"But we think there are still a lot of people out there who say, 'I like Windows on my PC. I like the Microsoft look and feel on my PC. But I know better what my consumer, my subscriber, my customer is going to look for'."

The idea of conflicting or overlapping brands on one screen, whether it's a PC or a television, says Orduña, can quickly escalate into a hot issue in a visual environment where impressions are everything. "Think of all the money that a Disney or a Time Warner has already

'The real target has always been the television and the telephone. That's the war.' –Arthur Orduña

put into Internet research, into creating their 'look and feel' on the Web. Windows CE is applications, not just the OS. And when you start messing around with the application level, in some places, that's almost religious.

"We're working with companies like Americast, that Disney is part of. And Disney doesn't want anything except something that looks like Disney. In other words, you don't mess with the Mouse.

"What we're saying is that we'll give you a solid, better-tested OS (DAVID V2.2) than this brand-new thing. We'll give you the connectivity to any network you want. We'll give you the openness (so) that you can create any kind of look and feel you want."

Microsoft, which declined to comment on the Open-Cable initiative and related issues, apparently is looking to play several hands, of which Windows CE is just one, to put together a winning video bid. These other hands include a $425 million buyout of WebTV, a $1 billion investment in Comcast Corporation and continued discussions with a variety of MSOs, coupled with the public acknowledgment that the company continues to look for other cable industry investments.

According to Orduña and recent press reports, one of Microsoft's first attempts to put together such a bid apparently has been trumped by a less-than-enthusiastic response by some MSOs. "If you're an MSO," says Orduña, "you heard the latest Microsoft pitch that's centered around a set-top box that can access the Internet. They're saying it's got a great Web browser. They'll make sure the application development programs are in place, and they'll license it to NextLevel and Scientific-Atlanta. Then they're saying, in return, that when your subscriber writes out a check for his $40 monthly bill, they're going to grab $5 of that. Is that OK with you'?"

That economic model, says Orduña, runs against the cable grain in a very basic way. "That's your money. It's your system. We make our money off your OEMs. Because right now, if you're a system operator, do you pay NextLevel any money based on your subscription revenue? And what Microsoft is attempting to do is break that traditional model."

While the David vs. Goliath analogy brings a certain sly smile to Orduña's face, he's under no illusions that Microware or any other company in Microsoft's way will ever score a direct, debilitating hit that will defeat the software giant. Instead, he puts his faith in the demand for open standards and the promise of content diversity that the two-way, high capacity broadband pipe can deliver.

"The bottom line is this," says Orduña. "Is the TV getting smarter? Yes. Is there going to be tons of opportunities out there because the pipe owners themselves are starting to want more and more digital applications to offer subscribers? Absolutely.

"Is the pipe big enough for multiple players? Yeah. Does Microsoft have the clout and the technology and all the resources put together to completely dominate this market the way it dominates the PC industry? I don't think so. Can it carve out a big niche for itself? Sure.

"You're not going to beat Microsoft. But what we are saying in consumer electronics is that this is a space that Microsoft isn't in yet. So, the goal is not to beat them. The goal is to have them acknowledge the fact that each of us is going to have certain parts of the market."

Goliath refused to comment. CED

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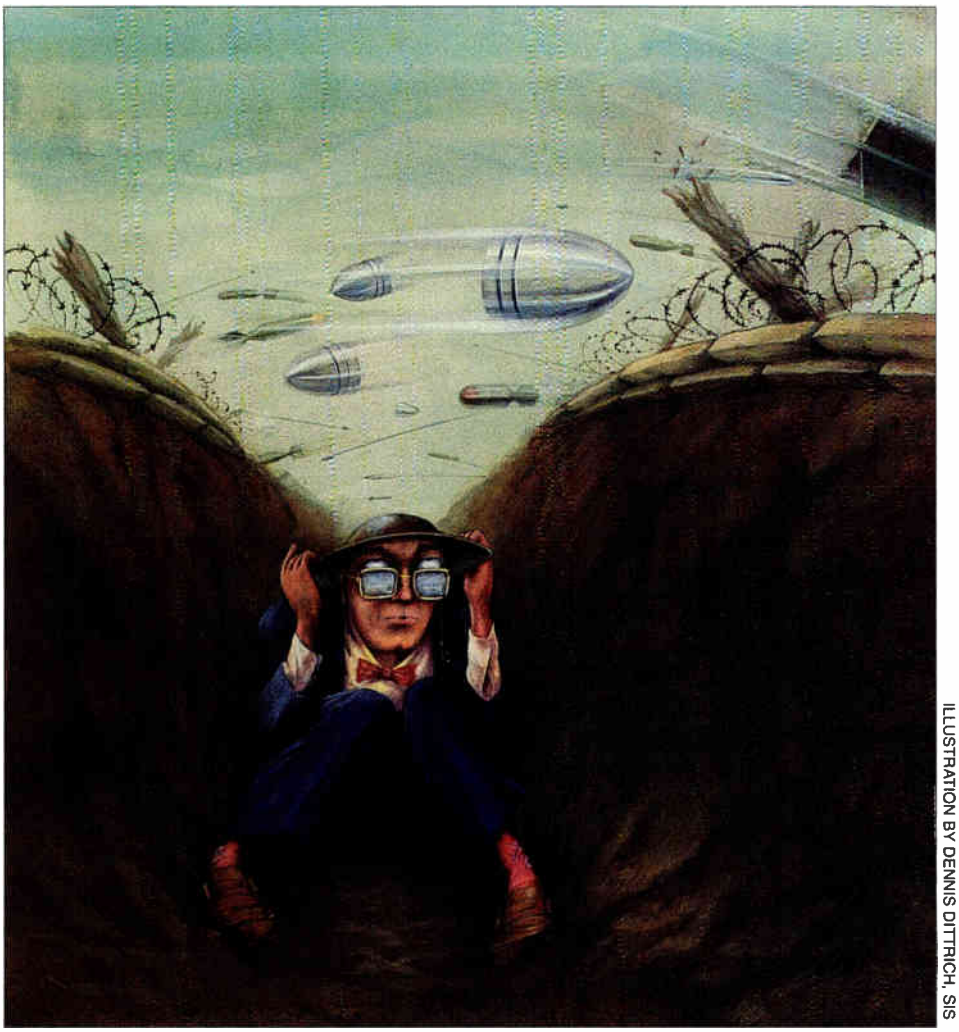

ILLUSTRATION BY DENNIS DITTRICH, SIS

Operators dodge flak in Silicon Valley content war

Trying to remain OS neutral

By Fred Dawson

The Open Cable set-top initiative notwithstanding, the cable industry faces an uphill battle when it comes to any effort to insulate itself from the influence of Microsoft Corp. over the software framework for next-generation media.

Industry leaders have made clear their desire to facilitate flexibility in their choice of set-top operating systems through a terminal architecture that can exploit the interoperability features of "virtual engines," such as Sun Microsystem's JavaScript, Lucent Technologies' Inferno and the Internet community's Dynamic HTML (hypertext markup language). Packaging content with such components, in theory at least, allows new media applications to run on multiple operating systems and also streamlines the use of processing power at the terminal or PC, thereby reducing the embedded hardware requirements, and therefore, the costs.

"With next-generation set-tops, I believe the operating system is going to become less and less of an issue," says Bob Van Orden, director of digital video systems for Scientific-Atlanta. "Everybody knows the story of Microsoft and IBM, and the cable industry is reluctant to do something like that again."

Tele-Communications Inc. CEO John Malone made much the same point in recent remarks to his company's shareholders. "It's critical that the industry has to pick published and open standards," said Malone, who, with MediaOne COO William Schleyer and CableLabs President Richard Green, sent the letter inviting vendor responses to the Open Cable set-top initiative in early September. Within a year, Malone added, a set-top "network computer" costing under $300 with built-in cable modem technology would be able to run a wide range of multimedia applications based on open scripting languages like Java.

Malone made it clear that the industry does not want to be drawn into the battle between Microsoft and its allies on the one hand, and the Sun/Oracle Corp./Netscape Communications camp on the other, where incompatible approaches to developing, distributing and playing back multimedia content are splitting the market base and chilling media companies' willingness to spend capital on interactive products. While, by throwing in with one side or another, the cable industry might be able to vastly broaden the market base for any given format, this approach would put the industry at the mercy of whichever side it chooses, industry officials note.

Moreover, a unanimous choosing of sides is not a real option, given the divisions already evident within the industry on the question of browsers and related software options. For example, the division poses a challenge to MSOs in efforts to unify on a common architecture for distribution of data signals through a national backbone connection, says Milo Medin, vice president for @Home Network.

"In order to be able to scale our network at a consistent level of service quality, we have to set limits on our software environment," Medin says, noting that the company is making use of back-office and other applications linked to Netscape's browser. "This doesn't mean we're shutting anybody out, but it does mean we can't meet our goals and accommodate 20 different software approaches to a given task."

Clearly, the cable industry will benefit if it can use its distributed computing architecture, buttressed with multi-service capable next-generation servers and high-speed links, to deliver

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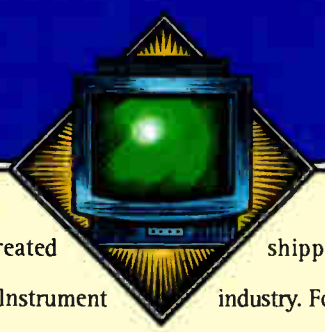

NextLevel Systems, which was created out of the restructuring of General Instrument Corporation, is the global leader in broadband networking solutions, and the only company shipping digital systems for the cable industry. For more information about NextLevel Systems (NYSE: NLV) and the opportunity we represent, visit **www.nlvl.com**.

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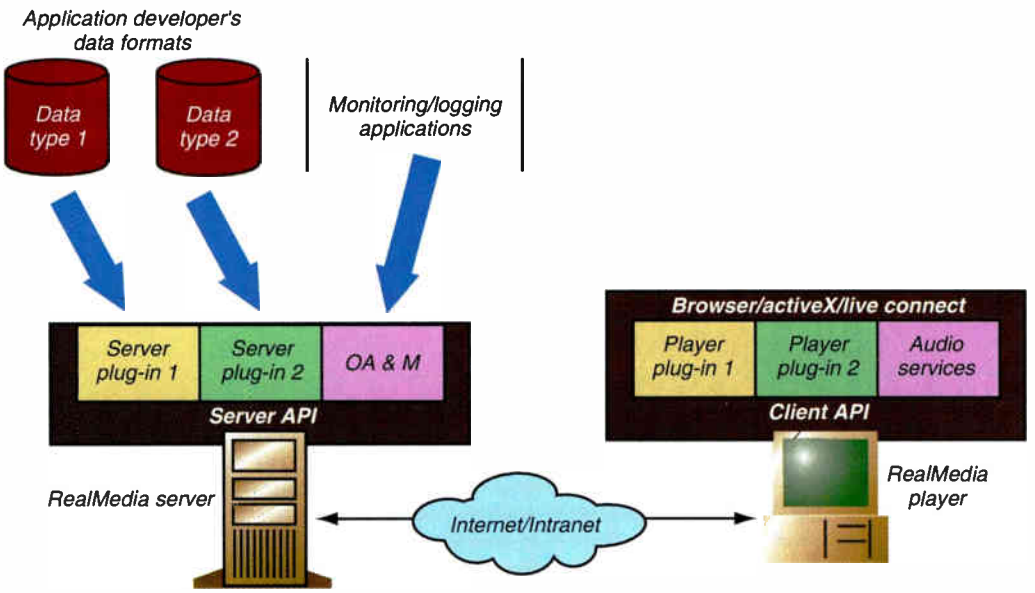


The RealMedia Architecture (RMA) provides an open platform for development of real-time streaming media applications as well as a market and distribution channel for streaming products and content. The RealMedia Architecture provides a platform for the development of streaming media applications that is designed specifically for the existing infrastructure of the Internet. It is an open framework of client and server plug-ins and APIs. RealMedia utilizes the proposed standard for streaming data, Real Time Streaming Protocol (RTSP).

Source: ©1997 RealNetworks Inc.

data streams, including back-office connections, to set-tops as well as PCs without having to lock into a universal operating system. But it remains to be seen whether ensuring this level of interoperability will have the intended impact on content developers.

Sun and its allies, which now include Lucent in a pact ensuring compatibility between Inferno- and Java-enabled devices, have focused most of their attention on the business market, leaving it to Microsoft and its partners to develop applications, such as video streaming and multiplayer on-line gaming, for the mass consumer market.

While suppliers of these capabilities maintain some degree of compatibility under the Microsoft umbrella, they also promote proprietary distinctions in functionality that represent the key attractions in their products over the more interoperable versions.

"The reason Microsoft succeeded in winning wide support for ASF (active streaming format), is there was

no alternative out there," says Pete Zaballos, marketing vice president at video streaming supplier Vivo Software Co., in reference to the sweeping realignment in Internet video triggered by Microsoft in late August. "The people at Netscape, Oracle and Sun have been asleep at the switch when it comes to support for video on the Web."

While Microsoft is employing a variety of means, including its own virtual engine and Dynamic HTML, as well as ASF and cross-licensing of various proprietary systems, to broaden interoperability, the fact remains that incompatibilities abound among the suppliers of content development tools, meaning, among other things, that users must download specific client plug-in software to access much of the more appealing content. As a result, many of the applications most appealing to cable are those least capable of meeting the universal distribution goals underlying the Open Cable initiative.

Microsoft's latest actions, including acquisition of the video streaming software company VXtreme Inc. and release of version 2.0 of its NetShow content development software, are aimed at promoting growth of a "broad streaming media industry," says Paul Maritz, group vice president for platforms and applications at Microsoft. By incorporating a uniform approach to streaming in NetShow and making NetShow part of its Explorer 4.0 browser software, Microsoft hopes to seed a vast user base with client software that provides access to most video content, he adds.

"We're trying to build out product with the strongest range of scalability, all linked to Internet standards," Maritz says. "We're developing NetShow not only as a standalone Internet distribution mechanism, but also as a means of integrating that distribution with back-office production."

Further strengthening its hand, Microsoft has licensed the source codes of the leading supplier of streaming software, RealNetworks Inc., formerly known as Progressive Networks Inc., as well as other codes so that developers working with NetShow can create content that will work with those suppliers' client software. Some of these plug-in components are also distributed within NetShow's player as part of the Internet Explorer browser.

"We believe the NetShow player will be the universal player for fostering growth in streaming multimedia," says Zenas Hutcheson, CEO of Vivo, which is also part of the player agreement. "It will greatly simplify users' ability to access content, and we believe it will accelerate corporate adoption of streaming media applications."

Microsoft alliance

Microsoft's success at bringing together so many disparate parties under the NetShow umbrella has drawn Justice Department scrutiny, but parties to the deals strongly defend Microsoft as having acted in the industry's best interests and in the best interests of fostering competition. Even VDOnet Corp., which lost a shot at being the lead streaming supplier in the NetShow hierarchy when Microsoft acquired its competitor VXtreme, expresses strong support for the new alignment, in which it functions as a software systems integrator on the broadband front within the Microsoft alliance.

"We've seen this set of moves coming for a long time and are well prepared to operate in

this new environment," says Steve Chambers, vice president of marketing at VDO, in which Microsoft holds a minority stake, believed to be about five percent.

"VDOnet has been focusing on one specific target as potential customers–namely, the cable companies," adds Asaf Mohr, chairman of VDO. In that connection, he notes, the company is working closely with Microsoft and other alliance members in shaping a new standard, MPEG-4, for marrying IP data with high-end video.

MPEG-4, incorporating MPEG-2 algorithms while adding extensions that interface with other compression techniques used in Internet applications, has been quietly edging forward, largely outside the purview of the cable industry. But, with the growing cluster of technology companies allying with Microsoft, the pieces have suddenly begun to come together to create a solution that could be ready for market implementation by mid '98, Chambers says.

A number of cable programmers have been experimenting with the pre-release version of NetShow, says Mike Ahern, lead product manager for NetShow. "We're shipping a version of NetShow that supports full frame video service with true high-speed access level compression," he says. "I think people who have been using NetShow are very excited about the possibilities, and some will be ready to move to applications fairly soon, but they're a little bit gun-shy about publicity at this point."

Along with memories of premature excitement over interactive television, these content developers are also wary of getting ahead of cable modem deployments, which have gone slower than some expected, Ahern notes. "Cable companies have shown much more interest in content development for high-speed data access lately, so I think the industry is getting its ducks in a row," he adds.

VDO and Microsoft will begin working together in marketing their solutions to the high-speed data community, Ahern notes. "They're building applications on NetShow, but we're the ones selling NetShow, so it's a joint sale to the customer," he adds.

While all these developments further strengthen Microsoft's hand on the content side, they don't necessarily mean developers and their partners in cable can finally assume that the compatibilities are in place to protect against Balkanization of the marketplace for their products. "Agreement on the file format is just a piece of what needs to be done, because you still have to deal with the incompatibilities among codecs (encoder/decoders) and the (streaming transport) protocol," says Phillip Rosedale, general manager of the

applications group at RealNetworks.

While RealNetworks licensed its source code to Microsoft to allow developers using NetShow to create content that works with RN's RealAudio and RealVideo player software at the user end, users must still download the player software to access the content, Rosedale notes. And this is the case with many other suppliers' client software in instances where the players haven't been licensed to be included automatically in the download of a particular browser.

New streaming protocol

Despite the inclusion of a growing cluster of streaming players in the Microsoft and Netscape browsers, the real answer to achieving broad interoperability is agreement on a new streaming protocol that embraces the advanced capabilities in these new streaming systems with a uniform set of APIs (applications program interfaces), Rosedale says. Taking issue with Microsoft executives who contend the steam has gone out of efforts to define what is known as "Real Time Streaming Protocol," Rosedale says the process, under the auspices of the Internet Engineering Task Force, is making significant headway.

"We have a person devoted full time to RTSP, which, for a relatively small company, is not an inconsiderable commitment," he says. "We wouldn't do it if it wasn't paying off."

But, even with agreement on a streaming transport protocol, the market has to deal with another layer of incompatibilities represented by a proliferation of proprietary codecs. In RN's case, for example, while the licensing deal with Microsoft ensures some degree of compatibility between NetShow-developed content and RN codecs at the client end, the level of functionality in the segment covered by the license excludes multicasting applications and certain aspects of the functionality contained in Release 5.0 of the company's streaming system, Rosedale notes.

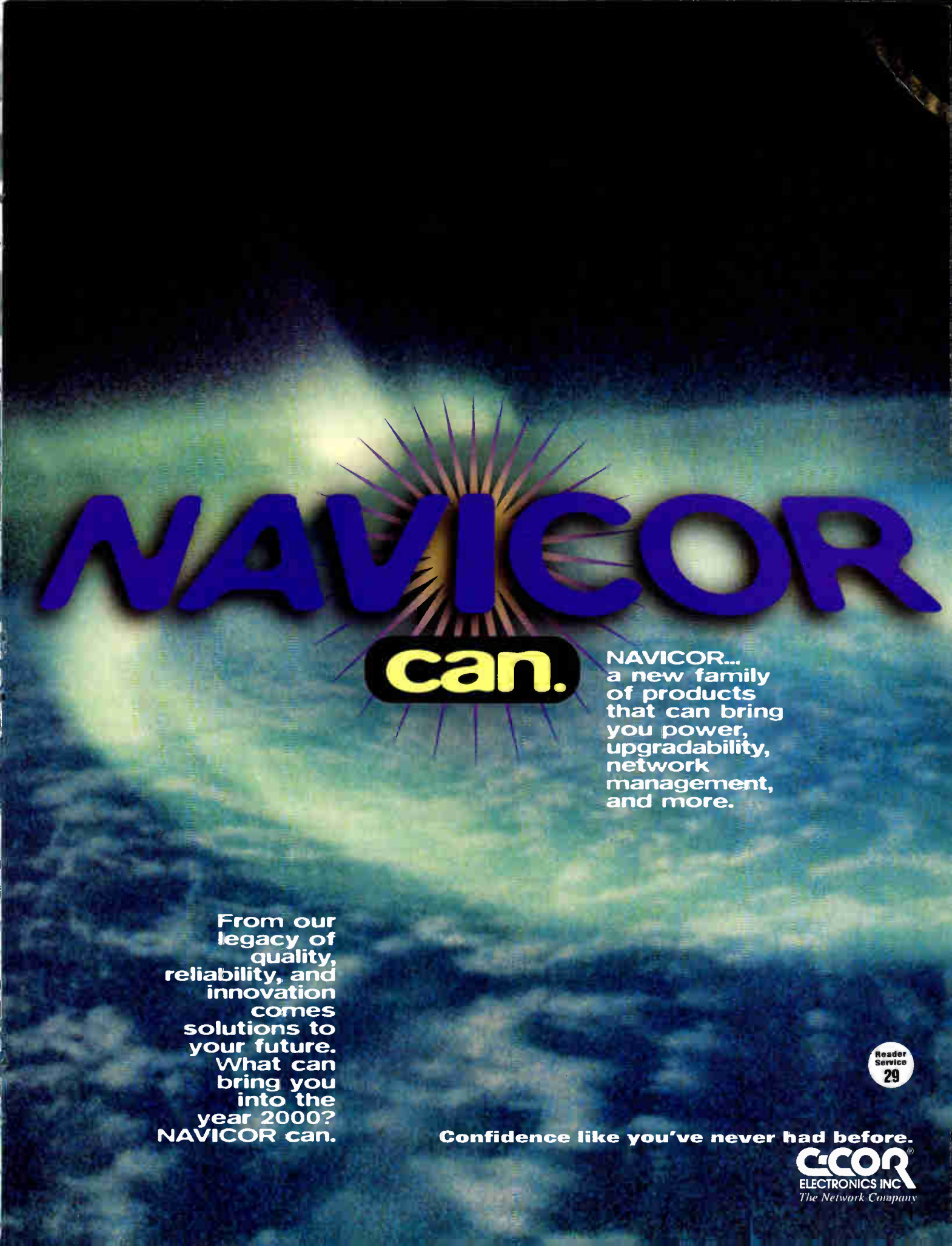
That functionality, including means to set up pay-per-view, subscription or time-limited access as well as multicasting and other capabilities, is proving to be a strong draw within the cable high-speed data community, Rosedale says. @Home Network, for example, which is partnered with MSOs representing over a third of the North American subscriber base, has begun testing broadband content applications based on RN's software in combination with new multicasting capabilities built into @Home's national backbone network.

Meanwhile, in moves closer to the Microsoft camp, MediaOne is moving forward with development of high-end multimedia content that makes use of technology supplied by VDOnet and others that is incompatible with the RN software. And Time Warner's Road Runner Group, which recently adopted Microsoft's Internet Explorer 4.0 as its default browser, is preparing to exploit the multi-player compatibilities of the browser to begin distributing streamed media.

"In the future, we're going to be focusing much more heavily on streaming content than we have up to now," says Howard Pfeffer, vice president of software technology for Road Runner. "IE 4 offers a great platform for doing that."

Cable data providers are especially enthusiastic about the multicasting capabilities their systems will support, Pfeffer notes. "The connectionless nature (meaning always on) of our technology is ideally suited for multicasting, which is another big advantage of IE 4, which supports multicast elements embedded in Web pages," he adds.

Multicasting is a newly standardized means of distributing content mapped to the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packetized format of the Internet Protocol that allows a single data feed from a server port to go out to multiple users at the same time. This approach greatly reduces congestion at the server and makes it easier to manage the flow of bandwidth-consuming video over the network, where delivering video to many users contending for dedicated bandwidth at the same time can result in an overall slowing of access speeds for everyone within a given serving area.

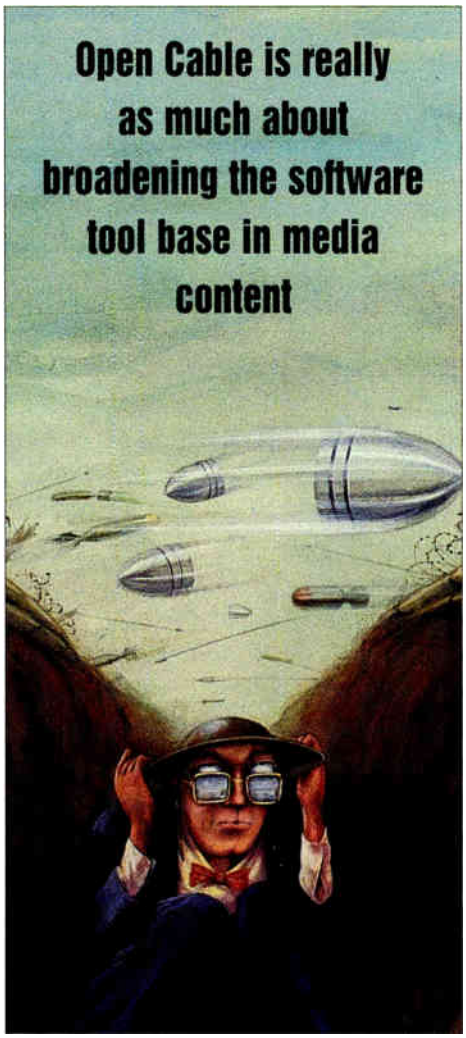
RN, not content to wait for @Home's market base to grow, is working with MCI to develop a streamlined backbone for supporting multicasting of content pegged to its software platform. "Our strategic goal is to accelerate the phenomenon of the Internet being used as a mass media outlet," says Rob Glaser, RN chairman and CEO.

The new network supports multicasting of audio and video content from RN's master server in Seattle to nine MCI data centers around the country via the long distance carrier's piece of the Internet backbone. Proprietary "splitter" software from RN segments data for delivery in a dedicated, unicast mode from the data centers through the regional connections to ISPs (Internet service providers) and on to end users.

"We see this as a first step toward taking the evolution of the Internet to the next level," says John Scarborough, director of product marketing in MCI's Internet group. "We've come up with a formula for using distributed multicasting to push caching of multimedia content out to the edge of the backbone network."

That formula involves undisclosed investment sums on the part of both companies to upgrade routers to support IP multicasting over MCI's Internet backbone, as well as to install the server and software components at various network points. Initial users include ABCNews.Com, for delivery of live news feeds and on-demand reports; ESPN's SportsZone for audio broadcasting of National Basketball Association games and other applications; Atlantic Records for distribution of live concerts; and Home and Garden Television for distribution of some of its cable programming to reach non-affiliated markets. Another early customer is JamTV, a multimedia music Web site, that plans to broadcast live concerts.

In each instance, these customers download, via satellite or direct landline feeds, the audio and video broadcast components of their Web sites to RN's facilities. When a user whose PC is loaded with RealVideo or Audio player software clicks onto a video



connection while visiting one of the participating Web sites, he or she is instantly connected to the data stream flowing from the RN site via the new backbone network.

Given its efforts to stay a step ahead of the Microsoft camp, one might expect RN to be making use of Java as a means of expanding the reach of its technology. But RN, like most other streaming suppliers, is not packaging Java at this point.

"Doing everything in Java is not necessarily the way to go from the standpoint of the user's experience," Rosedale says. RN "is aware of everything they're doing" and could move to a version of its software using the new Java Media Streaming Format now under development, Rosedale notes, but it remains to be seen whether drawbacks inherent to this particular virtual machine can be overcome.

JMSF will make a difference if it supports real-time decoding, Rosedale says, adding, "There are a lot of complicated details to be worked out for doing something like that."

VDOnet's Mohr also downplays the likelihood that Java will come into play anytime soon in connection with his firm's technology, notwithstanding the benefits it would offer by expanding the operating systems base for VDO-enabled content. "Java is fine in applications that aren't computational-intensive, but video streaming requires so much processing that, if you add an interface like Java on top of it, you end up consuming 20 MHz or more of CPU power unnecessarily," Mohr says.

Clearly, the Sun alliance is moving to catch up on the consumer side, with Oracle pushing consumer applications on the appliance track, and Sun now setting up the Sun Consumer Technologies Group in conjunction with its recent acquisition of Diba Inc., a company that certifies compliance of service providers with the Java-based Network Computer platform. For its part, Netscape has announced it will deliver a "pure Java" version of its Navigator client software next year as part of its new commitment to deliver more than 100 million copies of Navigator 4.0 to home users.

"This announcement, combined with the inclusion of our HTML component in the Java Development Kit, represents a tremendous step toward our goal of making Netscape client technology ubiquitous in both homes and businesses," says James Barksdale, Netscape president and CEO. This represents a strong reversal of the position taken a year ago, when Netscape made a point of downplaying the significance of the consumer market to its fortunes.

Cable executives hope they'll find willing listeners in the Sun/Netscape camp as they seek to persuade these companies and their allies that cable represents a tremendous opportunity to gain momentum on the consumer side. Open Cable, for all the concentration on set-top hardware, is really as much about broadening the software tool base in media content, notes one industry official, asking not to be named.

"We're already well down the road in defining the hardware components for next-generation boxes," the executive says. "But we've got to persuade Silicon Valley to support a more robust means of achieving compatibility across various operating platforms than we're seeing today in Java or other formats."

Whether cable's offer of a majority of U.S. households as a potential market for broadband multimedia is sufficient to bring the warring Silicon Valley factions together remains to be seen. But in the meantime, it's clear that decisions will have to be made that inevitably force content suppliers and cable operators to choose content development platforms that fall far short of the goal of universal reach. CED

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Reader Service 30

NextLevel Systems Inc.'s digital headend system

Digital boxes hit subscribers' living rooms

Ops test, some deploy boxes

By Dana Cervenka

After all of the hype, after several years of hoopla, after watching cable operators struggle to reach the digital shore, the industry is finally getting serious about the deployment of digital technology. For evidence that digital is finally "real," look no further than NextLevel Systems Inc. (formerly General Instrument), which to date, has shipped more than 300 digital headends and more than 500,000 digital set-tops–mainly the interactive DCT-1000 consumer set-top, but also the DWT-1000 (for wireless cable) and the DCT-1200, which adds 256 QAM functionality, according to David Robinson, vice president and general manager of NextLevel's Digital Network Systems Business Unit. To put those figures in perspective, those 300 headends are capable of serving about 15 million homes in North America, adds Robinson.

NextLevel's DCT-1000/ DCT-1200 set-top

"Of the major operators, the vast majority have already taken delivery of digital product from us, and at the very least, are quietly testing the technology in multiple systems," says Robinson, who predicts that by early 1998, about 100 different cable operators will have deployed NextLevel's digital set-tops and headend equipment. As for the status of the various roll-outs, operators are all over the board–everything from working out software and operational processes to full-stage commercial launch, he adds.

Of those MSOs that are deploying NextLevel's digital gear, one of those which is the farthest along in the process is Canadian operator Shaw Communications. Shaw has deployed more than 25,000 boxes in its Calgary system to date, at a rate of 250 to 500 per day, according to Barry Middlebrook, director of advanced technology for Shaw, who is principally involved in planning and implementing digital video compression services including VOD and DMX. Next in line for a box upgrade will be the MSO's Toronto system, where 38,000 digital set-tops are slated to be put in before the end of this year. At press time, the MSO had already deployed more than 5,000 new set-tops in the Toronto system, during the course of a couple of weeks.

Meanwhile in the U.S., Cox Communications, which is "close" to the commercial launch of Cox Digital TV, has put six digital headends in place, one of which is a testing lab, according to Anthony Surratt, director of corporate communications for Cox. As for the five which reside in systems, they are each in various stages of testing. The MSO has contracted with NextLevel for 350,000 digital receivers, to be delivered by mid-1999.

Other MSOs currently deploying the gear include major NextLevel customer Tele-Communications Inc., which recently announced its programming lineup for its Headend In The Sky (HITS) digital compression and distribution service.

For its part, Comcast recently announced that it will initiate commercial service in northwest Philadelphia in early January, utilizing 5,000 of the DCT-1000s. Roll-outs are slated to follow in the suburbs of Lower

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Blonder Tongue proudly announces the introduction of its new high dynamic range (70 dB) headend grade spectrum analyzer model BTSA 8558C. The BTSA-8558C analyzer is a light weight, battery operated spectrum analyzer that has a wide array of controls that allow for quick setup and measurement, including coarse and fine frequency tuning, digital frequency counter readout, 3 resolution bandwidth settings, including 30 kHz for composite triple beat distortion testing, 8 frequency span settings including ZERO SPAN for setting depth of modulation, 50 or 75 Ω input impedance, variable sweep rate, and "bright dot" center/marker frequency display. An optional calibrated noise generator is also available for sweeping frequency selective devices.

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I am a hard core test instrument addict. Ever since the discontinuation of the HP 8558B and the Tek 7L12 in the 1980s I have had a dream. That dream is to make available a personally affordable high dynamic range spectrum analyzer that is user friendly and provides the appropriate depth of measurement required for headend set up and trouble shooting. The 8558C is that dream come true. Because it is light weight and battery operated, the 8558C is appropriate for use anywhere in the system, especially the headend. The headend technicians job is most challenging in that he is tasked with identifying low level picture impairments and making them vanish. To do this he needs both 70 dB of dynamic range and a real time swept display. With this visibility, the technician can wiggle cables and connections, tap on chassis', tighten and loosen covers while observing improvements on the display. We addicts call this "chasing beats in the grass in real time". This is the first instrument I have seen with this capability, yet priced so that the technician can personally afford to own one.

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The BTSA-8558C is housed in a compact, rugged case that is at home in the field, on the bench, or in a headend.

Bob Pallé
Blonder Tongue Laboratories, Inc.

Reader Service 31

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Shaw's Barry Middlebrook: Operators must have personnel in place who understand computer networking technology.

Merion and Willow Grove (see *MCN* 10/20/97, page 3).

One of the most recent commitments came from GTE Media Ventures, which selected NextLevel to supply gear to support its launch of digital video service in the St. Petersburg/Clearwater, Fla. area. While the company declines to reveal, for competitive reasons, the number of set-tops purchased, telco executives are able to say that they plan to pass 400,000 homes in its Florida digital network by the end of next year.

Those MSOs in testing mode include MediaOne, which recently announced the start of its first consumer trial of its digital video TV product in the Detroit suburbs of Canton, Northville and Plymouth. The company has been testing the service in employees' homes for several months. The operator chose NextLevel's DCT-1000 set-tops and headend gear for the trial.

Also in testing mode is Canadian operator Rogers Cablesystems Limited, which has purchased "small quantities" of the DCT-1000 for use in technology and operations trial environments, says Nick Hamilton-Piercy, senior VP, engineering and technology. "We plan to replace these small quantities with the DCT-1200 model to take advantage of the better spectrum efficiency of 256 QAM," says Hamilton-Piercy. "Later, we might move these to the DCT-5000, which promises to be a more suitable platform for our service plans. Separately, we are in the process of buying a more substantial quantity of Scientific-Atlanta Explorer headends and terminals, as they better provide the interactive environment we wish to pursue." In fact, the operator has plans to roll out the Explorer platform into its two major clusters, which represent 2.5 million homes passed, says Hamilton-Piercy.

A notable exception to the major MSOs which are rolling out the NextLevel product is Time Warner, which is working with Scientific-Atlanta on developing the second-generation Pegasus digital set-top. The MSO will begin rolling out those digital set-tops next year, says Michael Luftman, VP of corporate communications; however, Time Warner had previously said it would consider purchasing the NextLevel boxes for those systems where a digital roll-out might be necessary before the Pegasus box is ready, he adds.

Responding to competition

Operators have been talking about digital for several years–so why take on digital now? In a word, competition. In terms of functionality, operators are looking for, at minimum, more channels, digital music, and a robust interactive program guide, says Robinson, to counter satellite competition. In addition, "every single operator" NextLevel is now supplying with digital gear has ordered a terminal with either an RF or a telephone return, in preparation, says Robinson, for the introduction of real-time, interactive services by early next year.

In an example of that proactive response to competition, there were several forces propelling Canadian operator Shaw Communications to make the move to digital, including a desire to recapture capacity, as well as provide subscribers with more choices. "We have focused on replacing our analog boxes with new digital boxes so that we can turn off the old analog scrambling system and get those channels back to launch more services," explains Middlebrook. "Customers are ecstatic because they get access to more pay-per-view, to digital audio services, to more stations, to better quality, and to an interactive program guide . . . . It was a no-brainer to deploy digital in order to gain security and put new technology into our customers' hands—and meet competition head-on."

Upgrading to digital also made more economic sense than upgrading the plant itself from 550 MHz to 750 MHz bandwidth, adds Middlebrook. "To go from 550 to 750 MHz would add another 30 to 40 channels, but take years to complete. But in the six months that it takes to accomplish a digital conversion, you can get 20 channels back. Digital allows us to defer the upgrade of some of our areas to 750 MHz for several years, when the cost of technology (will be less)."

As far as the mechanics of deployment are concerned, the complexity and the time commitment involved depend on whether operators are going the HITS route vs. local authorization. Rolling out the HITS headends is a fast process, says Robinson, usually taking about a half-day for set-up, plus a day-and-a-half slotted in for training the operator's technical staff on the new equipment.

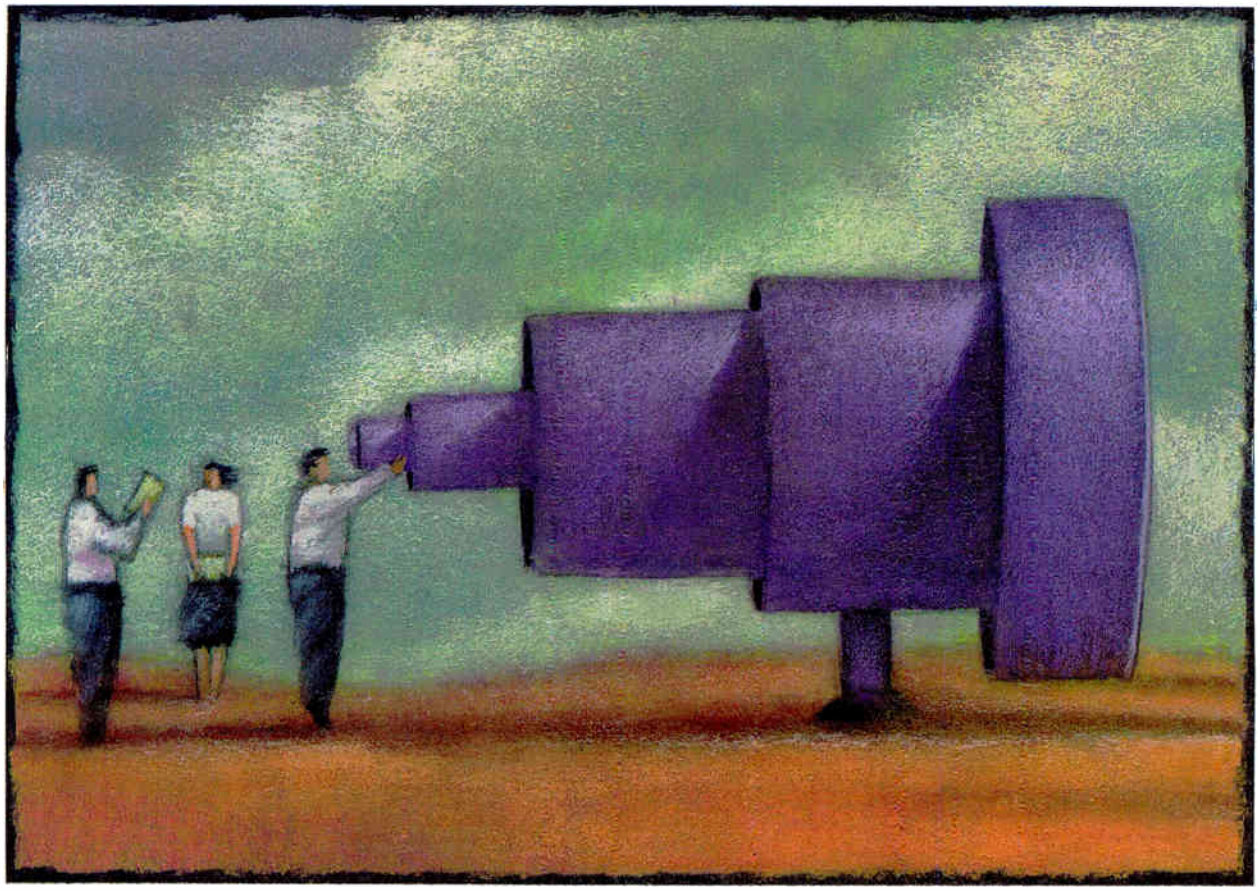
The task for operators who are installing a local control system utilizing the ACC-4000D is a bit more complex, requiring more integration in terms of the billing system, the electronic program guide, etc.

Shaw's Middlebrook has some advice for his counterparts who are just now deploying digital boxes and headends. First, for those operators who are going to utilize local control vs. the HITS service, headend support structures must be in place, composed of technical personnel who understand computer networking technology. If that expertise is not in a cable operator's arsenal, then the operator will have to hire outside talent, he says.

Second, operators should closely examine the operational side of deploying digital boxes. "How will you add the boxes into your installers' accounts? How will you set up retail centers where customers can come in and pick up the boxes? How are you going to get the two-way, interactive cable or telephone return modems wired in?," he queries. The third key piece is training customers on how to use the universal remote, how to use the new box, and even how to connect the new set-top up to their existing equipment, adds Middlebrook.

The next step

Beginning in mid-1998, NextLevel will begin shipping its DCT-5000 set-top, which will add "session-oriented" interactivity in the form of a TDMA return path for dedicated upstream bandwidth, as well as an MCNS-compliant cable modem, according to Robinson. Looking farther down the road, efforts are underway, both inside and outside of the cable industry, to influence the design of the advanced digital set-tops that would be standards-based, and some day, available at retail stores (see "OpenCable deal," page 44). For the present, though, operators have decided that it's time for action, not words, to meet digital competition head-on. CED



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Reader Service 32

ILLUSTRATION BY DON RUTH

Practical solutions for ad insertion into digital streams

Progress on standards

By Edward J. McGrath, VP of Engineering and Chief Technology Officer, SeaChange International edm@schange.com www.schange.com

The issues surrounding digital splicing of advertising into digital streams (DID) are many. While equipment manufacturers must always strive to find the ideal solutions to these issues, practical reality often suggests compromises or operational constraints which make implementation simpler, more cost-effective or enable earlier implementation.

In addition, any DID solution must be considered as an element of a total digital delivery system. A successful DID implementation can only be achieved through the development of standards and practices that easily, transparently and gracefully integrate with existing DIA (digital into analog) and AIA (analog into analog) operations and are compatible with today's new generation of digital systems as they come on-line.

Standards bodies

The issues surrounding digital insertion of advertising into digital streams are being addressed by separate efforts of a joint task force made up of members from the Society of Motion Picture and Television Engineers (SMPTE), the European Broadcasting Union (EBU), and the Association of Radio Industries and Businesses of Japan (ARIB); a working group within the SMPTE; and by CableLabs. While some efforts are focused on technical issues, others are addressing standards and practices for DID.[1]

To these groups' credit, they have addressed–and continue to address–the technical issues in a rigorous, yet pragmatic manner. The danger is, however, that some of the proposed standards could, for all intents and purposes, obsolete a significant portion of the headend equipment in use today in both Europe and North America.

What's required is an integrated end-to-end digital solution which allows for the insertion of advertising into a digital stream (DID). Any solution must include a way to migrate gracefully from today's solutions to the ultimate all-digital world we all desire.

Seamless vs. non-seamless standards

Seamless splicing, as its name implies, results in an invisible splice between the program material being delivered and the ad being spliced into it. This requires encoded

ads which fit exactly between splice in and out points in the program material and which match exactly in terms of VBV buffer levels at these transitions. Technically, this is difficult to achieve for any program and any ad.

In contrast, non-seamless splicing allows the splicing device to simplify the problem by allowing black frames where required at the transitions to manage these two issues. This is an example where the ideal–seamless splicing–is significantly more difficult to achieve than non-seamless splicing. The practical reality remains that the existence of a few (additional) frames of black before or after a break will not be noticeable to any but the most discerning eye, and certainly are no more noticeable than the cue timing imperfections that exist in nearly all of today's cable systems.

It is the author's belief that, from a practical standpoint, the non-seamless splicing standard as defined by the SMPTE working group meets a reasonable degree of acceptability for digital insertion of advertising. That's not to say that the eventual adoption of a seamless splicing solution shouldn't be the goal. However, non-seamless splicing does provide a way that won't unnecessarily delay implementation of digital into digital insertion.

Statistical multiplexing

The cost of satellite transponders and the desire for delivery of increased channel count to the home argue for statistical multiplexing of encoded streams. The difficulty that statistical multiplexing introduces is that it makes re-multiplexing at the headend (packaging services from different satellite multiplexes into a new multiplex for HFC delivery) impossible without recoding (see below). It also requires operational constraints (see below) to enable insertion of pre-encoded material at the headend. There are several possible scenarios, however, that can be implemented to make DID possible.

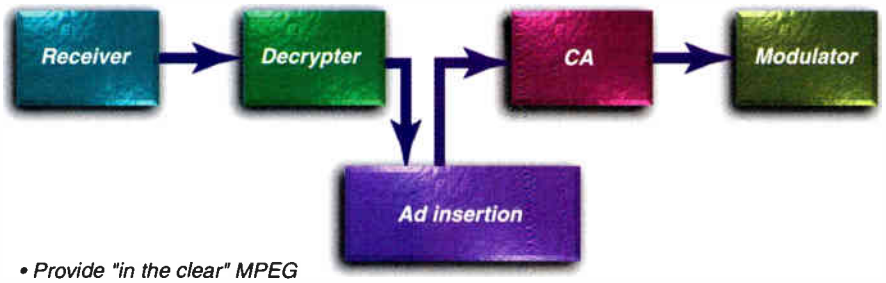
✔ No statistical multiplexing. All material would be delivered at a constant bit-rate (CBR). Ads would also be inserted at a constant rate. However, the industry must agree on a set bit-rate for both the material and ads. This technique makes re-multiplexing and ad insertion possible, but also increases satellite expense and reduces the number of channels that can be delivered to subscriber homes.

✔ Statistical multiplexing but with maximum and minimum bit-rates. Ads would be inserted at a CBR which makes digital ad insertion possible; however, all of the ads must be encoded at the minimum bit-rate of the program material. Unless this minimum bit-rate is 4 Mbps or more, the quality it can deliver will likely be unacceptable to advertisers. This assumption makes re-multiplexing possible but inefficient, because as streams are combined, each must be assumed to be running at the maximum bit-rate.

This results in a re-multiplexed statistically multiplexed stream being less efficient than a non-statistical multiplexed stream. You can actually end up sending fewer channels to the home. These two factors will work to drive the minimum and maximum bit rates closer together (such as 4 Mbps and 6 Mbps), a move which defeats the purpose of statistical multiplexing in the first place.

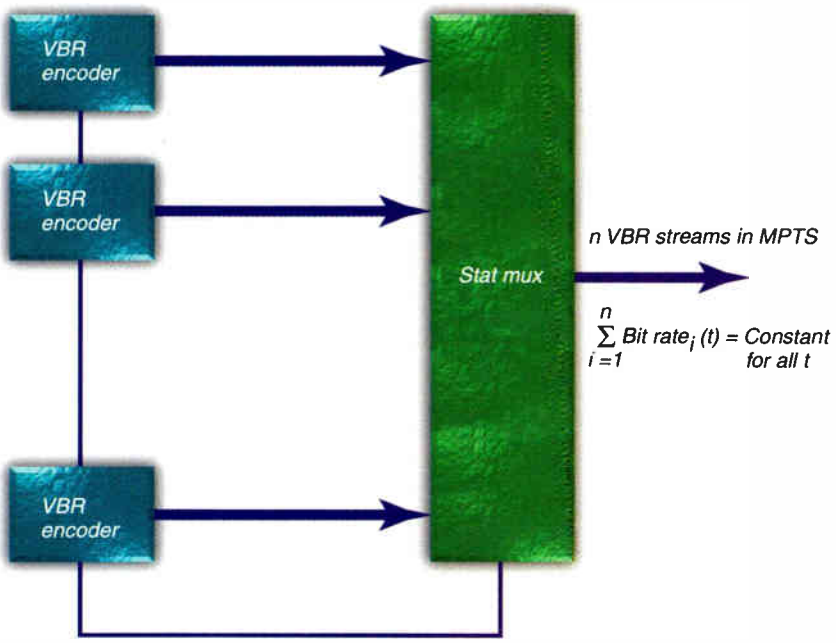
✔ Statistical multiplexing of program material with programs forced to CBR during local breaks. The statistical multiplex system at the uplink site has the capability of recognizing upcoming local breaks and forcing the bit-rate of any channel for the duration of a local break to a pre-defined CBR. The other channels in

Figure 1: *Equipment interfaces*



- *Provide "in the clear" MPEG*
- *Standard interfaces (DVB/ASI/LVDS)*
- *Failsafe bypass mechanism (ASI)*
- *Allow for external splicing devices*

Figure 2: *Statistical multiplexing*



the multiplex then increase or decrease in bit-rate to compensate. Selection of channels within a multiplex so that all channels don't go to a local break simultaneously minimizes the effect of this compensation.

This technique makes downstream ad insertion simple, and it makes satellite statistical multiplexing possibly very efficient because it doesn't otherwise constrain the minimum and maximum bit-rate. If re-multiplexing is required, this technique has the same issues as having maximum and minimum bit-rates. However, if it is not required, for example, if ad-insertable channels are packaged together, it can provide an effective way to maximize satellite efficiency and simplify DID ad insertion. The SMPTE working group has proposed this technique.

✔ Variable bit rate with recoding. Ad insertion and re-multiplexing of variable bit rate material while meeting maximum bit-rate requirements for input into modulators is a difficult problem. Some industry players have proposed techniques and are building equipment which, if successful, could help solve these problems. Some have demonstrated this concept using software-encoded material and software pre-multiplexing. However, real-world application requires real-time multiplexing and encoding. Much work remains to take this concept to practical implementation.

What bit-rate?

If any of the first three options are adopted, the industry will have to select a bit-rate which provides acceptable quality at a reasonable cost. Today's users of digital ad insertion into an analog stream (DIA) face a similar trade-off. However, that trade-off is one of disk storage for ads against quality/bit-rate. Given the low cost of disk storage, most operators have opted for the adoption of a relatively high bit-rate (8 Mbps). In the DID environment, however, the ad bit-rate must equal the material into which it is being inserted. The choice of an ad bit-rate, therefore, affects the number of programs that can fit into a transponder or into a QAM multiplexer. The cost of this requirement will drive DID users to choose a lower bit-rate.

Encoders of one to two years ago provided approximately Beta-SP quality at 8 Mbps. Today's encoders provide equivalent quality at 6 Mbps. Reducing resolution to one-half D1 provides similar quality at 4 Mbps, but with a slightly softer picture. This softness is only noticeable on the best cable systems and on monitors with greater than 400-line resolution. Given the trend of encoder quality improvements and the channel capacity trade-off, the author recommends a standard of 4 Mbps for constant bit-rate DID insertion.

Cueing

Today's ad insertion systems, whether analog or digital, use DTMF cue tones or the equivalent to indicate the start of a local break. However, continuing to use this method when program material is delivered to the headend in MPEG is costly, because it would require a third audio channel for every network. It should also be noted that many channels are likely to be delivered to the headend in MPEG but then delivered to the home via the analog spectrum.

The new cueing standard must supply both DID and DIA cues. It must also accommodate the different cue types that exist today, such as optional breaks and local news vs. advertising cues. Finally, it is likely that some networks will uplink MPEG digital service directly, while others will lag. Uplink consolidation service providers (e.g. HITS) or large MSOs will need the ability to receive both digital and analog services and uplink them in MPEG while providing cues for all insertable networks.

The ideal solution would be to embed cues in the MPEG stream along with the program material. The problem with this is that today's MPEG encoders are not capable of performing this function. Also, today's IRDs cannot decode this as-yet-undefined cue, and therefore, can't provide a signal compatible with DIA equipment.

What is needed is a pragmatic, consistent solution that flows with most uplink equipment in use today, and which would also accelerate the time-to-market for DID equipment. One such solution would reside in the uplink site and take its inputs either as DTMF cues as today, or as contact closures, so it can create cues for either analog services or serve as the cue creation system for networks which uplink MPEG directly.

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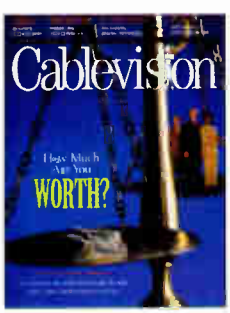

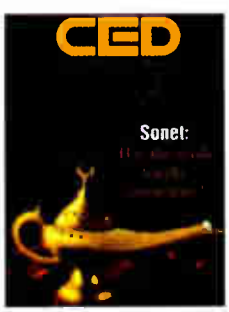

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simple protocol developed as an industrywide standard would be a direct mapping of today's analog cues. The author believes this system solution would address many of the cueing problems identified earlier. Specifically, it would:

✔ Work at either the network origination site or at the consolidator;
✔ Support either DID or DIA;
✔ Support different cue types (e.g. long form break, optional break);
✔ Embed cues in MPEG streams for all services on any given multiplexer;
✔ Would not require the installation of new encoders, IRDs, etc.;
✔ Would be based on an industry standard protocol; and
✔ Would be simple, inexpensive and available today.

Equipment interface standards

Most manufacturers of digital headend equipment historically have had proprietary interfaces between the various parts of the system. The DVB standards body has defined, as a part of its overall standard, a serial and parallel MPEG data interface between the components of digital headends. These are DVB/ASI and DVB/LVDS, respectively. Most manufacturers have either adopted these standards (Divicom) or have stated their plan to implement them (Scientific-Atlanta and NextLevel). This move should be applauded, and these companies should be encouraged to quickly implement the DVB standards. It is also recommended that the industry adopt DVB/ASI as the standard equipment interface.

Another issue the industry must face concerns how each manufacturer configures the receiver, decryption, conditional access/SI insertion, and modulation components in their product lines. Also, to be effective, DID insertion must happen "in the clear"–that is to say, after decryption but before conditional access. Integrating the DID insertion point into the headend hardware places unnecessary barriers to the development of a standard solution. The correct place to perform this function is in the server where the ads are stored and subsequently inserted into the program stream, which is passed through to the conditional access and modulation equipment.

We encourage manufacturers to provide a standard interface between these two modules–a place where the MPEG data is in the clear, making it possible for manufacturers of DID equipment to integrate easily with their equipment.

DIA ad insertion systems have long had the capability to automatically pass the program stream through if anything in the DIA equipment failed. However, with DID, that fail-safe assurance is more difficult to achieve, and because a failure potentially takes out an entire multiplex, it is even more critical. Because DID takes a much more invasive approach to inserting ads into a digital program stream, the DID system design must include the ability for the MPEG stream to pass through the insertion system during any power failures, computer hardware or software failures, etc.

Hybrid DIA/DID ad insertion

As noted earlier, most cable operators who decide to deploy digital set-tops will also continue to provide concurrent analog services for some time to come. For these operators, basic analog services will continue to use the largest part of the spectrum, while digital services (premium channels) will flow through the balance.

This stems from several facts. First, digital set-top boxes are expensive, and second, customers still wish to take advantage of their analog "cable-ready" receivers. Also, and quite importantly, the digital spectrum will be used to deliver premium channels such as pay-per-view, HBO and The Movie Channel, all of which do not carry advertising, and therefore are not ad insertable. The final issue facing the rapid deployment of DID ad insertion is that the extended tier of networks that operators might use DID for, in addition to the low penetration of digital set-top boxes, also have lower viewership, and therefore would make it much more difficult for the operators to recover their investments.

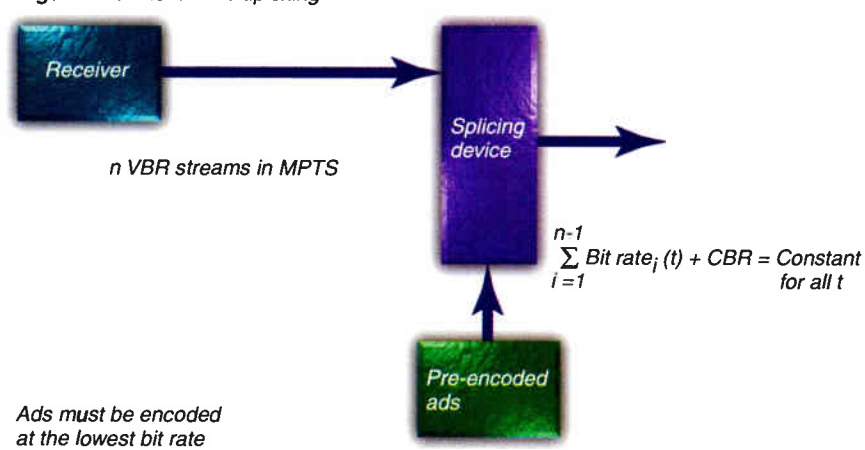
These are all business factors that will slow implementation of DID. However, a counter trend is coming from the continuous pressure that the direct satellite delivery systems are putting on some operators currently carrying a relatively low number of channels. This pressure could drive these MSOs to adopt digital set-top boxes to increase their channel count. In the long term, this could be less costly than rebuilding their systems. And, that strategy would drive demand for DID equipment.

But at least for now, ad insertion systems will have to be able to insert advertising into both analog and digital networks. This reality comes with its own set of issues that will have to be resolved. But the bottom line is, any hybrid DIA/DID system should have the look and feel of a single system.

Unfortunately, the differences in the MPEG formats for DID and DIA make this difficult. North American operators have chosen the AC3 audio compression system for digital service, while MPEG-2 and DVB specify MPEG level 1 (derived from Musicam). Store-and-forward MPEG systems usually use system or program streams, while DID will require transport streams. Cueing in DIA is typically through cue tones; cueing in DID will either use private data in the MPEG stream or an extemal data signal.

From a systems point-of-view, it will be unacceptable to have two solutions side-by-side–one for inserting DIA and one for DID. The only acceptable approach is a hybrid system which gives operators the ability to advertise on any channel, regardless of whether it carries an analog or digital programming stream.

Figure 3: *Statistical multiplexing*



Conclusion

While many issues remain facing successful commercial deployment of DID, the outlook is bright. The standards groups have made good progress in the technical standards required, equipment manufacturers show a willingness to adopt standards-based and open interfaces to their systems, and finally, digital set-tops are finding their way into homes. CED

References

1. "First Report of EBU/SMPTE Task Force for Harmonised Standards for the Exchange of Television Program Material as Bit Streams."

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Reader Service 34

Preparing to do battle in Chicago

21st Century lays out its plan

By Roger Brown

Not since the days of the notorious Al Capone has Chicago seen the all-out war that's about to be unleashed there.

When the Telecom Act was overhauled in 1996, supporters promised it would lead to a new era of competition. Generally, however, that hasn't yet happened, except in a few markets.

But soon, the city of Chicago will witness a shoot-out so intense, it might match the bloodletting that occurred in that town in the 1930s. If not, what it lacks in blood will certainly be made up for in intensity.

Telecom newcomer 21st Century Communications–which is singlehandedly trying to create a new three-letter acronym by referring to itself as a "competitive communications provider" or CCP–is rapidly gearing up to serve the city's downtown residents and businesses with a package of voice, video and data services. The bundled offering will be delivered over a unique, costly and state-of-the-art network that utilizes Sonet and wave-division multiplexing. Feeding it will be an expansive, bulletproof headend/network operations center (NOC) that would make even NASA engineers proud.

"We're building a world-class telephone system that also offers cable TV and data," says a haughty Glenn Milligan, the personable CEO and founder of 21st Century. "I believe it will serve as a model for other systems to replicate."

Those are big words, especially coming from a company that only signed on its first real customers about a month ago. But in order to make that boast a reality, Milligan has surrounded himself with some of the best engineering, marketing and customer service talent available, and garnered funding from the city's best known–and most elite–investors (see sidebar stories).

And he'll need them. Estimates are that 21st Century will spend roughly $200 million over the next four years to build its two-way interactive network in the famed "Gold Coast" area of Chicago, a two-mile wide strip of land that stretches from Evanston to Hyde Park and includes the urban canyons of downtown Chicago known as "The Loop."

It's this 28.5-square-mile parcel, known as Area 1 of the Chicago franchise, that will either make believers out of 21st's competitors, or send the upstart into financial oblivion.

No expense spared

The company has already plunked down $6.5 million to build out its Apparel Mart headquarters, which houses the NOC, a data operations center, and a video headend, as well as a complete network telemetry and control system. There are more than 160 racks of equipment, which includes gear for 110 channels of video, servers and controllers for a high-speed data service and a full network monitoring and surveillance system. According to Scott Phillips, a supervising engineer for Audio-Video Corp. and the guy

who spent weeks overseeing the headend wiring project, the headend has about 160,000 feet of cable running through it, and some 15,000 connections.

Of course, a dazzling headend doesn't make the system–and Milligan is keenly aware that the most daunting challenges are still in front of him. Yet he firmly believes he can make the incredibly expensive network pay off in the long run.

What's his biggest challenge? "Executing," says Milligan bluntly. "This opportunity is ours to screw up because we don't have a thousand other systems to subsidize the screw-up."

His reference to chief competitor TCI shows where Milligan expects perhaps the most intense battles to take place. However, he also believes TCI has largely ignored the inner Chicago market during its tenure there, and suffers from a seriously bad reputation. In fact, Milligan says, TCI in Chicago only enjoys about a 30 percent penetration rate and was recently voted the third-worst cable service in the country. Perhaps the company's 318 documented "outages" over the past year had something to do with it, Milligan muses.

To make sure 21st Century doesn't suffer from the same problems, the system is failsafe: it's self-healing, fully monitored and the headend/NOC will be staffed and monitored on a 7x24 basis.

TCI representatives say the company is prepared to repel any attacks on its subscriber base. LaRae Marsik, a corporate TCI spokeswoman, dismissed any fear of 21st Century in Chicago, saying that "we face competition in just about every market." She said 21st Century's aggressive moves will not alter TCI's plans to take a measured approach to adding advanced services in its metro markets. "Our response is the same: No, we're not necessarily speeding deployment," Marsik said. "We expect competition in this area, and our goal is to provide a superior product with superior service–not necessarily more quickly, but correctly."

Why Chicago?

While some, including TCI, have balked at building an underground network in the urban canyons of Chicago, Milligan and his crew have identified it as their life blood. "I wouldn't trade this franchise for any other franchise in the world," he says. Why? The reasons are many:

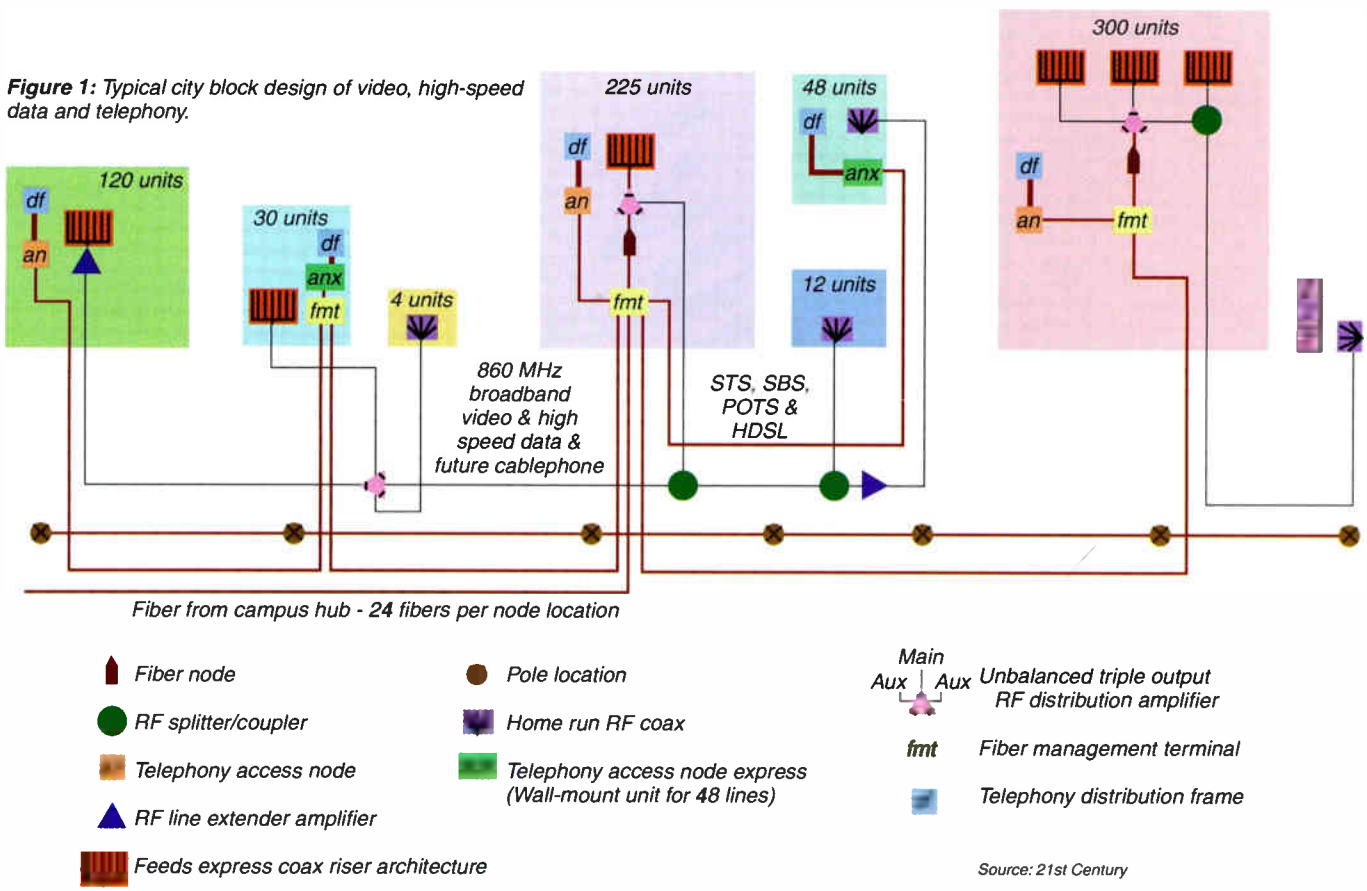
✔ Chicago generates two percent of the country's total telephony revenue;

✔ it boasts the nation's second-largest financial district;

✔ the downtown area has 800 homes per mile, and counts 300,000 residences, 500,000 businesses and 50,000 hotel rooms within its borders.

Getting a cable franchise was a long, frustrating exercise for Milligan, who says the four-year fight over the franchise application was the longest-running issue the Chicago City Council ever dealt with. But now that the battle is over, 21st Century is finally building its network. The previously-mentioned headend/NOC was designed to be functional and reliable, but even more importantly, it was designed to show potential customers and competitors alike that Milligan and his cast must be taken seriously. "This is really our retail outlet," notes Milligan, pointing to the

Figure 1: *Typical city block design of video, high-speed data and telephony.*



Source: 21st Century

glass-enclosed technical spectacle. "It reflects solidarity and gives us a stable appearance–and perception is important."

To date, 21st Century has few live customers, but already has a backlog. In fact, Milligan says he had 112,000 requests for service before he spent a nickel on marketing. And apartment buildings representing 44,000 individual living units have already been signed to five-year service contracts.

Despite all that, 21st Century is fighting any perception that it's just another cable company. With the business customer counted as "absolutely integral" to the success of the venture, the company's real success and profit margins will come from its role as a competitive local exchange carrier (CLEC).

Show me the money!

21st Century President Glenn Milligan might be chastised for spending so much money to build a competitive network, but he certainly hasn't had a problem getting the financial wherewithal to build it.

After a lengthy odyssey through Chicago's City Council in pursuit of a franchise, Milligan has several equity investors who, collectively, have shelled out tens of millions of dollars.

Current equity investors include an investment group led by The Chatterjee Group, an affiliate of Soros Management Fund; William Farley, chairman of Fruit of the Loom; Chicago telecommunications investment specialists JK&B Capital, Boston Capital Ventures; Thomas Burrell, chairman and CEO of Burrell Communications Group; Donald Jackson, founder and president of Central City Productions; George Johnson, founder of Johnson Products; Edward Joyce, president of Edward T. Joyce & Associates; Ralph Moore, president of Ralph G. Moore & Associates; and Mark Tauber, chairman and founder of the Communications Department of Piper & Marbury.

21st Century CTO Jay Carlson says designing and building this network has been a breath of fresh air compared to most of the cable systems he's built. "Our investors have told me to spare no expense when it comes to constructing this network the right way," he says. "That doesn't mean I can spend without regard for cost, but it does mean they have no tolerance for not doing it right the first time." –RB

Technology and topology

Chief Technology Officer Jay Carlson and VP of Network Operations John Brouse have worked–and reworked–the network's architecture to provide both capacity and reliability that today's customers are demanding. Carlson and Brouse chose Scientific-Atlanta for headend gear; Harmonic Lightwave for optoelectronics; Pirelli Cables for fiber optic cable; Belden Wire and Cable and CommScope for

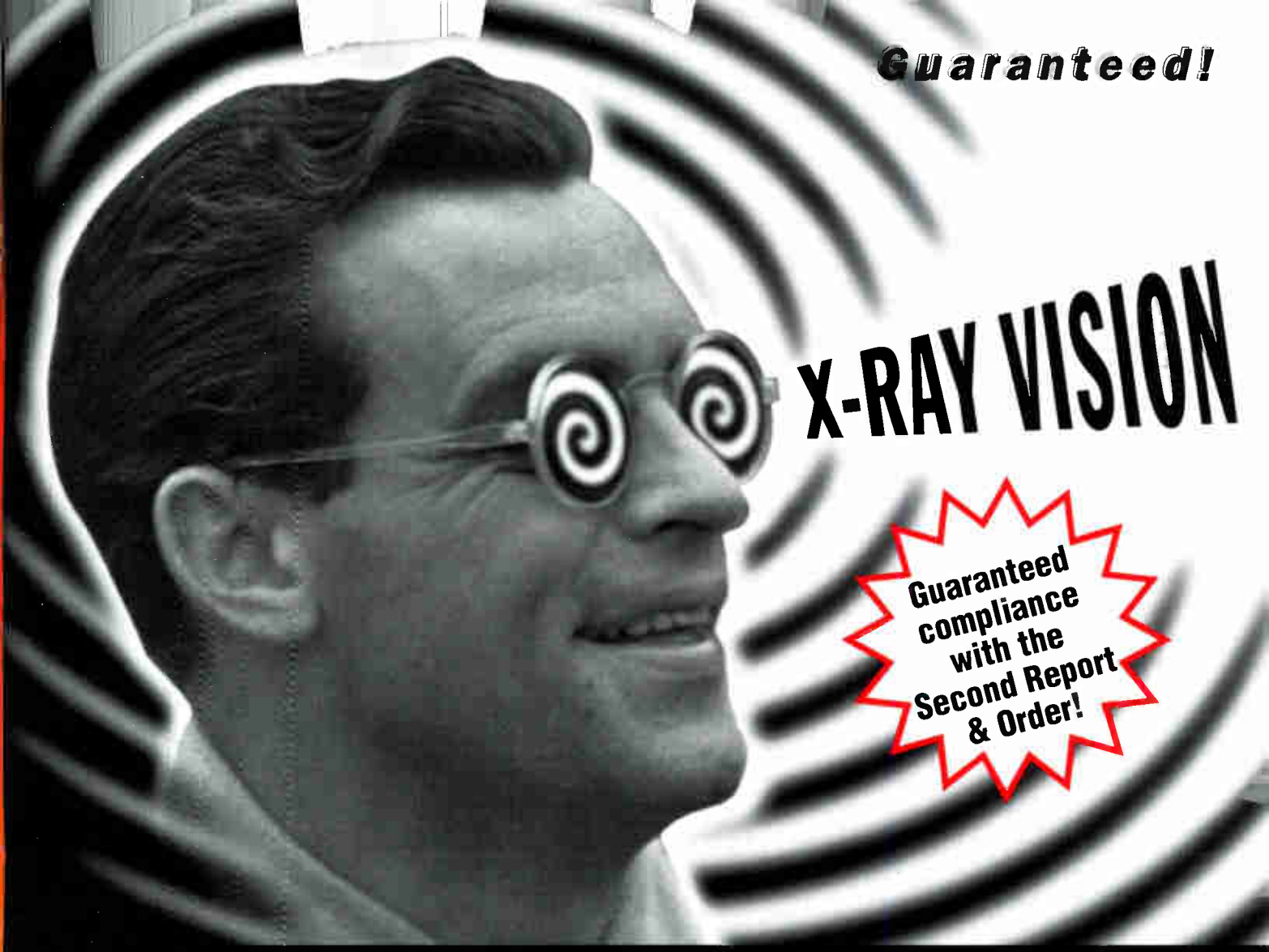


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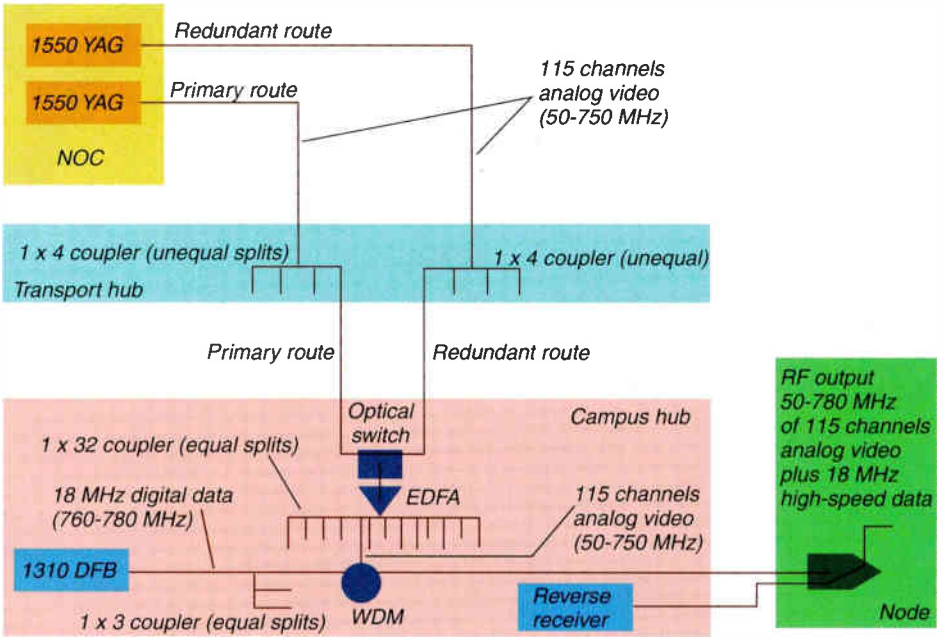
Figure 2: Fiber optics video transportation and distribution configuration. Source: 21st Century.



coaxial cable; Nortel for the voice network; and, in somewhat of a surprise, Zenith Electronics for high-speed data modems.

All that hardware is being integrated into a unique network topology that is, essentially, a beefed-up version of the Alexandria, Va. system that Brouse and Carlson built while they were employed by Jones Intercable.

Carlson and Brouse have dubbed it a "distributed ring/star" network that utilizes both 1310 nm and 1550 nm technologies in a Sonet-based system. Data and voice signals are sent out of the NOC on different fibers over a 96-count OC-48 fiber cable to each of eight "transport hubs," where each stream is split into four OC-12 tributaries and sent out to 36 different "campus hubs." Each campus hub is served via a 192-fiber cable.

At that point, the telephony and datacom signals are mixed on the same fiber as the video. From the campus hub, a cable packed with between 16 and 24 fibers extends out to the system's "nodes," each of which is located no more than three-quarters of a mile from the campus hub. Each hub serves between 24 and 36 nodes, which means the system will have up to 3,700 nodes when it's completed.

When the voice signals emerge from the campus hub, a variety of services are made available, typically to about 12 multiple dwelling units. Services include DS-1, DS-3, OC-3, STS-1 and basic DS-0s.

The video signals, meanwhile, emerge from the NOC at 1550 nm and are sent out over two different paths for redundancy. Those paths are each split four times in the transport hub and again sent out over route-diverse paths to the four campus hubs that each transport hub serves. At the campus hub, they come together at an optical switch, are amplified with an erbium-doped fiber amp, then split again 32 times.

Those outputs are then wave division multiplexed with the data signals, which are sent to each node using 1310 nm fiber technology. Using DFB transmitters, the 18 MHz digital data stream (which occupies the 760 MHz to 780 MHz region) is split three times, multiplexed with the video, and sent down the coax to the home.

John Brouse and Dave Divine make some last-minute calibrations with headend staffers.

Services and lineups

While other MSOs are faced with having to rebuild their networks to make them interactive and then add more services on top of the

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video-optimized network, 21st Century has the unique ability to build a network from the ground up with bundled services in mind from the get-go. So, while other operators talk about all the neat services they could package together, 21st Century will come out of the gate with the following services:

✔ Analog video. When 21st Century kicks off service, it will offer 110 channels of analog video, including 84 "basic deluxe" offerings, 10 premium channels and 16 pay-per-view channels (including a 10-channel "movie gallery"). In addition, more than 100 "virtual channels," consisting of both information and entertainment fare, will be made available. These include a preview guide with one-button VCR recording, airline schedule info, traffic advisories, a stock ticker, lottery results, local restaurant menus and more. Also included will be 25 channels of CD-quality audio.

✔ High-speed data. With a fiber pipe often stretching all the way to each building, the network can uniquely take advantage of Internet and Intranet services, according to Stephen Lee, senior VP of Internet and Data Services. The company has already committed to purchase at least 40,000 Zenith modems, which will provide Internet access at speeds up to 4 megabits-per-second. Free e-mail and mini-Web pages will be offered. To speed downloading time, local servers will regularly cache the top 250 Web sites and make them available to local users.

The agreement with Zenith may have stunned some, but Lee said it was a proper choice for two key reasons: immediate product availability and the scalability of the system. Scalability was especially important in that the modems will be served by the equivalent of 36 "headends," which would have made systems from other vendors cost prohibitive.

Is Lee worried that other MSOs may end up with interoperable modems through the MCNS standard? Not at all. "Zenith has committed to us that it will build a second-generation modem," he says.

✔ Telephony. As a provider of competitive local and long distance telephony to both businesses and residential customers, 21st Century chose to construct a traditional telephony network instead of pursuing the telephony-over-cable approach. One major reason was the powering problems posed by the HFC architecture. Instead, by using a traditional twisted-pair drop to the home, traditional powering solutions can be used.

"This is definitely a world-class network that's as reliable–or more so–than a traditional telephone network," says Tony Daniels, a senior network sales engineer at Nortel. "No corners have been cut in the design of this network."

✔ Security. 21st Century will partner with a third party to provide central security services for individual homes, apartments and businesses. On-site-camera-monitored security channels will also be offered to MDU residents so they can identify visitors prior to entry.

Figure 3: *21st Century's Chicago network topology.*

Construction issues and progress

With so many people packed so closely together, and faced with an all-underground construction mandate in a city as old as Chicago, the network build will be difficult, time-consuming and expensive. It will also call for creative decisions to be made on the fly as the construction crews encounter myriad obstacles.

The first stroke of brilliance was forging a deal with the Chicago Transit Authority to use the north-south rail supports and private right-of-way to construct the fiber transport ring.

But the rest will take incredible patience to get through the lengthy underground permitting and mapping process. Working within the bounds of Chicago's political structure has been "nothing like any city I've ever worked with," notes Dave Divine, technical operations director. "Part of the challenge is simply finding out who we have to talk to, whether it's Ameritech, ConEd, the CTA or someone else."

Although 21st Century is using an outside contractor (Walsh Construction) to actually perform the build, it's using its own resources to design the network on the fly. "We're going to have to be creative," says Divine. For example, the company is already looking at using existing coal and freight tunnels to pull fiber through.

But that's only half the fun. The rest comes after the fiber has been pulled into the building, and they're faced with how to run coax cable 50 floors straight up. "It's a real design nightmare," understates Divine. "You don't really have system specs, you have building specs."

Who ARE these guys, anyway?

You might not know them now, but if 21st Century manages to carve its niche in Chicago and the other cities it intends to compete in, you'll be hearing from Milligan and crew often.

Leading the charge, literally and figuratively, is founder, president and CEO Milligan, who cut his teeth in the cable industry with The Walt Disney Company. At one point, Milligan headed Disney's regional operations over eight states, with responsibility for sales, marketing, legal and financial activities, as well as personnel management. Milligan also managed the Kansas City corporate offices of Showtime and The Movie Channel.

Pictured in 21st Century's new headend are, from left, Steve Lee, Jay Carlson, Richard Wiegand-Moss, Glenn Milligan, John Brouse and CFO Ron Webster.

Milligan's right-hand man is Richard Wiegand-Moss, 21st Century's chief operating officer. Moss came to Chicago from Cincinnati, where he was VP of customer operations for Time Warner Cable's 200,000-subscriber system. His responsibilities included the call center, management information systems, human resources, installation and service in that 3,500-mile, dual-cable system. While in the Queen City, Moss managed the planning and construction of a 750-MHz hybrid fiber/coax rebuild.

Moss also has experience with two other major MSOs, serving as general manager and COO of Tele-Communications Inc.'s Chicago system and as a district VP of Continental Cablevision.

21st Century's Chief Technical Officer and VP of Engineering is Jay Carlson, who spent the last several years as a senior member of the corporate engineering staff at Jones Intercable in Denver. While with Jones, Carlson had overall responsibility for engineering and technical operations for more than 350,000 subscribers in the eastern region of the country.

Carlson helped deploy the first fully two-way interactive pay-per-view system in the Chicago area and helped engineer and deploy the first interdiction system in the country. In addition, he helped design and review the innovative fiber topology used by Jones in Alexandria, Va.

Carlson helped recruit longtime Jones associate John Brouse to 21st Century, where he now serves as VP of network operations. The 1996 winner of the Polaris Award (given annually by *CED*, Corning and the SCTE to recognize innovative use of fiber optic technology), also helped develop unique fiber systems in both Broward County, Fla. and Alexandria, Va. Over his career, Brouse has deployed more than 30,000 miles of fiber.

Rounding out the team is Stephen Lee, president of Broadband Internet and Data Services for the company. He comes to 21st Century from HyperSpace Networks, an Internet service provider, where he was national sales manager. He has also served as director of sales for Metropolitan Fiber Systems' Datanet division and had key leadership roles with various divisions of Graphnet Inc., a provider of value-added networking services. *–RB*

Knowing that most network problems, including ingress and other noise impairments, come from the drop, the company is going to great lengths to treat the drop as its own, closed system. Therefore, nothing but quad-shield cable will be used, along with more costly snap-in style F fittings.

Installations and service calls

Like so many other aspects of this Chicago network, technical operations had to be approached differently than most other systems, including nomenclature. For example, there are no "installers" or "service techs;" instead, there are "customer service technicians." "They'll do it all," says Divine, whether it's video, voice or data service installation. A crew of four will ride around town in a "war wagon," which consists of a van chassis with an ambulance body placed on it. But instead of carrying injured people, these wagons will sport a curb-side door, four jumpseats, cages for the two-wheelers and a workbench, in addition to several bins of equipment.

"With one guy driving and dropping the other guys off, he doesn't have to find a place to park–and the techs don't have to keep going back down to the truck to get more equipment, because they'll have everything they need with them," including about $20,000 in test gear to make sure the job was done correctly the first time, says Divine.

In addition to having extensive technical knowledge, 21st Century intends to hire intelligent and experienced front-line personnel and train them with more customer-contact skills, sales skills and technical expertise.

"We're going to need intelligent technicians because, with this system, you don't just go out there and, for example, cut in a directional coupler, because you'll affect service to a whole building," says Divine "I think the day of the entry-level technician serving as an installer is over."

Brouse concurs: "I've been mentally searching for an answer to the question of what an entry-level technician is."

Moving forward from here

For all his concentration on Chicago, Milligan plans to spring-board into other areas, as well. In fact, he's already applied for franchises in several Michigan cities, and wants to pass 3 million homes within eight years. All told, he plans to spend about $1 billion to construct those networks.

Clearly, Milligan and his crew are at risk. However, he's convinced that building the right network, and treating his customers the way *he'd* want to be treated, will cause him to succeed.

"We have no margin for error, because we're going up against Ameritech, MFS and TCI, among others. But I'll take our position any day, because we control the services we're going to be providing. This project has no legacy . . .The best technology money can buy is being brought to bear on the very first customer." CED

CableLabs giving technology a business flair

Seeking strategic alliances

PHOTOGRAPHY BY BOB SULLIVAN

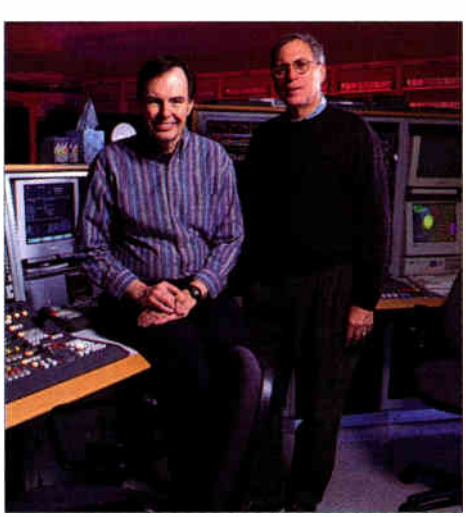
By Craig Kuhl

Strategic alliances are fast becoming THE business model of cable TV in the new millennium, and recently, CableLabs added an exclamation point to that strategy with its request for information (RFI) to leading computer and consumer electronics companies.

The RFI for "Open Cable," which asks for input regarding a new generation of interoperable advanced set-top boxes, places CableLabs squarely in the engineer's seat as an agent for the cable industry in its search for the much-needed partners needed to keep it competitive and profitable well into the next century. And the business of technology is where CableLabs will focus most of its attention.

"We must look at the business perspective of Open Cable (and technology in general) and turn it around to the business/revenue side," says Dick Green, president and CEO of CableLabs. "The set of businesses (computer, consumer electronics and cable TV) need each other–badly. The computer industry needs connectivity for high-speed data that will sell the next generation of PCs, and we bring value to the party. In turn, we need their technology because the set-top box is becoming a computer. It's important we work together, because the bottom line is we can bring advantages to each other."

Working in tandem with its current membership of 63 cable companies is CableLabs' mandate. As a non-profit research and development consortium, it has been active in the lives of cable operators since 1988, developing new business using emerging and existing technologies. Yet, it now faces its most challenging, and perhaps rewarding, time.



Dick Green, president and CEO; and Jerry Bennington, senior VP of Internet Technologies, CableLabs.

Forging alliances

Digital video, Web TV, IP telephony service, cable modems, MCNS/DOCSIS standardization and Open Cable are some of the key issues and projects being addressed at CableLabs, with each having its own special impact on the cable industry. And one of the most tenuous parts of the mandate is allying industries whose paths have rarely crossed before. Open Cable is an example. "The Open Cable requests have had a huge impact. They allow us a leadership role and to develop a business model for the computer and software industries. We can take the lead, and the door is open to help solve the problem of digital video and data services," says Green.

Through one of those doors lies the computer business, Green says, and an unexplored business opportunity of great magnitude. "The computer industry is very excited about Open

Computer gaming is expected to be a $1 billion industry by the year 2000.

Cable. It looks at cable with its broadband pipeline as a way to get into more homes, and it doesn't take a lot of bandwidth to download programs. Plus, they are getting into more than the 40 percent of the homes they're in now."

"Twitch" games, or computer games, is one opportunity Green insists is worth noting. "For about $2 per month (fee), you could have subscribers playing against each other within a cable system. The cable industry hasn't paid attention to the gaming industry yet. We want to offer it as a business opportunity." According to Green, on-line gaming is expected to be a $1 billion business by the year 2000.

Bits and bytes

It's the cable modem, however, which has CableLabs' full attention. "It's what's driving the business," notes Green. "Digital and analog have been the envy of competitors. Now, a second data network connects to a network and itself, and carries packet data. We can give IP telephone packets a priority, which is a huge advantage, and it has an @Home footprint, which any operator can connect with. That is the greatest platform to build a new business (on), and it's already in place," says Green.

Building an ancillary business using data as the driver is a good idea, according to Bruce Leichtman, an analyst for the Yankee Group in Boston. However, cable's core business shouldn't be forsaken. "It's exciting (data-driven business) because it's going from 0 to 60 and is an incremental new business, and cable hasn't had a new business in awhile. But if cable grows its core business by just small percentages, it can make more than it can with high-speed data. It must look at its core video business. Is it tapped out on pay-per-view and premium services? If they take their eye off the ball and focus on new technologies rather than their core business, that's a mistake."

Key issues and projects now at CableLabs

- OpenCable & strategic alliances
- MCNS/DOCSIS standardization
- Digital video
- IP telephony service
- Web TV

Keeping several balls in play is a strategy being deployed by a growing number of cable operators, small and large. Moving the technology forward which will lead to new revenue streams and profitability, however, is expensive, and has some speed bumps which CableLabs is addressing, according to Alex Best, senior vice president of engineering for Cox Communications. "The two most important projects at CableLabs are standardization of MCNS cable modems and Open Cable. CableLabs has a tough task; it serves many masters with different priorities, and sometimes, conversations are difficult because they have to make everyone comfortable. But, the fact we have a facility like CableLabs is a real asset. They've performed some valuable R&D and are a centerpiece which gives a good perspective on the industry and its technology."

CableLabs is also providing smaller operators with a new business perspective. "In the world of dramatically changing technologies, we don't have the wherewithal to keep up," says Ben Hooks, president and CEO of Buford Television Inc. "I can't experiment in my little towns with expensive modems. When we go into HITS (Headend In The Sky), that's an add-on business. But high-speed data is very different. That's a greater step for us. The application is a different business."

Looking skyward

Of all CableLabs' projects, digital HITS has had the most impact on Buford's business and will yield the best return, according to Hooks. "It was the most significant development. We are now benefitting from the technology (digital video compression) that led to HITS, which CableLabs initiated. The key is to generate enough cash to pay for the box, which is about $486, but the cost is coming down."

HITS is also being turned on at other systems, including Southwest Missouri Cable, a small operator which has used the information available at CableLabs to its benefit. "It has helped us to make better decisions and to look at the future. Now, we are turning on our new headends for a 30-day beta test of HITS, and for the first time, we can stand toe-to-toe with our competition," says Dean Peterson, president of the small operating company.

Investing in advanced technologies such as high-speed data is very appealing, but may be out of reach for most smaller operators until a set of standards is developed. Says Peterson, "For small operators, it's not smart to invest hundreds of thousands of dollars in the Internet if there are no standards. So, we're waiting for MCNS standards, which will enable us to do things we can't do now. There are lots of people beating down our doors for high-speed data. There's definitely a market there."

What the small operators lack in resources, however, they make up in what Green calls "entrepreneurial zeal." "There are lots of good ideas from small operators, and most are ISPs, which gives them a new relationship with their customers. They know where their customers are and have a very nice entrepreneurial flow. It's hard for a big operator to do that. The big guys are building the scale. Now, we must find ways to bring the scale to the smaller guys," he notes.

Web TV has become one of the top issues at CableLabs.

HITS has quickly worked its way to the top of the scale, allowing smaller cable operators to compete with larger, better financed competitors. "As a concept, HITS allowed small operators to compete with DBS," says Green.

CableLabs' task to broker technological deals among several disparate industries is a daunting one, and Green has no illusions about the organization's many challenges. "From the business side, it's the alliances and partnerships that will make these technologies work," he says. A recent example is CableLabs' discussions with local broadcasters. "We need their local programming, and we can give them access to billing for pay services. The business models show this as a win-win."

Walking the technological tightrope with no net has enormous implications, which Green and CableLabs are well aware of. "Our technical initiatives and ideas come from many sources, and they work because we don't try and drive them. We listen, and must pick tasks and goals that apply to most members."

Which future tasks and goals are chosen by CableLabs and its members could help set the course for a new set of standards and produce a whole new industry, a concept whose time may have finally arrived. Concludes Peterson: "I wish CableLabs had been here 25 years ago." CED

Bringing digital services to the headend

Enhanced headend maintenance, part 4

By Linc Reed-Nickerson, Product Development Manager, TV/Communications Test Business Unit, Tektronix Inc.
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Previous articles in this series have looked at optimizing a headend for traditional analog services. This final article will examine steps to assure a smooth transition to digital with a minimum of problems for the subscriber. Generally, headends that are providing good analog performance will be "digital-ready."

Digital service started appearing about 1990 with digital music services. Later, the Sega Channel came on the scene with a different type of entertainment.

These services differ in digital format. Music Choice, for example, uses quadrature phase shift keying (QPSK), which is robust and immune to most cable system problems. Digital Music Express and the Sega Channel use nine states of quadrature partial response (9QPR) as a modulation scheme. 9QPR can transmit the data in about one-quarter of the bandwidth as QPSK, but is less immune to noise, reflections and other system problems. In systems deploying DMX and Sega, operators have often found that work was required to achieve optimum performance of these channels.

Video services are digitally transmitted using 64 QAM–that is, 64 states of quadrature amplitude modulation. Presently, the SCTE Digital Video Subcommittee, chaired by Paul Hearty of NextLevel, is developing a set of standards for the industry. The transmission system uses ITU-T J.83 Annex B, which describes a 64- and 256-QAM system. In Europe, DVB has defined a standard for cable, called DVB-C.

Figure 1: *Simplified trellis diagram showing valid transitions.*

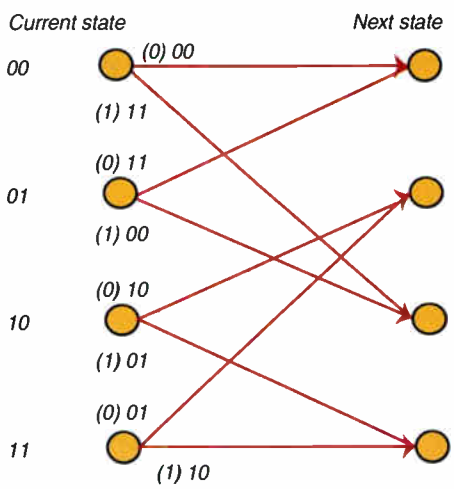


Figure 2: *Quadrature phase shift keying (QPSK) constellation diagram.*

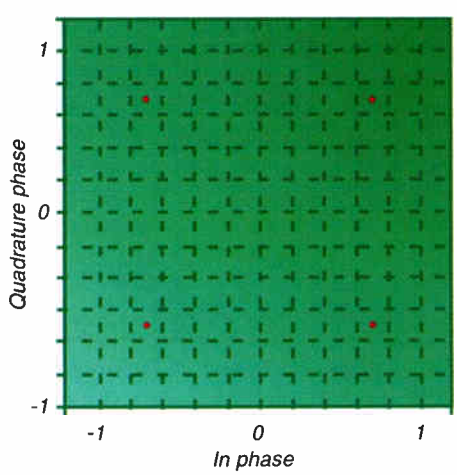
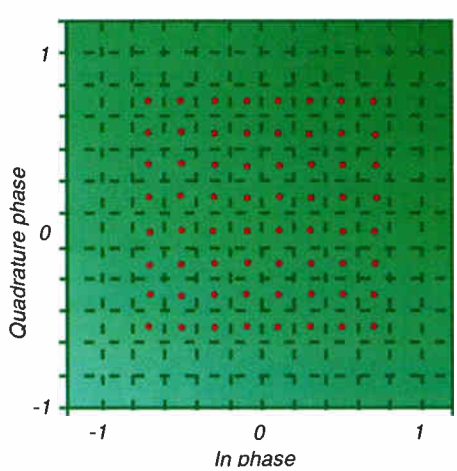


Figure 3: *64 Quadrature amplitude modulation (64 QAM) constellation diagram.*



How a digital system works

To better understand how to maintain a digital system, it is important to have an understanding of how it works.

The baseband digital signal goes through conditioning and error handling processes in the modulator. First, the data passes through a randomizer to assure that the RF signal has a flat spectrum. The randomized signal then goes to a Reed-Solomon encoder which works with the decoder in the receiver to provide error correction of short, bursty errors. Reed-Solomon coding adds extra bits that allow the decoder to correct some missing bits that may have been corrupted by short noise bursts. Noise bursts could be encountered that are too long for the Reed-Solomon to correct, so, after Reed-Solomon encoding, the data is interleaved.

An interleaver mixes up the order of the data sequence. Simply stated, the data is in sequential order entering the encoder (interleaver), i.e. a1, a2, a3, b1, b2, b3, c1, c2, c3. After interleaving, the data order would look like this: a1, b1, c1, a2, b2, c2, a3, b3, c3. A noise burst long enough to corrupt the b1, b2, b3 sequence would cause the loss of all "b" data, which Reed-Solomon could not reconstruct. In the interleaved example, the a2, b2, c2 bits would be lost, but two each a, b, and c bits would be preserved, leaving enough data for the Reed-Solomon decoder to correct the error. In the real system, the data sequences, of course, are much longer. A deinterleaver is used in the receiver before the Reed-Solomon decoder.

In much of the rest of the world, TV channels are 8 MHz wide, and the coding just described is all that is required to be DVB-C compliant. In the U.S. and countries with 6 MHz channels, an additional coding/decoding stage is used to carry the same payload in the narrower bandwidth. To accomplish this, the modulator uses Trellis encoding, which is sometimes referred to as convolutional encoding. Viterbi decoding is used at the receiver (set-top box).

Trellis coding achieves gain without bandwidth expansion. This would appear to violate the basic principle of the amount of data that can be transmitted in a given bandwidth (Shannon's Law). What is actually happening is called "coding gain." The tradeoff is in decoder complexity. A few years ago, trellis coded modulation was far too expensive to use in consumer products. With trellis coding, the minimum distance between points on the constellation that are likely to be confused is increased, but without adding power. This is done by an encoder where each incoming bit produces two bits at the out-

He Did It All Himself...

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put, but with a finite number of combinations output. Transitions between some states is not possible. The decoder can recognize these states.

The distance between points of the constellation with the state changes is maximized (hamming) to increase the likelihood the symbol will be correctly decoded in the presence of noise. The simplified trellis diagram, which looks a bit like the garden trellis from which the coding scheme got its name, illustrates the possible transitions. Figure 1 shows a simplified Trellis diagram.

The complement to the trellis encoder is the Viterbi decoder. The Viterbi decoder looks at a number of trellis transitions and is able to recognize an invalid transition. It is like listening to music in which a "sour" note is identified, and an accomplished musician can most likely replace the note with a correct one. Viterbi decoding works in a similar manner. A Viterbi decoder can be referred to as a maximum likelihood decoder.

A look at modulation schemes

Analog video deals with only amplitude modulation; the color subcarrier has both phase and amplitude modulation. Since 1995, cable operators have been required to make FCC color tests because problems in the modulator can cause signal distortion. There are a number of similarities between distortion of the color subcarrier and a digital signal.

The analog color subcarrier, QPSK and QAM all use amplitude and phase information to transport data. QPSK, shown in Figure 2, is rather simple, using a constant amplitude with the data transmitted using four different phase angles. A 64-QAM signal, Figure 3, uses eight different amplitudes and multiple phase angles. A system problem that causes nonlinear response, noise or an interfering signal can distort the desired signal to the point it will no longer be reliably decoded.

From this description, many assume that most of the impairments are likely to happen in outside plant. This is correct. But, keep in mind that, unlike analog services, digital services don't degrade gracefully. They fall over the cliff. Subscribers either have a near perfect picture or no picture at all. With a digital signal, just as with an analog signal, distortion accumulates. It is important to be certain the signal is leaving the headend with a minimum number of impairments.

And now for testing

At the headend, as well as in the field, there are certain measurements that can provide a good indicator of system health. Just as in working with analog, the most important adjustment for digital is levels. Many of the newer signal level meters will measure both analog and digital signals. However, be certain that the signal level meter is properly set up for the digital signal of interest. Digital signal levels are set 7 dB to 10 dB below those for analog signals.

With analog signals, the key interest is in the peak power of the carriers. With digital, you measure average power. Just as with analog, it is of the utmost importance that signal levels be set correctly, and that the ratio of analog to digital be maintained. With digital signals, it is also important to be certain the proper level is set from the satellite receiver decoder to the modulator.

Cable lengths are another issue. With analog, you can have relatively long runs of coax with minimal signal degradation. With the digital signal, long runs will cause roll off of the higher frequencies encountered with the digital signal and will result in degraded performance.

The common measurements for analog signals are carrier-to-noise, composite second order (CSO) and composite triple beat (CTB). For digital signals, intermodulation products (CSO and CTB), noise and ingress are combined in a single measurement called "desired to undesired" (D/U). D/U provides a single figure of merit number for all interference to the digital signal. Figure 4 shows the readout of a signal level meter displaying signal levels and D/U.

Once digital services have been installed and a digital signal level meter (SLM) has been used, to be sure the levels have been set correctly, use a

Figure 4a: *Signal level meter display of digital vs. analog signal level and desired-to-undesired ratio.*

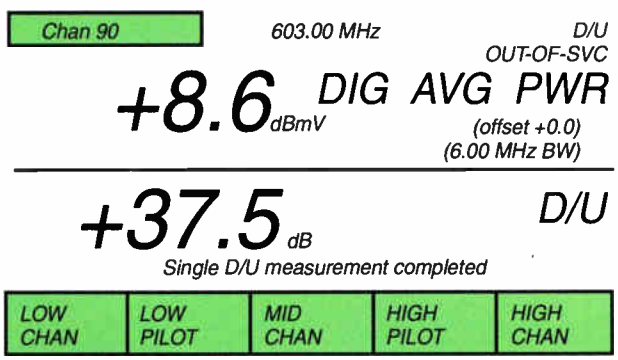


Figure 4b:

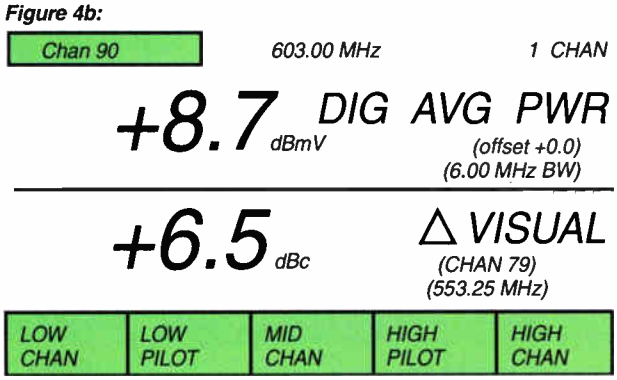
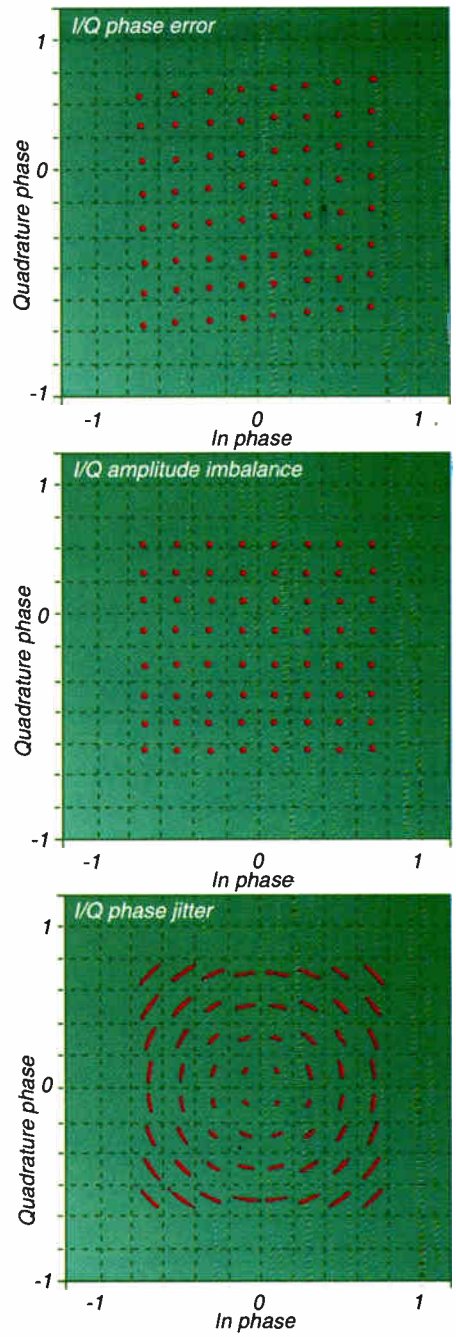


Figure 5: *64 QAM constellation diagram showing I/Q phase error, I/Q amplitude imbalance and I/Q phase jitter. Typically caused by modulator failure.*



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Measuring return system performance

A step-by-step guide

By Greg Davis, Network Specialist, Philips Broadband Networks Inc.
gdavis@pbni.attmail.com

When many of today's broadband networks were designed, transporting analog and digital downstream signals to the subscriber was the top priority. Deploying interactive services, like telephony and high-speed data transport, means that operators must now consider the impact of transporting more sensitive signals on a return path they either expected to use for convertor traffic, or never planned to use at all.

Among the issues which system operators and designers must now consider are:

✔the effect of carrier-to-noise (CNR) requirements on bit error rate (BER),

✔the effect of noise and ingress accumulation on performance requirements, and

✔the impact of installing network termination devices on performance requirements and the 2,000 homes-per-node architecture currently in place.

✔The effects of sporadic noise vs. Gaussian noise on BER, and

✔clipping limits vs. BER.

This article examines the first three items, offering some guidelines for return path design that will help operators plan for the introduction of new services.

Table 1: *CNR vs. BER for QPSK at 1 Mbps.*

CNR (dB)	BER	Error rate in time
17	$10E^{-4}$	100 errors/sec.
19	$10E^{-6}$	1 error/sec.
20	$10E^{-8}$	1 error/100 sec.
21	$10E^{-10}$	1 error/3 hours
22	$10E^{-12}$	1 error/100 days

Higher performance requirements

Providing interactive services like telephony and high-speed data means stepping up the performance requirements for the return path. Why?

First, although set-top traffic is vulnerable to noise, this vulnerability is not "real-time" sensitive. Most interactive boxes use telephone return, for which real-time is critical.

Second, noise and ingress accumulate through a system, and in the reverse, converge at first the node and then at the headend. When determining return path capabilities, operators and designers need to consider *both* BER and CNR performance, as well as operating windows for return amplifiers and transmitters.

In order to transport high-speed data and telephony services on the return path, operators and designers must consider the minimum acceptable bit error rate (BER), or the number of bit errors per second, that still allows the application to work. Then, operators and designers must consider the CNR (carrier-to-noise ratio) required to provide the desired BER. Table 1 shows how error rates for QPSK correspond to CNR.

Forward error correction can usually be maintained if the BER is less than 10^{-6}. Hence, for most systems, BER should be no less than 10^{-6}, with 10^{-8} being the most desirable, which corresponds to a combined CNR at the headend of 19 dB to 20 dB for QPSK data in a white noise environment. A T-1 rate QPSK channel occupies 1.4 MHz of bandwidth.

Achieving a 20 dB CNR in a white noise environment is practical and can be achieved. In practice, however, return paths will also experience other events like ingress in the RF plant and sporadic noise in the optical path. The reality is that real-world environments are not white noise environments. Planning for these events is difficult, but system operators and designers must still keep them in mind when building networks.

Noise in the return path comes from a multitude of sources, converging first at the node and then the headend. This phenomenon is known as the funneling effect. When determining the CNR of a specific return path/link, first calculate the CNR for each section of the return network (fiber link, RF section and network interface units).

The standard formula for calculating CNR for one amplifier (forward direction) is:

$$59 - NF + \text{Input level}$$

where 59 represents thermal noise for NTSC systems with 4.2 MHz bandwidth/channel.

This article deals specifically with T-1 rate QPSK, which is 1.4 MHz wide. Hence, we need to find the thermal noise figure for a 1.4 MHz/channel.

$$\text{thermal noise for 1.4 MHz/ch} = 59 + 10 \log \left(\frac{4.2}{1.4}\right)$$
$$59 + 4.77 = 63.8$$

Then, substitute the 63.8 for the 59 in the standard CNR formula.

To determine the CNR for an entire return HFC system, combine the CNR numbers according to the formula below.

$$CNR_{Total} = 10 \log \left(10^{\frac{-CNR_1}{10}} + 10^{\frac{-CNR_2}{10}}\right)$$

where:

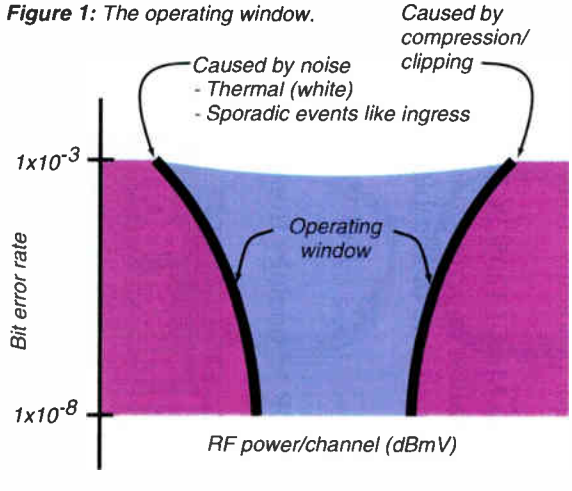
CNR_{Total} = Carrier/noise ratio at the headend.

CNR_1 = Carrier/noise ratio of the optical link between the node and the headend.

CNR_2 = Carrier/noise ratio of the RF return path to the node.

**Note: Sensitivity of the return system to changes in temperature will alter noise performance. These calculations assume an ambient temperature of 20°C. Depending on the environment in which the system resides, the system designer also has to consider thermal variations and the effect temperature changes have on signal levels.*

Figure 1: *The operating window.*



WHEN IT COMES TO RETURN PATH MAINTENANCE

CAPTURE INGRESS

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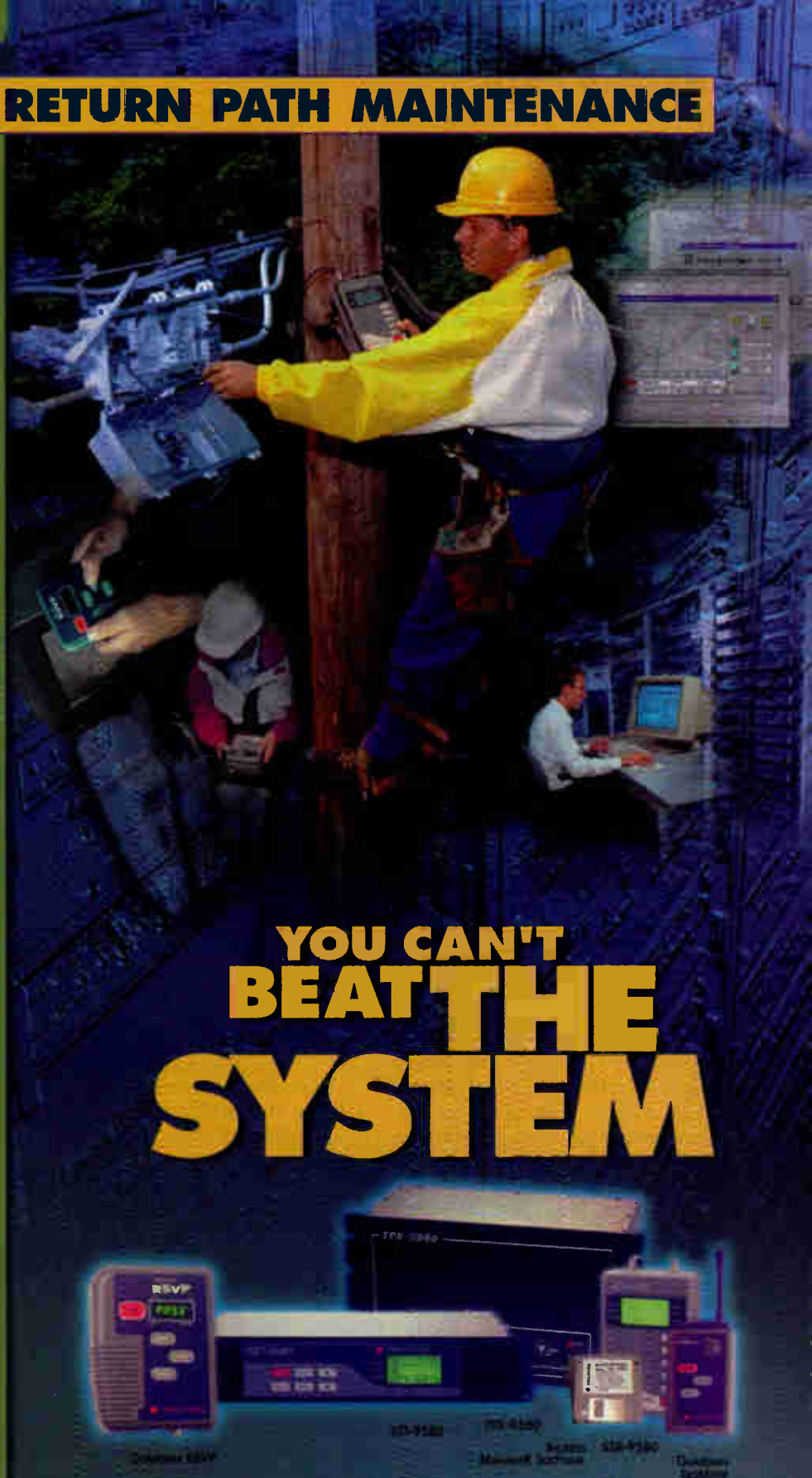

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Reader Service 41

Avoiding gridlock on the data infobahn

Port mismatches pose challenge

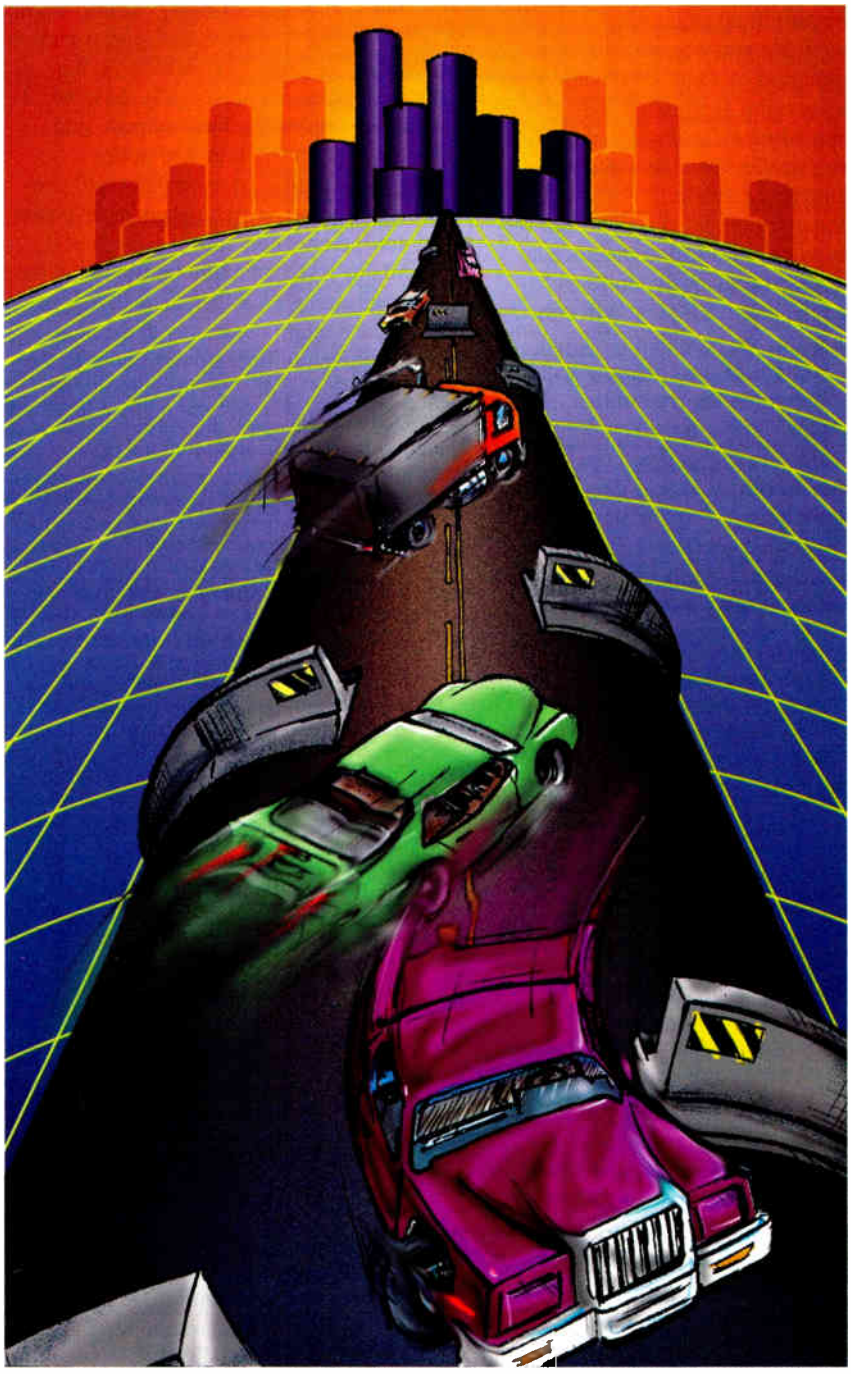

ILLUSTRATION BY BOB STEWART

By Mark Laubach, Chief Technical Officer, Com21 Inc. laubach@com21.com

The deployment of high-speed data services over all-coax and hybrid fiber/coax (HFC) networks has always been anticipated to follow a relatively straightforward implementation strategy. However, recent industry experience deploying cable modem termination systems (CMTSs) has uncovered an unforeseen and challenging system engineering issue when deploying new services over HFC systems.

The problem is a mismatch in CMTS upstream "ports" to the large number of return path "ports" on HFC systems. Adding more CMTS upstream ports places an operator in an undesirable upfront capitalization situation because the upstream costs would be well beyond the revenue stream during initial sparse deployment. This article illustrates the engineering problem that has been discovered and suggests how to avoid spending too much money before the subscriber revenue stream is in place.

The incremental growth story

In general, there are two engineering and business rules to follow when deploying high-speed data services on all-coax plants: first, the new service must be available to any and all subscribers in the headend serving area, typically a city or collection of adjoining towns; and second, the business model for deployment must incrementally add high-speed data CMTS equipment in concert with subscriber demand (capacity) and the associated gains in revenue.

All-coax cable television distribution plants are well-suited to the deployment of high-speed data services in that there are one to few downstream distribution coax trunks leaving the headend, and there are one to few upstream coax trunks entering the headend. For initial deployment scenarios, a single downstream transmit channel (e.g. single 64-QAM 30-Mbps digital data channel) can service the entire all-coax cable plant by distributing the same downstream signal to all downstream trunks.

Similarly, one or more CMTS upstream channels can share the same CMTS upstream port, which can also be coupled to more than one upstream trunks via an RF combiner. One or more upstream data channels can be supported by the CMTS gear, each separated by frequency. An upstream port is the F-connector which makes the 5-42 MHz upstream spectrum available to the CMTS gear.

The use of an RF combiner in the upstream to combine several trunks into one port is of limited use because the known noise funneling problem raises the noise floor at the port. The rise in noise floor is a combination of both background system thermal noise and of externally generated ingress noise.

These noise sources collectively form the impairment noise that must be overcome by the upstream data channel for any interactive service, including high-speed data services, impulse PPV and others. The number of upstream trunks that may combined is chiefly limited by the noise characteristics of the return plant. Some all-coax return plant trunks may be noisier than others.

Initial deployment of high-speed data services on all-coax plants can typically be accomplished using one

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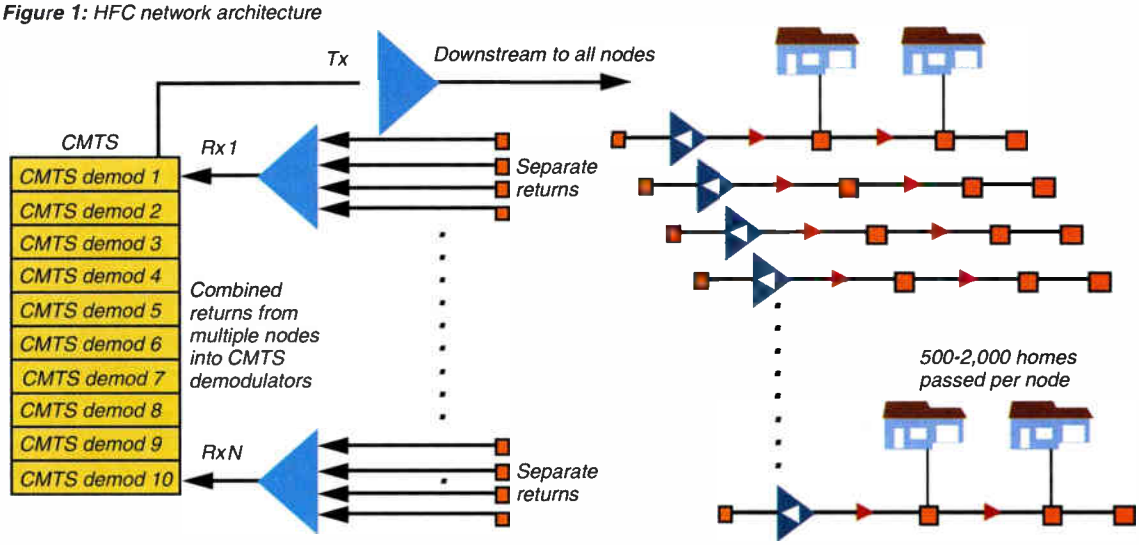
Figure 1: HFC network architecture



CMTS for the entire plant. Existing CMTS equipment typically comes in one of two scalability architectures: a "fixed" scale configuration with one downstream port and only one upstream port; or a "flexible" scale configuration with one or more downstream ports and one or more upstream ports. Incremental growth to meet new subscriber demand or capacity is different for fixed vs. flexible architecture.

Fixed-scale CMTS equipment requires an additional CMTS when subscriber growth calls for additional data capacity. With a flexible-scale CMTS, when more upstream capacity is needed, the cable operator can add an upstream channel demodulator (demod) card to the CMTS. When more downstream capacity is needed, the cable operator can add a downstream channel or purchase a new CMTS box.

There is a large difference between fixed- and flexible-scale CMTS systems. With a fixed configuration, the operator must recombine upstream trunks into as few ports as possible to avoid having to purchase a large number of fixed-scale CMTS boxes. With a flexible configuration, each upstream channel may be connected to a different upstream trunk, eliminating any need for the recombination of trunks. This has two benefits: first, the cost of an additional upstream channel is generally less than the cost of a fixed configuration CMTS box; and the noise floor is reduced at the upstream port, making the operator free to distribute to trunks and combine upstream trunks with a flexible scale system.

At some point in the growth of service deployment, more downstream capacity will be required to meet subscriber demand. In a fixed-scale CMTS, a new downstream channel is required for every upstream channel added and vice versa, regardless of whether the downstream or upstream channel capacity has been filled by demand. In a flexible-scale CMTS, the relationship of the downstream channels to the upstream channels within a single CMTS box are separately scalable, allowing the addition of downstream or upstream channels to follow demand.

In addition, this flexible scalability allows for capital expenditures to more closely match revenue growth, and also allows for noise impairment to be better controlled by use of more upstream ports per downstream channel. This latter point is very important in that the cable operator has much more flexibility in managing the recombination of upstream trunks and subsequent noise funneling issues.

When the downstream channel capacity has been exceeded, and not enough RF spectrum is available in the cable plant, the operator has the option of upgrading the plant to HFC. The upgrade will produce more upstream and downstream trunks. In an incremental HFC upgrade scenario, the operator has the option to do upgrades only where high-speed data capacity is needed, i.e., where the active subscribers and revenue are coming from. Upgrading the entire plant to HFC is not required.

Another option is to postpone the HFC upgrade for as long as possible. When ingress noise management is a motivation for upgrades, the cable operator has the ability to manage the noise. Options include keeping the plant tuned, using high-pass filters, or using more sophisticated, soon-to-be-available and affordable, intelligent switching filters. Combinations of these tools allow the cable operator to increase revenue growth before spending capital to upgrade the plant.

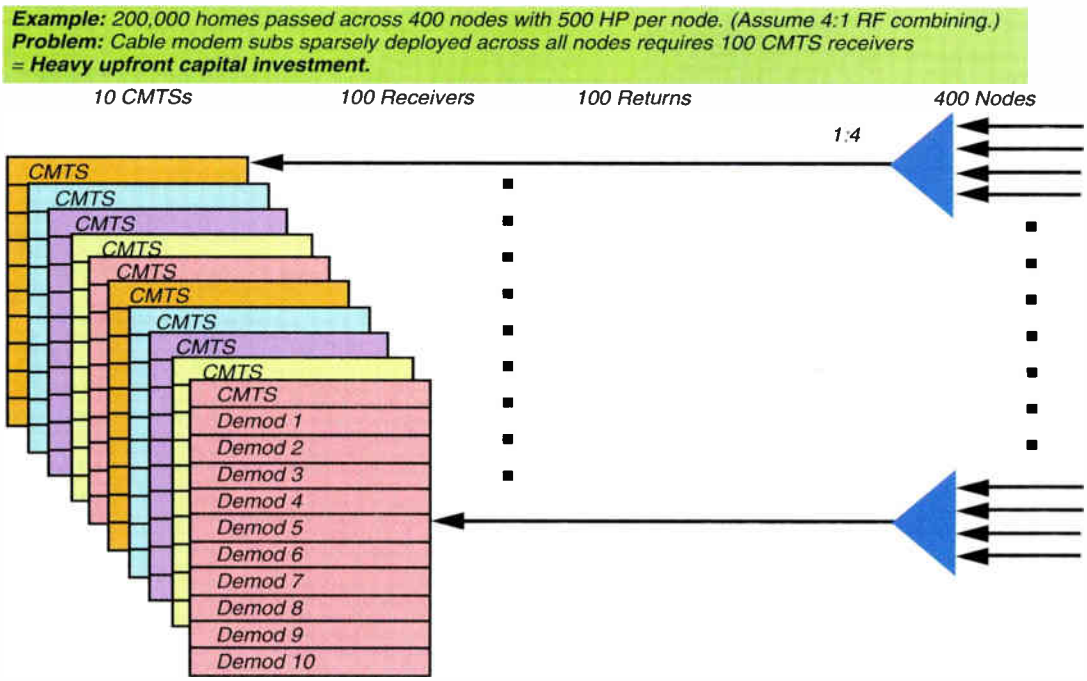
The cable modem handling capacity of CMTS equipment is also an issue and affects how and where cable operators must grow capacity to meet demand and capital spending. Some thoughts on how to get the most out of CMTS equipment are: use the highest available modulation available in the downstream and the upstream (i.e. 30 Mbps 64 QAM in the downstream, 2.56 Mbps QPSK or greater in the upstream); use FEC (forward error correction) on the downstream and upstream as bit errors reduce the number of modems supportable by the channel; use the data channel effectively by looking for superior performance and low delay; and use flexible-scale CMTS systems only, avoiding fixed, one-to-one scale CMTS systems.

An ideal world for high-speed data service deployment, business and growth is to upgrade to HFC only after having established a revenue stream from high-speed data penetration. Because the world is not ideal, new high-speed data services must be deployed on existing all-HFC plants. The issue that arises is the matching of CMTS upstream ports to the large number of cable plant upstream ports. The number of return ports is a direct function of node size (the smaller the node, the more ports). The ability to recombine upstream trunks is directly influenced by thermal noise issues of return path lasers and by ingress noise management.

The following example illustrates the return port abundance problem. Assume a small, 20,000 homes-passed plant is converted to all-HFC with a node size of 500 homes passed. This yields 40 separate returns. Assume that Fabry-Perot (FP) lasers have been used for the upstream returns based on their affordability. Typical FP lasers allow a recombination of four upstream trunks into one upstream port.

With fixed-scale CMTS equipment, 10 boxes are required. Worst-case economic impact would be that where one box might

Figure 2: *Return aggregation: example*



have supported the entire previous all-coax plant, nine additional boxes are now required.

With flexible-scale CMTS equipment, one box is required, provided it supports 10 upstream return ports. The one box might have supported the previous all-coax plant and just rolls over to support the new HFC plant. Capital may be needed to purchase additional upstream channel demodulator support for the CMTS.

Smaller node sizes increase the number of upstream return trunks. In the above example, if the node size was 2,000 homes passed instead of 500 homes passed, then the number of returns trunks would have been 10, not 40. Ten return trunks could be recombined into three upstream return ports.

The port mismatch problem gets worse with larger systems. A typical 50,000- or 200,000-homes-passed system greatly multiplies the number of upstream return ports. In the 20,000-home example, a system which passes 200,000 homes has 10 times the number of return trunks (i.e. 400!). Recombination yields 100 return ports, which is still a large number of ports that must be supported by CMTS equipment.

Figure 3: Recommendations for all-coax plants.

- *Hold off HFC upgrade for as long as possible:*
  - *Use better modulation techniques: efficiency, robustness.*
  - *Use CMTS solutions that support flexibility for changing plant.*
  - *Go back to looking at filters, especially active filters.*
  - *Plan on using same CMTS equipment after upgrade as before.*
- *Know where the service is before committing to an upgrade:*
  - *Only upgrade plant where there is service demand.*

The design goal for node sizes for HFC plants is on the order of 500 HHP. This goal is still valid in light of this port mismatch problem; however, it is difficult to support in initial deployment of interactive services. A better idea would be to start with 2,000 HHP or 4,000 HHP-sized nodes, while laying sufficient fiber to downsize to 500 HHP per node in incremental steps, as service demand and revenue grow.

Initial sparse deployment problem

Recall that service must be made available to the entire serving area. From the previous example, the worst subscriber support scenario would be one sub per upstream return port. The available revenue from 100 subscribers is not sufficient to purchase CMTS equipment with 100 upstream return channels. Note that in this scenario, one downstream data channel is sufficient to supply services to any subscriber in the serving area until such a time as when demand exceeds the capacity of that single channel.

Recombining return trunks at a greater ratio than four-to-one causes noise funneling contribution and reduces the carrier-to-noise ratio below a 25 dB margin at the upstream return port. This ratio is being used by several cable operators. Converting the upstream lasers from FP to direct feedback (DFB) lasers allows the upstream return trunks to be recombined at a ratio of up to 10-to-one, which is attractive. If the plant currently has FP lasers, the cost differential to go to DFB is substantial, and in most cases prohibitive.

A high noise floor interrupts all upstream modulation schemes in an HFC plant. The ability to recombine upstream return trunks is limited by the lowest capable interactive service; for example, impulse pay-per-view, interactive two-way node management protocols, etc. The recombination problem affects more than just high-speed data services for Internet.

Solutions for the initial sparse deployment scenario are few. Either buy sufficient CMTS equipment to cover the upstream return ports, or look into solutions that recombine data but do not recombine noise. Look toward CMTS solutions that support a large number of upstream return ports per downstream port.

Summary

A port mismatch problem exists when deploying high-speed data services on new HFC plant. This problem results in the economic reality that more CMTS boxes must be purchased than the initial sparse subscriber capacity requires, or the revenue stream comfortably allows. Upstream trunk port combiner techniques that recombine high-speed data streams but do not recombine noise impairments are both clearly and desperately needed in the industry. When available, these devices and techniques will help cable operators better match capital growth with revenue growth in the initial deployment of high-speed data services on HFC systems.

This article suggests holding off doing HFC upgrades for as long as possible, using techniques for managing noise impairments, such as high pass filters or newer technology intelligent switching filters. When upgrading to HFC, do so in an incremental fashion by only upgrading plant where there is a service demand and a revenue stream. Start with large node sizes and then, if needed, incrementally decrease toward 500 HHP as service and revenue increase. CED

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FILTERS

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DISTRIBUTION EQUIPMENT

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People on the move

John Mulcair has been named president and chief operating officer at Alpha Technologies. Mulcair comes to Alpha with a diverse background in the aerospace, electronic security, and high-tech battery and UPS industries. As part of his new position, he will become a member of the company's newly-formed executive committee.

Borchert

Riser-Bond Instruments has announced a change in management. **Marshall Borchert** has become chief executive officer. He has served as the company's president since its inception in 1981.

Campbell

Walter "Duff" Campbell II has been appointed as the company's new president. Campbell joined Riser-Bond in 1982, and served most recently as vice president for sales and marketing.

CableLabs has named **Christopher Lammers** as chief operating officer. Most recently, he was president and CEO of Western Communications, a cable MSO serving 330,000 subscribers. He holds a law degree from the University of Chicago Law School and a bachelor's degree with distinction in psychology from Stanford University.

Greg Bicket has been named chief operating officer at Online System Services (OSS). A 20-year veteran of the cable industry, Bicket has held a number of positions, including two years as CEO for TCI Argentina. He subsequently worked for TCI's International Group, TINTA, in Chile, Brazil, Venezuela and Mexico. He holds a Master of Business Administration from the University of Phoenix at Denver and a bachelor's in finance from the University of Illinois.

TV/Com International Inc., a subsidiary of Hyundai Electronics, has announced the appointment of **Jeff Wallin** as president and CEO. He succeeds Bob Luff, who was recently named as vice chairman of the TV/Com board of directors.

Wallin

Since September 1996, Wallin has served as the company's vice president of marketing and sales. Previously, his work included senior positions at Snell & Wilcox, General Instrument (now NextLevel Systems), and Teledyne Ryan Electronics.

ADC Telecommunications Inc. has announced the promotion of **Robert Switz** to the position of senior vice president and chief financial officer. In his new position, he will be responsible for all financial, legal, information systems and facilities groups.

Switz first joined ADC in January 1994 as vice president, chief financial officer. Prior to that, he was employed for six years by Burr-Brown Corporation, where he served as chief financial officer and director for ventures and systems business. He holds a B.S. in marketing/economics and an M.B.A. in finance.

ADC has also announced the appointment of **Frank Little** as vice president of engineering for the Broadband Communications Division. He joins the company after having served most recently as Antec's vice president of strategic planning for its Actives Division of the Network Technologies Group. In his new ADC position, Little will oversee the development of all digital and broadband linear fiber transmission products.

In another promotion, **Jack Pogge** has been named president and chief operating officer for CSG Systems International Inc. He has also been appointed to CSG's board of directors. Most recently, he served as the company's executive vice president.

Pogge

Prior to his current assignment, Pogge served in various executive positions, including vice president of corporate development for US West Inc., vice president and general counsel at Applied Communications Inc., and as a partner in the law firm of Richards, Riekes, Brown & Zabin, P.C. He holds a bachelor's degree in business administration-finance from the University of Houston and a juris doctorate degree from the Creighton University School of Law.

Rifkin & Associates Inc. has announced a series of appointments to its corporate staff. **Lee Clayton** has been named vice president of marketing, where she will evaluate each R&A system's current product offerings, prices and overall marketing and communications strategy. **Al Fosbenner** steps into the company's vice president-controller position. Most recently, he was vice president of finance for Interactive Television Network. In his new position, Fosbenner will oversee the day-to-day accounting activities of R&A.

Elizabeth Suarez has joined R&A as its director of new business development. She will be responsible for identifying and obtaining commercial and residential accounts for non-traditional cable services (e.g., data transmission, Internet access, telephony, etc.). **Patrick McDonough** has been named to the newly-created position of director of engineering. He comes to R&A from United International Holdings, where he served as vice president of engineering.

The Jones Internet Channel has named **James Ginsburg** as chief technology officer and executive vice president. During his 25-year career, he has spent 15 years working with Jones International subsidiary companies. In his new position, Ginsburg will help manage the rollout of the company's high-speed Internet and content product launches in cable television systems. He comes back to Jones after having served most recently as vice president/advanced information technologies for Tele-Communications Inc.

Ginsburg

Antec has announced that **Jack Bryant**, formerly senior vice president and president of its Digital Systems Division, has been promoted to executive vice president-sales for Antec Network Technologies. Bryant has 18 years of technical sales and marketing experience and has been with Antec since 1991.

Columbine JDS has announced the promotion of **Mark Eagle** to senior vice president/director at its headquarters in Golden, Colo. Previously, he was vice president and general manager of the company's

New York office. In his new role, he will take responsibility for development of the company's product development and testing, as well as special development projects.

Harmonic Lightwaves Inc. has announced the appointment of two new executives. **Kirk Flatow** has been named vice president of international sales. Most recently, he was vice president of business development at Flextronics. Prior to joining Flextronics, Flatow was founder of nChip, a semiconductor packaging company later acquired by Flextronics.

Flatow

Harmonic also announced that **Ed Thompson** has been named as vice president of new business development. He comes to the company from Hyundai Electronics America, where he served most recently as executive director for business development. In his new position, Thompson will be responsible for expanding Harmonic's business into new areas of the fiber optic and digital video markets, as well as investigating and developing new opportunities for the company within the communications industry.

Thompson

NextLevel's Broadband Networks Group has announced a number of executive promotions and the creation of a dedicated customer accounts position. **Geoffrey Roman** has been named senior vice president and general manager for sales and support. A 15-year company veteran, Roman was most recently senior vice president and general manager of the company's Telecommunications Strategic business unit. In his new position, he will be responsible for worldwide sales and customer accounts.

In other NextLevel promotions, **Matthew Aden** has been promoted from vice president, international sales and support to senior vice president for worldwide sales; **Charles Dougherty** has moved from vice president of marketing for the Transmission Network Systems business unit to vice president for the company's newly-created customer accounts function. This division-wide service organization will integrate all aspects of customer service, field engineering, technical response, customer training and NETAdvantage professional services.

In addition, NextLevel has announced the appointment of **Ed Ebenbach** as vice president, logistics and project management. He will have responsibility for worldwide logistics and will lead the company's efforts to support TCI's digital deployment projects.

Scientific-Atlanta Inc. has selected **David Levitan**, a nine-year S-A veteran, to lead a new management team to bolster the company's ability to develop, deliver and market SkyRelay interactive satellite data VSAT products. As vice president of satellite data networks, Levitan will head a team comprised of directors and managers in research and development, systems engineering, finance, product marketing, program management, service quality and human resources. In addition, S-A's Network Operations Center, which monitors and supports U.S. and international VSAT customer networks, is also under Levitan's direction.

Time Warner's Excalibur Group has announced a number of new hires and promotions in its business development, technical and marketing groups for its broadband on-line service, Road Runner. **Cathy Talmadge** has been named vice president, affiliate development in the Business Development department; **William Nazaret** has been appointed vice president of Internetworking products; and **Paul Hart** has been selected as director of operational support engineering in the company's Technical department.

Road Runner promotions include **Malia Flynn,** who has been promoted to affiliate marketing manager, and **Mike Murphy**, who has been promoted to software engineer in the Technical department.

George Holmes has been appointed vice president of broadband sales at Ortel Corporation. Prior to joining the company, Holmes served as vice president of worldwide sales for Level One Communications Inc. In his new position, he will direct Ortel's worldwide broadband sales organization and continue the company's expansion into the cable television/telecommunications industry through OEMs and system integrators.

Holmes

Trompeter Electronics Inc. has named **Dale Reed** as vice president of marketing.

Reed

He comes to Trompeter from Soladyne, where he was general manager. Prior to that, he held positions as division manager, marketing manager, controller and field sales engineer during 23 years with Rogers Corporation. Reed has authored many technical papers and holds an M.B.A. from Georgia State University. In his new position, Reed will oversee all product marketing, facilitate the development of new products and direct the company's advertising program.

Microware Systems Corporation has announced three new appointments to its management team. **Derek South** has been named vice president for North American sales. Most recently, South served as president and co-founder of Automated Testing Solutions Inc. He received his bachelor's degree in electrical engineering from the University of Virginia in 1975.

Neil Guy has been appointed Microware's vice president of professional services. He brings 15 years of business and technology consulting experience to the new position. Previously, he was vice president of business and systems development for Briggs Corporation, and director of information planning for Meredith Corporation. He received his master's in business administration from the University of Iowa in 1984.

Microware also announced that **Stephen Bashada** has been named vice president of marketing. Most recently, he was president of Tarkenton Net Ventures, an Internet start-up company, where he developed an interactive multimedia educator and turnkey solution to help businesses market themselves on the World Wide Web. In his new position, Bashada will be responsible for enhancing the company's overall marketing strategy.

Cromwell

Mark Cromwell has joined Celerity Systems Inc. as vice president of engineering. Most recently, he was vice president of transmission product engineering at DSC Communications. During his career, Cromwell has also held positions at AMF Control Systems, Chrysler Corp. and General Dynamics. CED

Advanced Networking

C-COR Electronics, Inc. Circle # 28, 29
C-COR's RF amplifiers. AM headend equipment, digital fiber optics, and customized service and maintenance provide global solutions for your network. p. 54-55. 57

NextLevel Systems, Inc./Broadband Networks Group Circle # 19
GI/NextLevel Broadband Networks Group is a worldwide market leader in digital and analog set top systems for wired and wireless cable television networks. p. 37

NextLevel Systems, Inc. (Corp. HQ) Circle # 27
GI/NextLevel Broadband Networks Group is a worldwide market leader in digital and analog set top systems for wired and wireless cable television networks. p. 53

Construction Equipment

Telecrafter Products Circle # 4,
Supplies drop installation products for CATV, DBS, and wireless operators. single and dual cable fastening products, identification tags, residential enclosures. p. 8

Datacom Equipment

Hayes Microcomputer Products, Inc. Circle # 42 p. 91

ISC Datacom Circle # 43
Manufactures frequency-agile RF modems and translators. Modem speeds to 64 kbps. Builds electronics to specifications. p. 92

Terayon Corporation Circle # 9 p. 17

Distribution Equipment

Alpha Technologies Inc. Circle # 2
World leading manufacturer of power conversion products, widely used in cable television, telecommunications, and data networks around the world. Offer a complete line of AC and DC UPS systems, line conditioners, batteries, and accessories. p. 5

Lindsay Electronics Circle # 25
Focused on the last mile, our revolutionary new technology creates 1 GHz communication amplifiers, passives, taps, and subscriber materials to solve system problems before they become subscriber problems. p. 50

Philips Broadband Networks Circle # 24
A global supplier of broadband RF and fiber optic transport equipment, is also a leading provider of advanced systems used to access broadband telephony and data services. p. 48-49

Distributors

ITOCHU Cable Services Circle # 8
iCS, Inc. is a leading full service stocking distributor. iCS operates ten sales offices and nine warehouses conveniently located in North and South America. p. 15

TeleWire Supply Company Circle # 12, 39
TeleWire Supply is a leading nationwide distributor of products needed to build and service a broadband communications network. p. 23, 83

Fiber Optic Equipment

Corning Incorporated Circle # 18, 21
The Corning Optical Fiber Information Center gives you FREE access to the most extensive fiber-optic library in the industry. p. 35, 40-41

Pirelli Cable Corp. Circle # 10
Leading manufacturer of fiber optic loose tube, ribbon, interconnect, and distribution cables. Supplier of connectivity systems including connectorized cable assemblies, drop cable, distribution panels, adapters, and optical fiber access tools. p. 19

Synchronous Group Inc. Circle # 33
The Actair and Antares 1550nm external modulation transmitters offer outstanding performance and the best specifications in the industry. Perfect for super trunks and direct distribution. p. 65

Headend Equipment

ADC Telecommunications, Inc. Circle # 1
Leading global supplier of transmission and networking systems. The company holds a preeminent market position in physical connectivity products for fiber optic, twisted pair, coaxial and wireless networks worldwide. p. 2-3

Barco, Inc. Circle # 34
BARCO's Gemini Upconverter is an ideal alternative to conventional modulators for hub site headends. accepts digital or analog IF inputs and saves cost and space. p. 69

Blonder-Tongue Laboratories, Inc. Circle # 13, 51
Quality manufacturer of headend equipment (including pre-fabricated headends), reception, distribution, MDU interdiction products and test equipment. p. 61

Dawn Satellite Circle # 22
Dawn Satellite offers technical information and competitive prices on products such as: satellite "dish" antennas, satellite receivers, digital ready LNBs, modulators, processors and a wide variety of related products. p. 43

FrontLine Communications Circle # 36
FrontLine Communications manufactures patented, field proven, Emergency Alert and PC-based Character Generator products to fulfill the needs of cable and other multi-channel system operators. p. 73

Harmonic Lightwaves, Inc. Circle # 7
Worldwide supplier of highly integrated fiber optic transmission, digital headend and element management systems for the delivery of interactive services over broadband networks. p. 13

Microwave Filter Co., Inc. Circle # 45
Passive electronic filters, traps and filter networks for interference elimination and signal processing at the TVRO, headend and distribution equipment. p. 95

Monroe Electronics, Inc. Circle # 46
We supply rack mounted or cased cue tone encoders/decoders. Also, timers, A/V and RF/IF switches and other control products. p. 95

Scientific-Atlanta Circle # 48
Scientific-Atlanta's new Continuum™ Headend System for analog and digital applications. This features a vertical packaging design which allows for up to forty front-loaded modules to fit into a standard 70" rack. p. 116

SeaChange International, Inc. Circle # 32
SeaChange International - leader in digital video delivery systems including ad insertion, NVOD/VOD Movie System, T & B, and Broadcast Play-To-Air Solutions. Backed by world-class Media Cluster technology and customer service focus. p. 63

SkyConnect Circle # 23
SkyConnect meets the demands of the growing cable advertising industry by offering the most complete digital advertising solutions available. p. 47

Standard Communications Circle # 3
The industry's leading manufacturer of rebroadcast quality satellite reception and RF broadband products. Delivering programs to thousands of CATV and SMATV systems. p. 7

Spectrum Circle # 37
The Sub-Alert utilizes the advanced features of the Sage Endec for total automation and will interface with your headend by IF, baseband video or comb generator. p. 42-43, 74

Services

International Engineering Consortium (IEC)
A nonprofit organization dedicated to advancing the field of business and engineering in the information industry through noncommercial and university programs. p. 75

TCS Communications Circle # 44 p. 93

Subscriber Equipment

Pace MicroTechnology Circle # 26 p. 51

Pioneer New Media Tech. Circle # 11, 13
Manufactures advanced analog and digital CATV terminal featuring interactive functions, as well as controller software. p. 20-21, 24-25

Telecom Equipment

Fujitsu Network Communications Circle # 30
Manufactures and markets advanced SONET transport and access equipment which mazimizes network operational capacity and services. p. 59

Test Equipment

AM Communications Circle # 47
OmniStat by AM is the worldwide choice for monitoring HFC telecommunications networks. It is the standard for ADC, NEXT Level, Philips and Scientific-Atlanta. p. 115

Cable Leakage Technologies Circle # 38
With the FCC imposing stiff fines for leakage, CLT presents operators with the only sure, comprehensive method of locating and documenting the nearest street address of system faults/signal leakage. And it's totally automatic. "WAVETRACKER". p. 81

Cable Resources, Inc. Circle # 17
Cable Resources Inc. has introduced an efficient new tool to activate and maintain broadband return networks. HFC networks require a concrete and repeatable test for 2 way operations - The RDU® - Return Display Unit. p. 33

Hewlett-Packard Company Circle # 5, 16
Hewlett-Packard offers a comprehensive range of test equipment to keep your entire broadband system at peak performance - from headend to subscriber drop. p. 9, 30-31

Riser Bond Instruments Circle # 40
Manufacturer of TDRs with unique and exclusive features to locate and identify faults and conditions in metallic two conductor cable. p. 85

Sadelco, Inc. Circle # 35
Sadelco, Inc. manufactures SLMs for CATV. Minimax meters can now provide accurate reading of the average power of all digital channels. p. 72

Sencore Circle # 14
Sencore designs and manufactures a full line of CATV, Wireless CATV, QAM and MPEG-2 test instruments. Each instrument is designed to meet your system analyzing and troubleshooting needs with exclusive tests and measurements. p. 27

Trilithic, Inc. Circle # 15, 41
Trilithic manufactures test equipment for the CATV and LAN industries and components for aerospace and satellite communications. Key products are SLMs, leakage detectors, and a comprehensive line of return test equipment. p. 29, 87

Wavetek Corporation Circle # 6
Manufactures equipment for CATV, telecommunications, wireless, and general purpose test. CATV equipment includes signal level, analysis, and leakage meters, sweep and monitoring equipment. p. 10-11

Companies in this issue

The following companies are cited in articles and features in the current issue. Page numbers refer to where the initial mention takes place in a particular story. Listings do not include some departments.

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http://www.ras.com/mwfilter/mwfilter.htm

Monroe Electronics, Inc.
http://www.monroe-electronics.com

NextLevel Systems, Inc./Broadband Networks Group
http://www.nlvl.com

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http://www.nlvl.com

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http://www.pace.co.uk

Philips Broadband Networks
http://www.be.philips.com/pbn

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NOVEMBER

5 Emerging Video and Telecommunications Technologies, produced by Tektronix Inc. Location: Raleigh, N.C. Call (800) 763-3133.

6-7 Operating RF-IPPV Systems, produced by Scientific-Atlanta Institute. Location: Atlanta. Call (800) 722-2009, press "3" when prompted.

7 Emerging Video and Telecommunications Technologies, produced by Tektronix Inc. Location: Atlanta, Ga. Call (800) 763-3133.

11 Emerging Video and Telecommunications Technologies, produced by Tektronix Inc. Location: Dallas, Texas. Call (800) 763-3133.

11-12 Wheat State SCTE Chapter, Testing Session. BCT/E certification exams to be administered. Location: Wichita, Kan. Call Vicki Marts (316) 262-4270.

12 Mid-South SCTE Chapter, Testing Session. BCT/E certification exams to be administered. Location: Memphis, Tenn. Call Kathy Andrews (901) 365-1770, ext. 4110.

12-1/15 Return Path Test Seminar, presented by Hewlett-Packard. Call (800) 765-9200 for dates and locations.

17-21 Hands-On Fiber Optic Installation for Local Area Networks (Multimode and Singlemode), produced by Siecor Corp. Location: Hickory, N.C. Call (800) 743-2671, ext. 5539 or 5560.

18-20 Cable Television Technology, produced by C-Cor Electronics Inc. Location: Fremont, Calif. Call C-Cor Technical Customer Services (800) 233-2267, ext. 4422.

19-20 Planning, Implementing and Managing Network Telephony, produced by ICM Conferences Inc. Location: Las Vegas, Nev. Call Eric Beauchamp (312) 540-3854.

21 Emerging Video and Telecommunications Technologies, produced by Tektronix Inc. Location: Santa Clara, Calif. Call (800) 763-3133.

Trade shows

December

10-12 The Western Cable Show. Location: Anaheim, Calif. Call the CCTA at (510) 428-2225.

January

8-11 Consumer Electronics Show (CES). Location: Las Vegas, Nev. Call (703) 907-7600.

28-30 SCTE Emerging Technologies Conference. Call the SCTE at (610) 363-6888.

February

25-27 The Texas Cable Show. Location: San Antonio, Texas. Call (512) 474-2082.

March

TBD SCTE Telecommunications Vendors Day. Location: Omaha, Neb. Call Riser Bond Instruments (402) 466-0933.

April

20-23 COMDEX Spring '98. Location: Chicago. Call Softbank (617) 433-1500.

May

3-6 National Show '98, produced by the National Cable Television Association. Location: Atlanta. Call the NCTA (202) 775-3669.

June

10-13 SCTE Cable-Tec Expo '98. Location: Denver, Colo. Call (610) 363-6888.

DECEMBER

1 Introduction to Digital Video Systems, produced by Scientific-Atlanta Institute. Location: Atlanta. Call (800) 722-2009, press "3."

8-9 Fiber Optic Network Design, produced by Pearson Technologies Inc. Location: Washington, D.C. Call (800) 589-2549.

8-11 Hands-On Fiber Optic Installation for Outside Plant Applications, produced by Siecor Corp. Location: Hickory, N.C. Call (800) 743-2671, ext. 5539 or 5560.

15-18 Hands-On Fiber Optic Installation, Maintenance and Restoration for CATV Applications, produced by Siecor Corp. Location: Hickory, N.C. Call (800) 743-2671, ext. 5539 or 5560.

JANUARY

6-8 Taiwan Broadcast and Communications '98. Location: Taipei, Taiwan. Call *Cable & Satellite Magazine* 011-886-2778-5818.

8-9 Telecommunications Fundamentals, produced by American Research Group. Location: Morristown, N.J. Call (919) 461-8600.

26-27 Telecommunications Fundamentals, produced by American Research Group. Location: Chicago, Ill. Call (919) 461-8600.

26-29 ComNet '98. Location: Washington, D.C. Call MHA Event Management (800) 545-3976.

FEBRUARY

2-4 Wireless Cable International's Winter Show. Location: Singapore. Call the Wireless Cable Association (202) 452-7823 for additional information.

8-11 CompTel '98. Location: Las Vegas, Nev. Call the Competitive Telecommunications Association (202) 296-6650 for more information.

8-12 1998 Western ComForum. Location: Dallas, Texas. Call the International Engineering Consortium (312) 559-4600.

10-12 Australasian Cable & Satellite Exhibition & Conference. Location: Sydney, Australia. Call AIC Conferences 011-61-2-9210-5700.

17-19 Philips Broadband Networks Mobile Training Center. Location: Albuquerque, N.M. Call (800) 448-5171, or (315) 682-9105.

22-27 OFC '98 (Optical Fiber Conference). Location: San Jose, Calif. Call the Optical Society of America (202) 416-1980 for additional information.

23-25 CTIA's Wireless '98. Location: Atlanta, Ga. Call the Cellular Telecommunications Industry Association (202) 785-0081.

24-26 Philips Broadband Networks Mobile Training Center. Location: San Antonio, Texas. Call (800) 448-5171, or (315) 682-9105 for additional information.

MediaOne, DEC conclude trial

BOSTON–MediaOne has announced the successful completion of a high-speed data telecommuting trial with Digital Equipment Corporation. Digital will roll out MediaOne Express service to its telecommuting employees by the end of the year.

"We are increasingly relying on telecommuting to meet the needs of our rapidly-changing business environment, and a high-speed secure connection to the office is absolutely critical," says Laurence Cranwell, Digital's director of corporate telecommunications. ". . . Using MediaOne Express and Digital's AltaVista Tunnel 97 software, our telecommuters can access their network resources safely and securely."

Digital employees involved in the trial worked from home and connected to the Digital corporate network via MediaOne's broadband infrastructure.

Lemco, TeleWire re-establish agreement

COGAN STATION, Pa.–Lemco Tool Corp. and TeleWire Supply have re-established distribution ties. Under the agreement, TeleWire will inventory the full line of Lemco splicing, installation and aerial construction tools, according to a statement by Lemco.

"The sales coverage and overall customer service capabilities that TeleWire can offer for our products will significantly enhance our profile in the industry," said Rick Jubeck, national sales manager for Lemco.

Pace builds millionth digital receiver

SHIPLEY, U.K.–Pace Micro Technology plc held a ceremony at the company's headquarters in Shipley recently to announce the manufacture of its one-millionth digital set-top box. John Battle, Minister for Science, Energy and Industry, was on hand to dedicate a plaque commemorating the milestone and was presented with set-top number one-million.

Pace began manufacturing digital receivers in July 1995, building 360,000 in the year ending May 31, 1996. In the year ending May 1997, the company produced an additional 503,000 digital receivers.

Philips to supply Century with fiber link

MANLIUS, N.Y.–Century Communications' Mendocino County, Calif. systems recently selected Philips Broadband Networks to supply a fiber optic backbone system to support "Distance Learning Television," an educational partnership formed between the cable operator and nearby Mendocino College in the spring of 1996. Century Mendocino is in the process of designing a fiber link from the college to its main headend facility in Ukiah, Calif.

Mike Cline, general manager of Century Communications' Mendocino County, Calif. system, inspects a Philips node in preparation for the installation of a fiber optic backbone to support "Distance Learning Television."

The fiber backbone was necessary to increase the volume of educational programming, according to Michael Cline, general manager of Century Mendocino.

"Presently, videotapes are cycled from the college for insertion at the headend, which limits the number of classes broadcast each day." said Cline, in a statement. "By connecting the college to the plant with fiber optics, classes will be able to run consistently, including live broadcasts directly from the college."

In 1991, Century Mendocino and Philips embarked on a successful program to reduce amplifier cascades, improve proof-of-performance statistics and the reliability of the broadband systems throughout Mendocino County.

Tektronix to buy Siemens' test gear biz

WILSONVILLE, Ore.–Tektronix Inc. has announced an agreement to purchase Siemens Communications Test Equipment GmbH, a wholly-owned subsidiary of Siemens based in Berlin. The cash transaction has been approved by the Tektronix board of directors and was expected to close by the end of September.

Siemens Communications Test Equipment had revenues of about $60 million in its last fiscal year. All of the company's 230 (approximate number) employees who are based in Berlin are expected to join Tektronix. In addition, about 15 employees based in Stockholm and a majority of the 45-person worldwide salesforce are expected to sign on.

The purchase strengthens Tek's position in the communications test market, says the company, one of the higher growth segments of the overall market for measurement products.

Harmonic to supply 21st Century net

SUNNYVALE, Calif.–21st Century has selected Harmonic Lightwaves Inc. to supply the opto-electronic and network management products for 21st Century's new Chicago area network. The equipment that will be installed in the new system includes PWRLink DFB transmitters, MAXLink 1550 nm transmitters and optical amplifiers, NETWatch Element Management System hardware and software, optical nodes and return path equipment.

21st Century, a competitive communications provider, is building a distributed ring-star (DRS) network based on a state-of-the-art fiber architecture. The architecture will provide advanced network capabilities for delivering high-quality video, voice and data services to customers along Chicago's lakefront from Evanston to Hyde Park. The new build represents the first deployment of a full duplex wave division multiplexed approach to voice, data and video services.

Zenith to supply set-tops for Sky L.A.

GLENVIEW, Ill.–Zenith Electronics Corp. has been selected to supply digital set-top boxes to Sky Latin America, marking the manufacturer's entry into the digital direct broadcast satellite (DBS) market.

Under the agreement with Sky Latin America, a strategic alliance that includes News Corp., Zenith will design, manufacture and distribute digital set-top integrated receiver decoders (IRDs) beginning in early 1998.

The IRDs for the DBS service are based on the advanced system architecture developed by NDS Ltd., a subsidiary of News Corp. Zenith plans to distribute boxes through Latin American consumer electronics retailers, initially in Mexico and Brazil, with plans to expand Sky Latin America throughout the region.

"The Sky Latin America agreement represents important firsts for Zenith; our first entry in the digital DBS market, and our first digital set-top box available through retail," said William G. Luehrs, president, Zenith Network Systems division, in a statement.

The Zenith/NDS system uses industry-standard MPEG-2 and DVB architectures in direct-to-home DBS applications. CED

Transport remultiplexer

SAN DIEGO, Calif.–TV/Com International Inc., a subsidiary of Hyundai Electronics, has announced an addition to its digital compression headend systems–the Transport Remultiplexer (RMUX). The RMUX can receive up to four DVB/MPEG-2 ASI transport streams (T-Links) into two identical transport MPEG-2 outputs, one primary stream and one redundant feed.

TV/Com International's RMUX

Specially designed for the peripheral component interconnect (PCI) architecture, the RMUX is the first in a product series to use this PC open systems, modular architecture, according to TV/Com. The PCI architecture is a robust interconnect mechanism designed specifically to accommodate multiple high-performance peripherals for graphics and full-motion video.

RMUX provides program clock reference (PCR) restamping, program identification (PID) filtering/remapping and program specific information/service information (PSI/SI) processing to handle regional inputs of MPEG-2 transport streams.

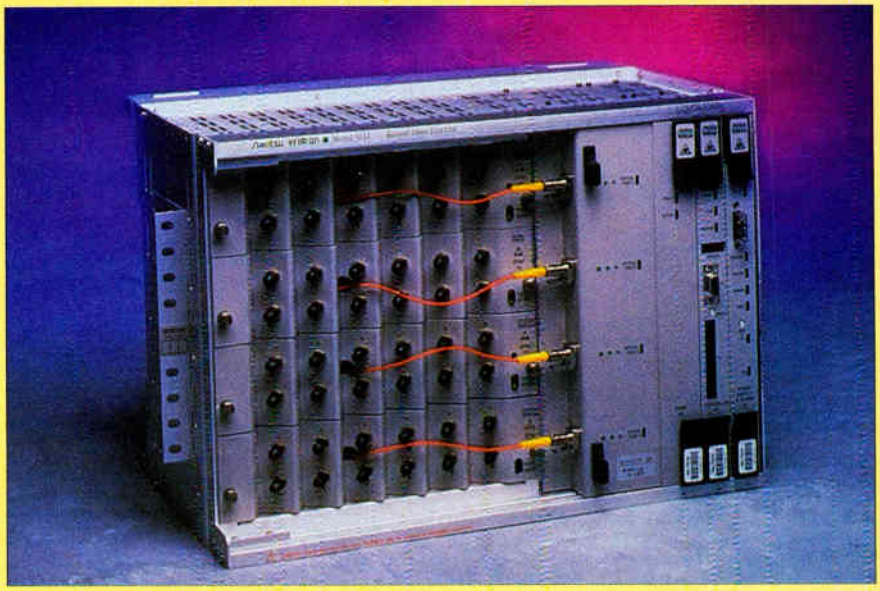
Circle Reader Service number 61

Powering HFC telephony

WEST KINGSTON, R.I.–American Power Conversion Corp. has designed a range of indoor and outdoor UPS products that can be used specifically to protect a locally-powered CIU. The PowerShield HFC product family provides an uninterruptible power source with extended battery backup for use with HFC networks and/or fiber-to-the-home systems. These units can be integrated into the CIU (customer interface unit) or configured as a stand-alone device to provide up to eight hours of run-time during extended power outages.

The PowerShield HFC solution provides local power for the customer premise electronics for any network architecture that places the active interface electronics at the side of the home; nominal 48 VDC up to 5 watts average (17 watts peak), using 100/120/230 VAC input power (this can be changed to meet specific requirements); and extended battery run-time with typical backup time of two to eight hours.

Circle Reader Service number 62



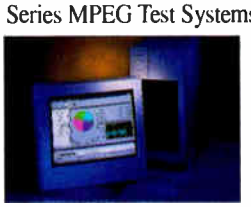
Fiber test system

MORGAN HILL, Calif.–Wiltron Company's Telecom Division and Anritsu Corporation have jointly developed the Remote Fiber Test System (RFTS), which integrates access, test, fault location and an Operations System (OS) to test fibers up to 200 km (approximately 124 miles) from a central location.

The RFTS combines Anritsu's OTDR technology with Wiltron's centralized test

MPEG/DVB test generators

BEAVERTON, Ore.–Tektronix Inc. has announced a family of real- and deferred-time analyzer and generator products for use with compressed digital video systems. The MTS200 Series MPEG Test Systems offer extensive MPEG and DVB analysis capabilities and perform functions ranging from real-time analysis to custom creation and indepth analysis of MPEG transport streams. The series consists of the flagship MTS215 Real and Deferred Time Analyzer and Generator, the MTS210AG Deferred Time Analyzer and Generator, the MTS210G Deferred Time Generator, the MTS210A Deferred Time Analyzer and the MTS205 Real Time Analyzer. The products support custom creation of transport streams, and perform real-time analysis with trigger capability for trapping errors that can be analyzed in detail at a later time. Functions include installation and acceptance testing of MPEG broadcasting and distribution systems.



Tektronix Inc.'s MTS200 series

Tek's Signal Scout RFM151

Tektronix has also introduced the Signal Scout RFM151, a digital services and analog video transmission field tool which features broad RF digital signal measurement capability. Designed for technicians deploying digital video and data services, this portable tool delivers highly repeatable analog and digital channel RF measurements. In addition, the RFM151 measures, identifies and isolates upstream path interference signals (ingress), particularly in the return path of HFC networks.

A frequency range of 5 MHz to 1080 MHz enables measurement capability for forward and return path coverage of digital signals. The unit features automated analog and digital channel analyses, and also provides an RF measurement of digital channel noise and distortion.

Forward path analog- and digital-channel

Wiltron and Anritsu's Remote Fiber Test System

system experience to monitor fiber networks, perform tests, and detect and locate faults, breaks and other abnormalities without shutting down a network.

The system can test up to 48 fibers through a built-in OTDR that has a dynamic range over 40 dB and less than 5 meter dead zone. The system also features a Windows-based OS that controls the Remote Fiber Test Units (RFTUs) which are comprised of a test system controller, optical test access unit and an OTDR.

When used in fiber cable construction and installation, the RFTS verifies the quality of every joint and stores traces of the unique characteristics of each cable. Once the network is operational, the RFTS monitors the fibers on a continuous basis by comparing them against the stored traces.

Operators can also perform a variety of demand tests using controlled variables such as automated detection and reporting, detailed analysis of any fiber node, system diagnostics and RFTU checks.

Circle Reader Service number 60

level measurements are specified within ± 1.0 dB (40-500 MHz), and ± 1.1 dB (> 500 MHz) across the instrument's operating temperature range of 0 to 50 degrees, with repeatability of ± 0.5 dB.

Circle Reader Service number 63

Aerial optical cable

ROANOKE, Va.–Optical Cable Corp. has announced a new Polyethylene Aerial D-Series Distribution Fiber Optic Cable for aerial installations. The 2 to 48 fiber count cable is similar to the company's D-Series Distribution indoor/outdoor rated fiber optic cable. It has a larger diameter and increased stiffness with its polyethylene outer jacket, which also provides excellent weather and UV resistance, making it suited for aerial lashed installations. Applications include cable TV, fiber-in-the-loop and fiber-to-the-curb.

Circle Reader Service number 64

Test equipment

VANIER, Quebec–Exfo E.O. Engineering Inc. has announced several new pieces of test equipment. The company's new benchtop series includes an optical power meter with a dynamic range of 110 dB. The PM-1100 has exceptional data storage and allows the user to store up to 512 readings and up to 1,024 data points, says the company. Standard GPIB and RS-232 interfaces, as well as control codes, permit remote operation of the PM-1100 from any compatible PC or test station.

The company has also announced the LTS-3900, a loss test set that joins the new benchtop series. It combines a power meter with a light source, and an optional optical return loss meter. A visual fault locator is also available as an option. The instrument is suited for combined insertion and return loss testing in a manufacturing environment. The LTS-3900 can be used as a stand-alone instrument or mounted on a 19-inch rack (optional).

Circle Reader Service number 65

Video line blanker

ALPHARETTA, Ga.–Fox Electronics Inc. has announced its VLB-100 Video Line Blanker, which removes signals from the active portion of any line(s) between 10 and 21 of both fields in the vertical blanking interval of a video signal. (Some headend scramblers have operational problems when VBI signals are present; and network-provided test signals must be removed for headend video testing.) Front panel DIP switches allow the user to easily select the lines for removal. No user adjustments are required.

The VLB-100 is housed in a small case which can be placed inside an equipment rack and operates from an external power supply, so no heat is generated. It is designed to be looped into the desired video path and to remain on-line.

Circle Reader Service number 66

Emergency message system

SALT LAKE CITY, Utah–FrontLine Communications LLC has released an application-focused version of its All Channel Message (ACM) System.

The ACM-3L, when combined with other necessary EAS equipment, places a crawling alert test message over original programming–on all channels simultaneously. The text rolls across the top of the screen so that it does not block the programming, subtitles or closed captioning.

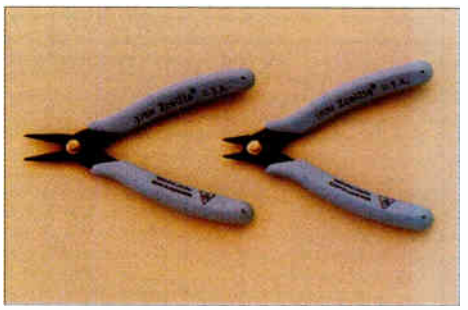
The system can also be used for a variety of other applications including new and channel re-alignment messages, system maintenance messages, PPV promotions and any other system-wide or channel-specific informational messages.

The ACM-3L is a selective system, affecting only configured channels. That means it won't disrupt other channels or services such as telephony or data. It also offers automated programmability for unattended operation.

Circle Reader Service number 67

Shearcutter/plier set

PHOENIX, Ariz.–Jensen Tools Inc. is now offering XCELITE's new two-piece Shearcutter/Plier Set.



XCELITE's Shearcutter/Plier Set

The general purpose flush-cutter accommodates most leads encountered. The needle-nose pliers have serrated jaws, a thin profile and long reach to access tight spaces.

Both tools feature carbon-steel construction and comfortable cushion grips.

Circle Reader Service number 68

Encoding system upgrade

ST. PETERSBURG, Fla.–Vela Research Inc. has announced the release of Centaur 6.0, an upgraded version of its Unix-based MPEG-2 encoding system.

This next-generation encoding system incorporates many new features, including variable bit rate encoding (VBR) for digital versatile discs (DVD), video scaling and dual stereo audio channels.

Circle Reader Service number 69

Video server software

GOLDEN, Colo.–Columbine JDS has introduced Clip Vault, a new software and hardware package designed to manage video servers and digital tape archives.

The package has been designed to improve spot management, reduce operating costs and improve efficiency. Batch spots can be loaded from cart machines to video servers, spot schedules can be loaded or restored from archives and the servers can be purged to make space for new or restored materials.

Circle Reader Service number 70

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KNOLOGY Holdings, Inc., a Telecommunications Company headquartered in West Point, Georgia has an opening for Headend Technician in the Montgomery, Alabama system. KNOLOGY of Montgomery is a CATV, Telephone and Cable Modem provider. Responsibilities include: Managing the quality control and electronic repair of all headend equipment; timely installation of headend equipment; implements special projects such as channel changes, equipment upgrades. Oversees the maintenance of addressability and billing system interface. Qualifications: Associates degree in electronics or 4 years experience in headend maintenance and installation. NCTI Advanced Technical Certificate. Valid drivers license and satisfactory driving record.

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A municipal utility located in the capital city of Kentucky, has an opening in its Community Cable Television Division. An **Experienced Chief Technician** is needed to assist with the maintenance of its CATV system (17,000 subs) by implementing preventive maintenance standards, providing emergency repair service, conducting proof tests; trouble-shooting system from head-end or taps; performing leakage-detection and repair service; and providing emergency repair service at all hours.

Must have high school or equivalent plus **five years directly related work experience**. **Vocational courses in related field and/or SCTE certification is preferred.** Must possess a valid KY drivers license with a good driving history. Must be able to successfully complete drug screening and background investigation.Must be willing to relocate.

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Time Warner Cable of Okeechobee is seeking a qualified Chief Technician to oversee, manage, and supervise the daily operation of the plant at system level in the Belle Glade system. Must have proven experience in successfully supervising employees and the ability to extensively interact and effectively communicate with technical and office personnel, contractors, and general public.

Must have thorough knowledge of electronics installation techniques, and repairs, OSHA and FCC regulations, specifications and requirements, experience with plant construction, microwave and satellite earth station. Knowledge of Fiber Optic Technology. AT&T and Phillips equipment preferred.

Must have a minimum of 3 years experience as system chief technician or senior technician along with advanced electronics training and training in Human Resources Management.

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RESULTS

The issue: Emergency alerting

Although cable operators have until the end of 1998 to comply with new emergency alerting rules, it clearly is a responsibility cable operators will be adding to their suite of services. A recent FCC rulemaking overhauled the Emergency Broadcasting System and is requiring participation by most cable systems. Despite the delay, are you ready to comply?

The results:

A wide majority of those who responded to our survey said their systems are not in disaster-prone locations, which causes them not to be active in the current Emergency Broadcast System local program.

Nevertheless, cable operators are widely aware of the fact that the FCC wants their participation in the new EAS, and nearly one-quarter have already added emergency alerting gear in their headends, while another 43 percent are making plans to do that.

A majority also reported that they already have programming override equipment in their headends, evenly divided between audio-only and audio/video gear.

Most report that their emergency equipment gets activated only a few times a year.

Congratulations to Rich Flanders of Time Warner Cable in Jamestown, N.Y., who just won $50 for faxing in his questionnaire. Thanks to everyone who responded!

1. Is your system active in the current EBS locally?

Yes	No	Don't know
43%	**57%**	**0%**

2. Is your local geographic area prone to numerous emergencies on an annual basis?

Yes	No	Don't know
14%	**86%**	**0%**

3. Are you aware of the FCC proceeding that made the cable industry part of the new national alerting system?

Yes	No	Don't know
100%	**0%**	**0%**

4. Does your franchise agreement require emergency alerting capability?

Yes	No	Don't know
28%	**43%**	**14%**

5. Do you have plans to add emergency alerting equipment to your headend in the next year–or have you already done it?

Planning to	Already did	Don't know
43%	**28%**	**28%**

6. How much will your system have to spend, per channel, to comply with the EAS rules?

More than $1,000	$500 to $1,000	Don't know
14%	**28%**	**57%**

7. Does your system presently have programming override equipment in place in the headend?

Yes	No	Don't know
57%	**43%**	**0%**

8. If so, does it override audio only, or audio *and* video signals?

Audio only	Audio and video	Don't know
50%	**50%**	**0%**

9. If your system has such equipment, does it override all channels, including broadcast?

Yes	No	Don't know
100%	**0%**	**0%**

10. If you have emergency alerting equipment, how often has it been activated and/or tested?

Monthly	Few times a year	Don't know
25%	**75%**	**0%**

Your comments on emergency alerting:

"As a small independent (operator), we are most concerned with the cost of implementing EAS."
– Jean Gippert, Televista, New Boston, Mich.

"Over the last 20 years, the only time we could have used an EBS system was when the power was out for the entire community. Of course, no one had power, or TV, so what good would it have done? This is just another government program gone berserk."
– Bruce Witte, Country Cable, Ramona, Calif.

Want the whole story? The eyes have it

By Thomas G. Robinson, Director of Regulatory Affairs and Technology Development, River Oaks Communications Corp.

Have a comment?
Contact Tom via e-mail at: ctrobinson@worldnet.att.net.

Its very name suggests that television is an essentially visual medium. (It is important to note, however, that annoying audio can negatively affect the viewer's perception of visual signal quality, although it has not seemed to alter my daughter's positive perception of MTV.)

Early on, television's strong and lasting visual imagery pegged it as the "cool fire." Moreover, now that TV has become the top source of news and information for many in our nation, the imagery that we see can significantly influence our attitudes. This is one reason why it is especially important to get the words along with the picture in order to get the whole story that is being conveyed.

It's with this in mind that Congress in 1996 crafted Section 713 of the Communications Act, requiring closed captioning to be provided for a much larger portion of television programs in the future. Congress' goal was to make closed captioning more widely available, and thus enable viewers with hearing disabilities to get the "whole story."

In requiring the Federal Communications Commission to craft rules to implement Section 713, Congress allowed the Commission to exempt specific programs, classes of programs or services where the FCC determines that the provision of closed captioning would be "economically burdensome," or where such a requirement would constitute an "undue burden." The FCC addressed these exemptions and a host of other closed captioning rulemaking matters this past August. As part of developing standards for these types of exemption determinations, the Commission indicated that Congress intended for the FCC to balance the need for an increase in closed captioned programming against the possibility of inhibiting the production and distribution of programming, and thereby restricting the diversity of programming available to the public at large.

Consistent with this balancing act, the Commission has exempted certain types of "locally-produced and distributed non-news programming with limited repeat value." According to the FCC, this would include, for example, "local parades, local high school and other non-professional sports, live unscripted talk shows and community theater productions." Beyond this, the Commission also allows a general revenue-based exemption, focusing on a cap of two percent of the gross revenues received from any particular channel. Moreover, the FCC has specifically exempted program distributors from being required to caption PEG (public, educational and governmental) access, leased access and must-carry programming, where they have no editorial control.

From some of the general industry buzz on this issue, it was like a giant "Whew!" could be heard throughout multichannel-video land. "Now we don't have to worry about captioning the PEG and LO (local origination) stuff," some were heard to say.

Well, that response is akin to hearing without really listening. For example, a number of PEG organizations currently caption some of their offerings that typically have the broadest viewer interest and repeat value, and want to caption more programming, but do not have the resources. Additionally, the FCC specifically notes that its locally-produced programming exemption is narrowly-focused and applies only to a limited class of truly local materials. For example, local news, programs that have repeat value and programs readily captioned through an ENR ("electronic news room") process, where captions can be created from the same information sent to a Teleprompter, are not exempted.

Operators, programmers could work together

The Commission also mentions alternative mechanisms (although not substitutes) for making programming more accessible to persons with hearing disabilities, such as the addition of text or a graphic display of the content of the audio portion of the program and the use of sign language interpretation. (The use of sign language, though, may not have the total benefit anticipated, because senior citizens who have recently become hearing-impaired generally favor captions over having to learn sign language late in life.) Finally, the Commission notes that the cost of captioning continues to decrease, and that it expects that new technology will allow closed captioning to be done more efficiently and easily in the future.

Taken all together, it makes sense for operators to work with local programmers to develop cost-effective ways to increase the amount of closed captioned programming that will make local programming more accessible to a significant portion of their audience that is hearing-disabled (equating to 8.6 percent of the nation's population currently, and growing as the population ages). Services such as PEG channels are already valuable to the hearing-disabled community, based on the amount of text-based programming that they provide. Potential ways to make them more valuable include:

✔Provision by operators for each PEG service of ENR equipment ($2,500-$5,000 per channel) to enable pre-scripted programs or portions of programs to be captioned.

✔Allocation of a portion of PEG fees to closed captioning expenses.

✔Allocation of a portion of the two percent of gross revenues amount from other channels for captioning on locally-programmed channels. The FCC gives discretion to providers on how to allocate funds to captioning and indicates that they may choose to expend funds for the captioning of less widely-viewed programming, based on its importance to the hearing-disabled community in light of the absence of alternative sources for that information.

This issue will grow with our aging population. Those who respond well now will continue to see their audience gather around their "cool fire" in the future. CED

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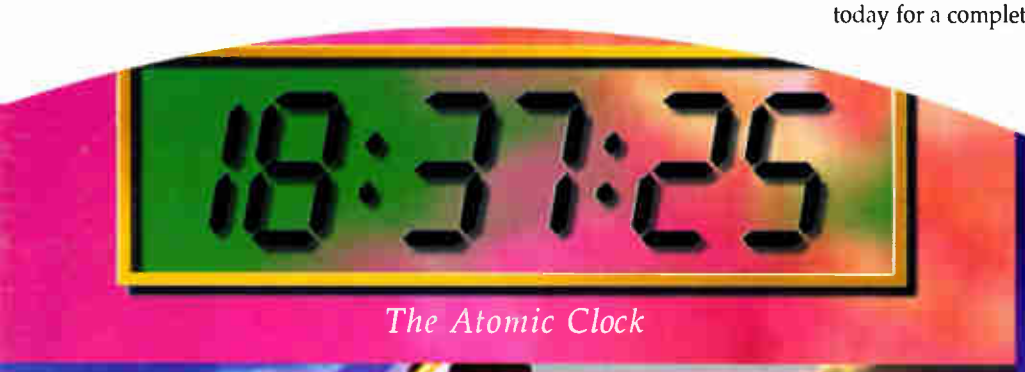

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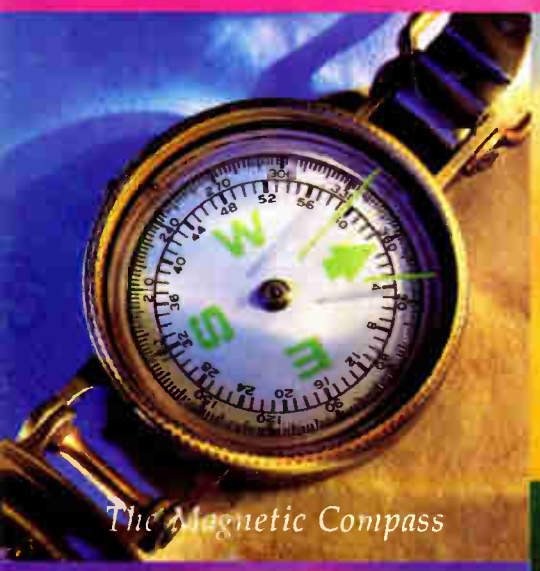

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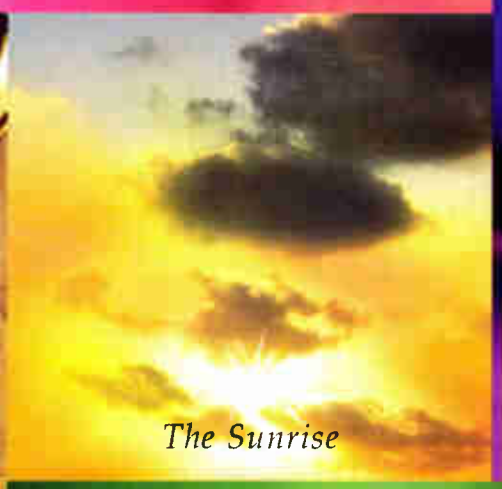

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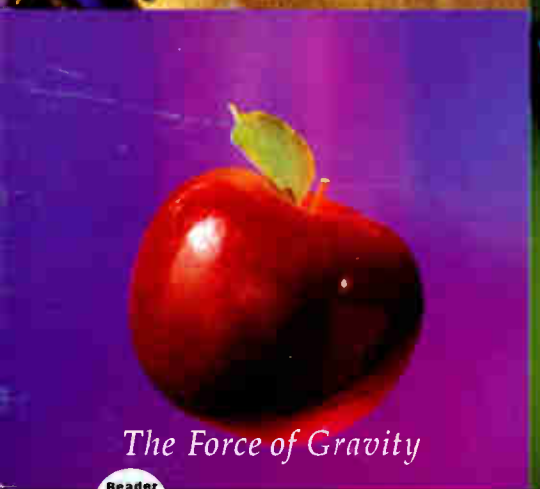

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