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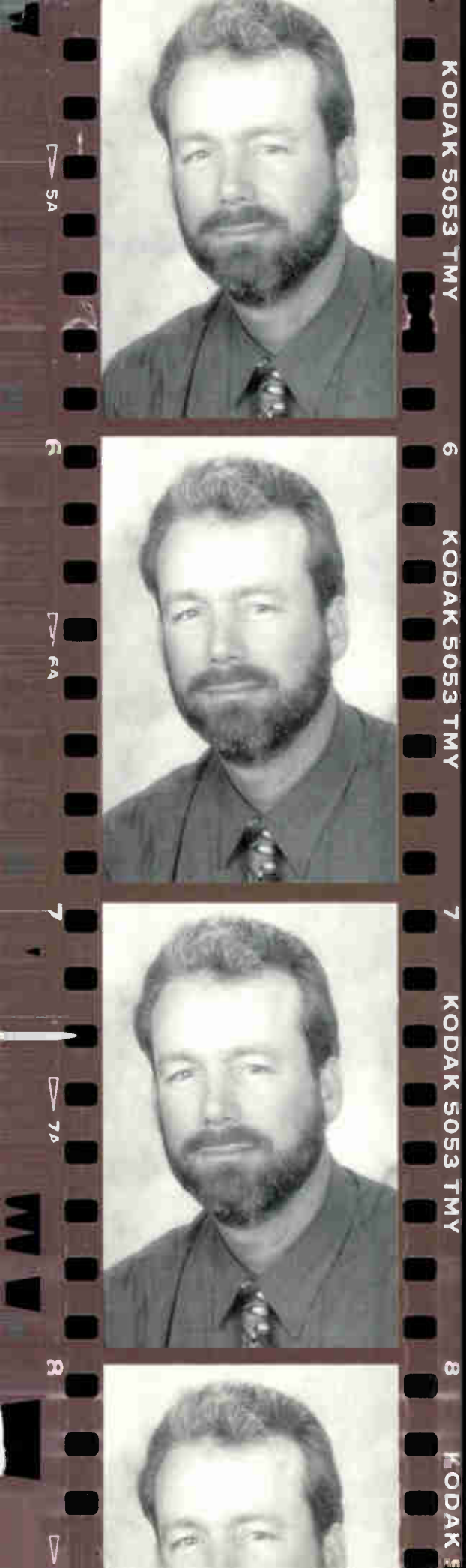

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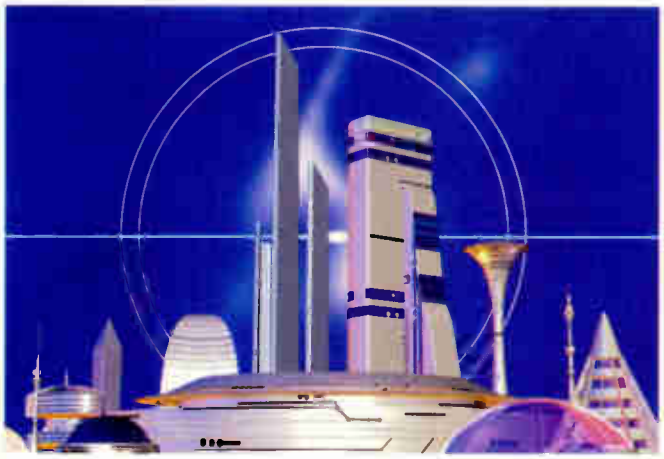
contents

FEATURES

Congratulations, Sally Kinsman • 40



The Brave New World of DOCSIS • 48

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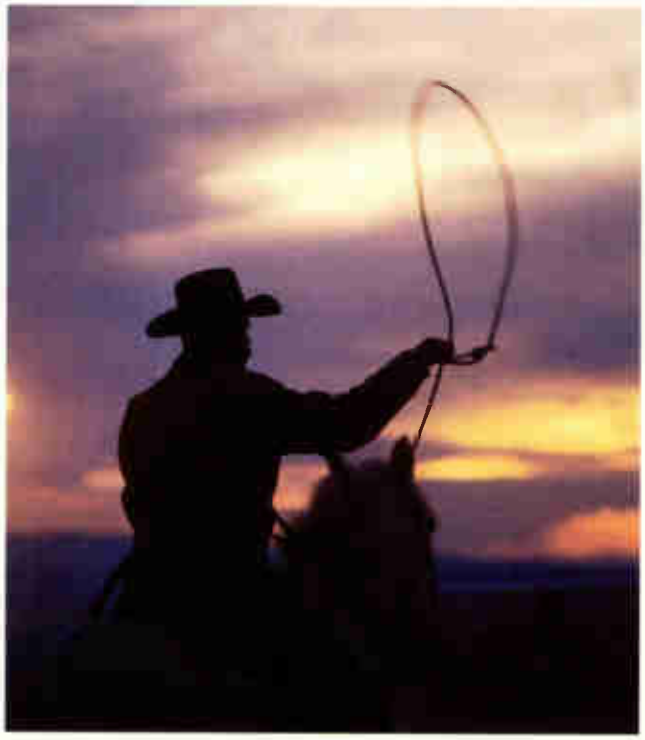

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Reader Service Number 4

By Rex Porter

"The Emperor's New Clothes"

This is both the end of the year and sort of the end of the century (it actually begins Jan. 1, 2001, but the Y2K bug muddles things), and many are making predictions. I hate to predict anything. No one's very good at it. I'd rather just ask questions and have discussions.

I certainly wouldn't minimize Y2K concerns. But as we'll soon know one way or the other, I wanted to discuss how far overboard many of us have gone worrying about a problem that should have been laid at someone else's doorstep.

There was a lot of money to be made—if the Y2K problem was handled just right. Not only have fly-by-night companies sprung up to solve these problems, but even the government charges for Y2K information. The U.S. Small Business Administration provides workshops on it—for a fee. I have received telephone calls from legal firms representing insurance companies. It seems that major companies are now submitting claims for repairs to their systems, all in the name of Y2K solutions. Not being an expert on this subject, I referred them to others who are.

What really concerns me is how this scenario has played out. The computer industry has made billions of dollars manufacturing and selling its products around the world. After it got our money, we found out its products won't work because it didn't program them properly.

Where was the public outcry to have these same manufacturers fix the problem they caused? If this had been any other industry, people would have marched on Congress, unrelenting with their claims against the parties responsible. We see other industries held accountable. When cars, even older ones, are proven unsafe, the manufacturer has to recall and fix them, at the manufacturer's expense.

How big is this problem? No one really knows. Could there have been a simpler fix? I think that only the computer manufacturers really know, and we used tax and corporate dollars instead of theirs.

But we are faced with a situation similar to that of the children's tale, "The Emperor's New Clothes." If the worldwide communications system goes into failure mode on Jan. 1, all the prophets of doom will say, "See, the problems were even worse than we thought." However, if nothing happens, Y2K fixers will say: "Of course not. We fixed the problem."

How will we ever know?

Rex Porter
Editor-in-Chief

mean Mr. Green

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Communications Technology

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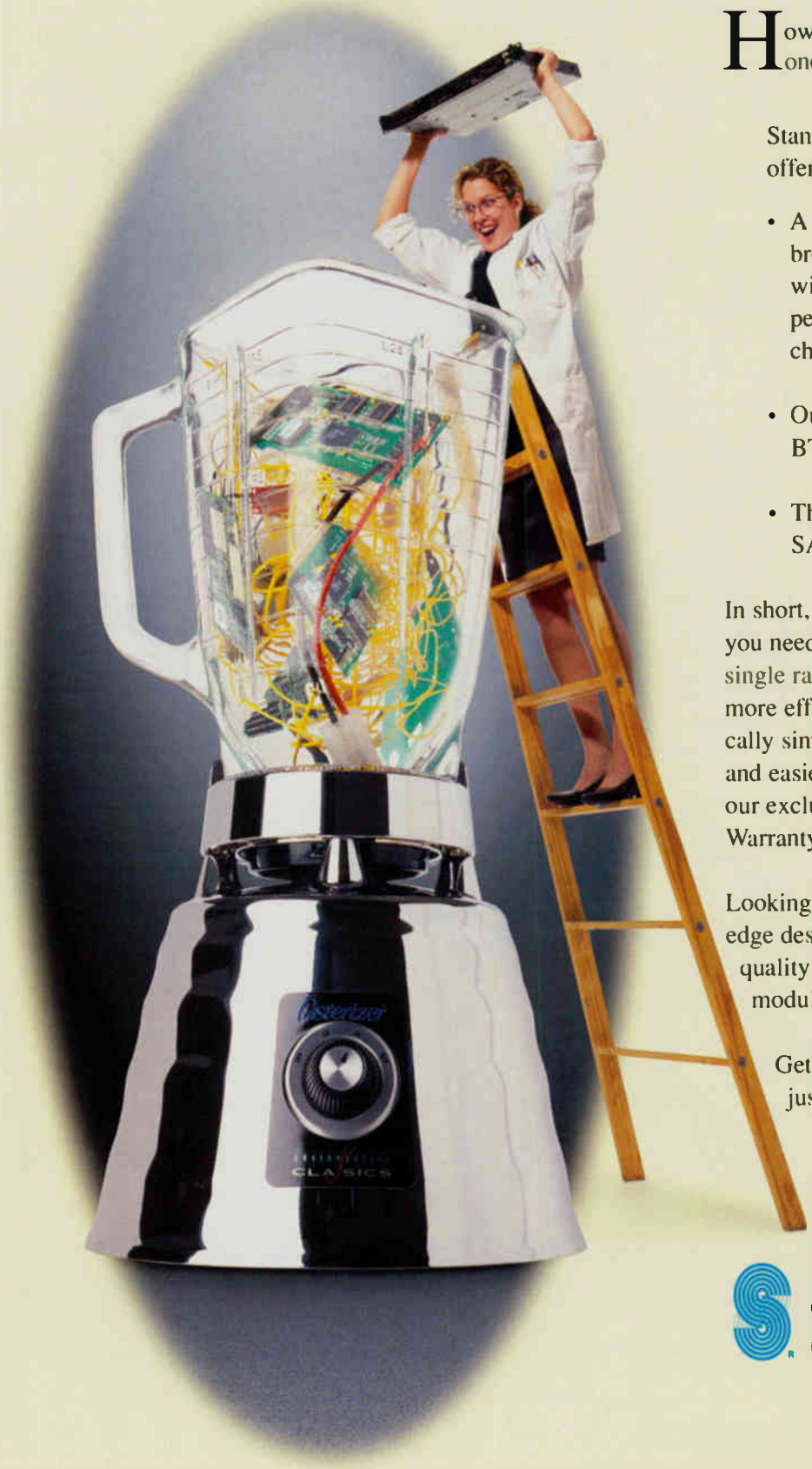
How Standard blended four big capabilities into one little modulator.



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Reader Service Number 8

Terayon Builds One-Stop Shop

By Doug Larson, Senior Editor

Terayon Communication Systems wants to broaden its capabilities and build a comprehensive broadband portfolio to deliver high-speed voice, data and video over hybrid fiber/coax (HFC) networks. And the company is taking the necessary steps to get there.

Terayon is partnering with ECI Telecom, a multibillion dollar reseller and systems integrator, to collaborate on developing an end-to-end voice over Internet protocol (VoIP) offering. ECI currently delivers gateway systems and synchronous optical network/synchronous digital hierarchy (SONET/SDH) high-speed network transport.

Terayon also plans to acquire Israeli broadband supplier Telegate Ltd. for its telephony expertise.

"Telegate's product line currently fits in very nicely with what cable operators are deploying, which is circuit-switched," said Terayon spokesman John Giddings. ➤

ICTV Goes Digital

By Jennifer Whalen, Editor

Recognizing that one-way analog cable networks soon will be as common as the dodo, ICTV is pinning its future on digital. The Internet-via-TV specialist will be demonstrating its new digital platform this month at the Western Show.

"The big change for us is our ability to deliver the Internet with MPEG-2 (Moving Picture Experts Group)," explained Michael Collette, senior vice president of marketing for ICTV. "Now instead of using one analog channel for each session, we can get 40 sessions into one 6-MHz slot."

The move to digital will require ICTV to change equipment in the home and headend. Currently in one-way systems, ICTV installs a small modem to provide a low latency return path for keyboard and mouse signals.

"With digital, it's easy to integrate that function into the two-way set-tops. We're in discussions with GI and S-A to do this," Collette said. "You need to create a switch so that the key strokes that normally go to the guide can be switched to go to the headend. It's about six lines of code, a very minimal modification." ICTV also plans to work with headend manufacturers on software to let the headend poll smaller groups of digital set-tops. A smaller polling group increases the response time of ICTV's Internet system, Collette said.

The move from analog to digital also requires ICTV to change its encoding scheme. "We are adding a hardware encoding approach for very high bit rate activity that is IBM chip-based. It provides low latency encoding for things like game play or broadband Web sites with lots of video," Collette explained. "For light-duty applications such as e-mail or static Web pages like Yahoo!, we will use software encoding that's based on a Ligos encoder."

ICTV will start taking orders for the digital system this month, but doesn't expect to ship the new products until sometime in the first quarter.

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Reader Service Number 10

"Obviously, we recognize that the move is toward voice over IP ... (and) that is something we will be working with Telegate to develop."

Telegate's flagship product, Multigate, supports telephony, high-speed data, cordless mobility, video telephony and other broadband services, all over one video channel and a single integrated end-user device.

Giddings said Telegate, which employs about 75 engineers, also has done important work in some of the business-related areas of cable telephony, such as billing, which will strengthen Terayon's venture into the telephony business.

But wait, there's more. In addition to the Telegate and ECI Telecom announcements, Terayon also recently acquired Radwiz, a privately held company that produces broadband access systems that provide IP network routing for the small office/home office (SOHO) market.

"Moving into voice over IP, we also realized that we wanted to get some folks in who had some additional IP expertise, and that's really Radwiz," said Giddings. "We'll definitely be working with them to migrate to a voice over IP solution."

Telcos Enlist iMagicTV To Battle Cable

By Elisa Modugno, Editor, *Broadband Networking News*

Up until now, the main threat to cable's video programming has come from satellite TV providers. If iMagicTV has its way, all that could change.

The New Brunswick, Canada-based software vendor is peddling a platform to telcos that would enable them to offer TV services over asymmetrical digital subscriber line (ADSL). iMagicTV's DTV Manager 2.0 digital TV software lets service providers offer television over basically anything Internet protocol (IP)—ADSL, symmetric DSL (SDSL), very high data rate DSL (VDSL) and, if there's enough bandwidth, integrated services digital network DSL (IDSL).

The DTV Manager's server suite software provides a viewer interface, set-top box support, administration and business system interfaces. The system's components run on UNIX-based servers, set-top boxes and personal computer (PC) clients.

"We built a product that completely allows (carriers) to run a television business," said Marcel LeBrun, iMagicTV president and chief executive officer.

LeBrun, a former director of marketing at New Brunswick's independent telco NBTel (which owns a 51-percent stake in iMagicTV), asserts that his company's software creates an airtight business case for incumbent carriers. The telcos are under extreme pressure from cable and competitive local exchange carriers (CLECs), he reasoned. "The telcos are losing customers completely," said LeBrun.

With DTV Manager, telcos can offer a user experience similar to satellite TV, LeBrun said. "The telco can run a mall of entertainment services," he said. "They can also allow partner companies to offer services on their network."

Cable need not apply

Telcos also needn't worry that iMagicTV is courting their competition—LeBrun said he's not even marketing DTV Manager to cable companies because the technology won't work with cable modems' shared coax and channels. Diluted service quality is not an issue with DSL, however. "On ADSL, we can have one user or a million users," he added.

"The services that (iMagicTV is) enabling will allow the telcos to compete with cable companies," said Greg Howard, principal analyst with the San Andreas, Calif.-based telecom consultancy HTRC Group. "I was pretty surprised when I saw (DTV Manager). I thought they were ahead of their time."

Howard said there really are no other products out there now that even come close to what iMagicTV has on the market today. The closest comparables would be video streaming and pay-per-view (PPV)-type applications, he added.

However, iMagicTV is facing competitive pressures from direct broadcast satellite (DBS) providers, which are teaming with carriers to offer many of the same services. In iMagicTV's own stomping grounds, for example, Bell Canada has decided to use PixStream video networking systems to try out new TV services over existing telephone lines through parts of

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Canada. PixStream's networking structure will enable Bell Canada to redistribute television and music channels from Bell Express Vu, a fast growing Canadian DBS provider.

Still, iMagicTV is experiencing early-adopter success with its software from independent telcos, NBTel and England's Kingston Communications among them, which could represent a solid customer base for the vendor.

Networked Home Moves From Blueprint To Construction

By Doug Larson, Senior Editor

Have you been thinking about remodeling your home? Others have. At the Yankee Group's Networked Home Symposium, senior executives from companies such as 3Com, Lucent, Microsoft, Motorola, Sony and Sun Microsystems met to discuss their vision for the networked home of the future ... and the future is knocking on your door now.

According to the Yankee Group, some 650,000 U.S. homes currently have some form of networking. They expect this number to leap to nearly 10 million by 2003 under a compounded annual growth rate of 95 percent over the next four years.

Based on feedback from a home survey, the research house says consumers are ready and the market is ripe for the picking. The survey indicates that more than 17 million households currently show an interest in home networking.

Also propelling this nascent industry is the maturation of compelling applications and affordable, unobtrusive networking technology, says the Yankee Group. And let's not forget about those cable modems, which it cites as a "critical catalyst" to the explosive growth of home networking.

"1999 has been a watershed year for the home networking industry," said Karuna Uppal, a senior analyst at Yankee Group. "Advancements in home networking standards and product availability have moved home networking technology from the laboratory to the living room."

By the end of 2003, Yankee Group predicts the home networking market will be driven by an estimated five million broadband homes that will have residential gateways installed.

NEWS BITES

- Harmonic plans to buy the Divicom business of C-Cube Microsystems. In the short term, the deal will strengthen Harmonic's ability to deliver digital video services. Down the road, the company will leverage the relationship to support video transmission over Internet protocol (IP) networks.
- CableLabs has promoted Donald P. Dulchinos to senior director of its OpenCable set-top box initiative. Dulchinos previously served as director of business development working on the business aspects of OpenCable.
- High Speed Access Corp. will incorporate Northpoint Communications' digital subscriber line (DSL) service into its portfolio for small to midsize businesses.
- Concurrent Computer Corp. and Nagravision, the digital pay TV division of the Kudelski Group, are working together to integrate Concurrent's video-on-demand (VOD) platform with Nagravision's conditional access system (CAS).
- Philips Broadband Networks is supplying Cox Communications with 750 MHz RF network line amplifiers and line extenders and transport solutions for the operator's Tucson, Ariz., rebuild. When completed in 2002, the rebuild will pass more than 2,000 miles.
- EPITAXX Inc. has signed a definitive agreement to be acquired by JDS Uniphase Corp. for $400 million in stock. EPITAXX's products include long wavelength detectors and receivers for applications such as dense wavelength division multiplexing (DWDM) and synchronous optical network/synchronous digital hierarchy (SONET/SDH) transmission, optical network monitoring, test and measurement, and fiber-optic analog cable TV. CT

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Training Coming for "One-Tech" Modem Installs

As the demand for cable modem service increases, the industry is faced with a shortage of trained personnel. To meet this growing need, the Society of Cable Telecommunications Engineers is partnering with Wave Technologies International to provide A+ Certification training to cable installers.

Frequently, cable modem installations require two technicians: one to install the TV cable and the other to install and configure the personal computer (PC) and modem. The Wave training is designed primarily to bring cable personnel up to speed in the PC arena.

"By implementing Wave's training programs, the Society hopes to move toward all cable installations only requiring a single technician so that there would no longer be the need to outsource for the installation of cable modems," explained Marv Nelson, SCTE vice president of technical programs. "This would result in the cable industry saving thousands of dollars a year per installer."

Wave Technologies International is an information technologies training company. Wave will offer three cable industry programs, which will cover the basic areas of competence expected of a PC service technician with six months of on-the-job experience. Each program will incorporate Wave's multiple media A+ Certification kit. The training includes teaching the installer to:

- Install a network interface card (NIC) in the PC
- Configure the PC to properly recognize the NIC
- Configure the PC to interface with the cable modem
- Attach the cable modem to the cable plant and verify proper operation
- Attach the cable modem to the PC and verify operation of the system

The programs will be designed to provide installers with certification training on the core A+ Certification requirements of PC hardware and operating systems. In addition, Wave will develop a textbook to address the installation and configuration of a cable modem, and the company will put together a compact disk-read only memory (CD-ROM) with job-task simulations and digital video demos on modem installations. These components will be included in the A+ self-study kit.

Alan Babcock, SCTE's director of training development, said the testing itself will be under the auspices of the Computing Technology Industry Association, which embraces computer hardware and software manufacturers such as Apple Computer, Toshiba and Lotus. Being CompTIA certified means the technician can open a PC without voiding the manufacturer's warranty in most cases, and Wave can administer the tests in 13 centers nationwide. Certification requires passing two tests, the core section and the Microsoft DOS/Windows module portion. For more information on the exams, go to www.comptia.org.

Though the CompTIA exams don't currently cover cable modems, SCTE plans to work with Wave to add a module that will apply to Data Over Cable Service Interface Specification (DOCSIS) cable modems.

SCTE still is finalizing a distribution and presentation schedule for the programs. Specific product and pricing information were not available at press time.

Need Cash for Tuition? *Call SCTE*

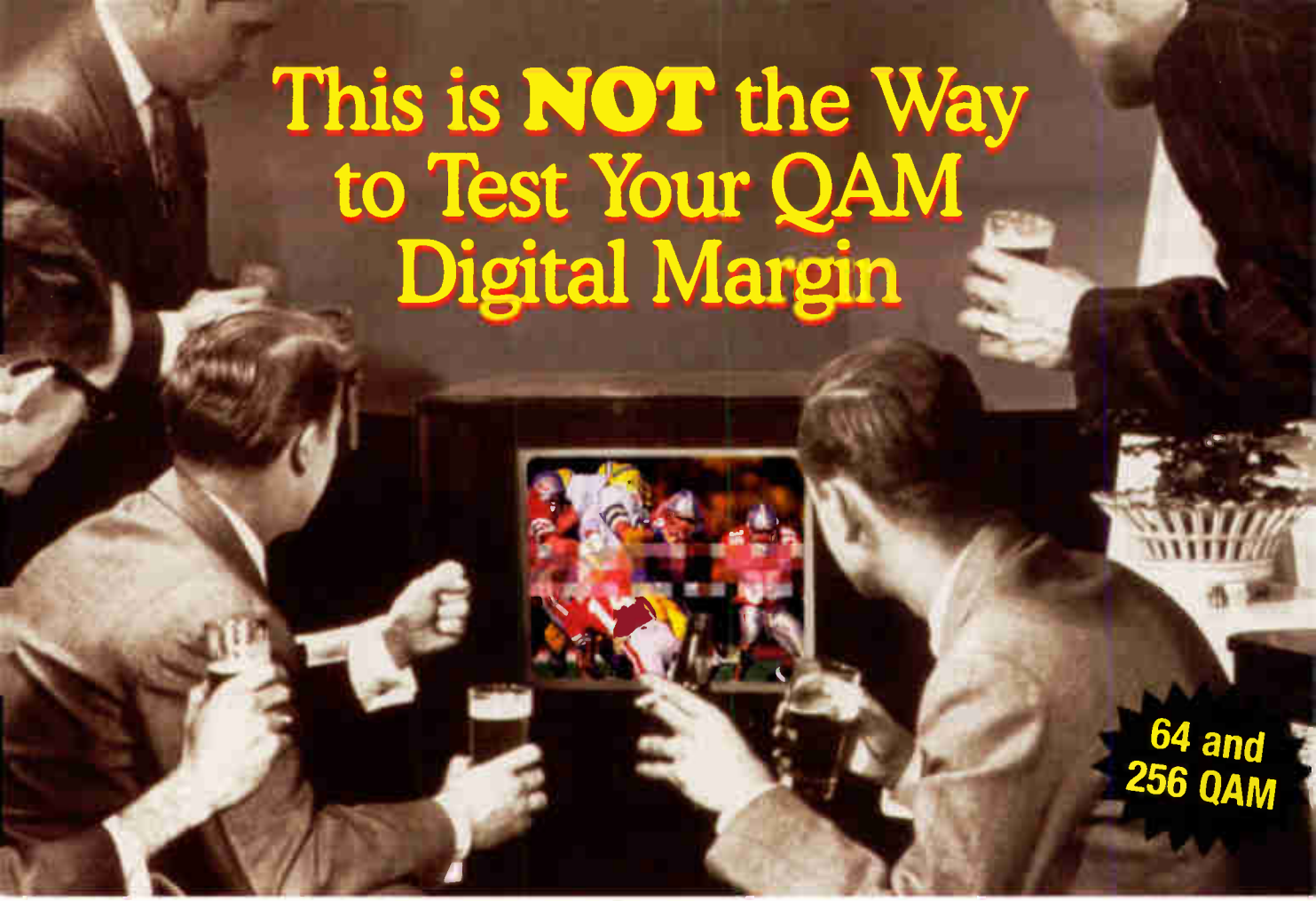
If a shortage of cash is keeping you from continuing your education, the SCTE may have the answer. The Society offers a Technical Tuition Assistance program to provide financial aid to members.

With today's rapid changes in technology, continuing education is increasingly critical for individuals and the industry itself. SCTE is committed to helping you obtain training that will not only broaden your technical knowledge, but also will contribute to the future advancement of the cable telecommunications profession.

"Today's technology changes every 18 months. That's an incredible rate, and it's a real challenge to keep your knowledge and skills current," said Chairman of the SCTE Scholarship Subcommittee Rod Bennett. "The Technical Tuition Assistance program is a tremendous tool available for SCTE members to develop and keep their industry knowledge on the cutting edge. This program is a valuable resource for SCTE members."

The program provides financial aid to career-minded members who demonstrate potential for advancement. You can apply your scholarship to SCTE certification programs and regional seminars, correspondence courses, technical schools, equipment manufacturers' training programs and college courses. More than 135 members have increased their technical knowledge through the program.

To apply for tuition assistance, you need to be an active member in the Society, express an interest in furthering your professional development and demonstrate a need for financial support. For more information or an application package, contact the SCTE Membership Services Department at (800) 542-5040 or e-mail membership@scte.org. CT



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Reader Service Number 15

By Arthur Cole

Cable Modems and the Retail World

Cable operators are entering a new realm in more ways than one with the advent of new services. Deployment of cable modems is leading many to forge new relationships with retailers as a means to get hardware into the hands of customers.

Unlike the good old days, where the operators leased the consumer hardware and thus had complete control over the system end-to-end, the new world will add a bit of uncertainty to your operation. Though the Data Over Cable Service Interface Specification (DOCSIS) is moving the industry closer to true interoperability, we're not there yet. In the meantime, the challenge will be to identify the modems that work best with your systems and encourage customers to purchase them.

The retail model

That's why a number of operators are working hand in hand with retailers and manufacturers to get cable modems into the hands of consumers. Not only does it offer a chance to show off the capabilities of the high-speed devices, it also helps operators guide users to the modems that work best with their systems.

A case in point is MediaOne's Road Runner offering. The company has teamed up with Circuit City in the Boston; Richmond, Va.; and Atlanta areas to show off the latest devices.

"We've been bullish on retail because we believe in the power of demonstration on the sales floor," said Kelly Reubel, vice president of sales and marketing for MediaOne Internet Services. "You have manufacturers talking about high-speed data and retailers talking about high-speed data. To the extent that we can be branded with that, we think there is value there."

Reubel added that MediaOne does not share in any of the profits generated by retail sales, but benefits only from the online service fees.

Risky business

Value, yes. But there is a certain element of risk when it comes to relying on others to help drive a vital part of your business.

Reubel said it is vital to make sure that retailers and manufacturer reps are clear on the technology and are truly interested in pushing the product.

"One of the challenges for us is to make sure the retailer and manufacturer are as aggressive as we are in driving demand," she said. "We don't want to be in a position where we become a funding pool for rebates."

In the Atlanta region, customers can obtain modems in a number of ways. They can purchase them from Circuit City or directly from MediaOne for $199 apiece after a $50 rebate, or they can lease from MediaOne for $10 per month. The $99 installation fee is being waived for the rollout period.

Reubel said MediaOne will continue to lease modems and write off the depreciation of the hardware because it offers a means for consumers to get online without having to shell out a lot of cash up front. After all, the goal is to get customers using the data service, where the real profits are.

"We believe that we need to build a customer base quickly, to drive market share," she said. "Other systems might not be as concerned about being aggressive, that they can take advantage of early adopters and react to the market. We want to precede the market."

MediaOne is not the only operator pursuing a retail strategy. Excite@Home has lined up such retailers as Office Depot, The Good Guys and CompUSA, as well as Circuit City, through its Retail Merchandising Program. Paul Salzinger, vice president of business development, called the retail outlets "an acquisition channel for new subscribers."

"One market saw a 25-percent increase (in new subscribers) out of a handful of stores," he said. "One thousand people a day pass through Office Depot. That's a lot of potential buyers." CT

Art Cole is a contributing editor to "Communications Technology."

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But we have to warn you... you won't want to settle for less.

By Ron Hranac

What's in a Number? Defining Availability Is Tricky

You've probably seen or heard about the so-called "four nines" (99.99 percent) used to describe telecommunications reliability. Where did that number come from, and just what, exactly, does it mean?

First of all, four nines describes availability, not reliability. More on this later.

What it is, sort of

Four nines is an availability specification developed by Bellcore (now Telcordia), and it refers to the percentage of time that service is available. From a pure numbers perspective, 99.99-percent availability means a maximum of about 53 minutes of downtime per year. Assuming a 365-day year, the maximum downtime number works out to 52.56 minutes, but given that the earth's trip around the sun is a bit more than 365 days, "about 53 minutes" is close enough. As usual, I digress.

Logically, you might be inclined to assume that service availability would be the net availability to the end user, regardless of the reason for the service interruption. Close, but no cigar. You see, different industries have used different measures of their own service availability. Translation: 99.99 percent doesn't mean the same thing to everyone.

Consider how the exchange carriers define it: "The service availability objective for the subscriber loop is 99.99 percent, which corresponds to 0.01 percent unavailability or 53 minutes per year maximum downtime. This objective, incorporating all network equipment between the local switch and the network interface (excluding the local switch and customer premises equipment), refers to the long-term average for service to a typical customer." (Bellcore TA-NWT-00909, Issue 2, Generic Requirements for FITL Systems Availability and Reliability Requirements, December 1993, p. 13-1, Bell Communications Research)

> "Any loss of service for any reason is an outage, including planned outages. To the customer, it doesn't matter."

I lifted this quote and paraphrased a few other statements in this month's column from *Modern Cable Television Technology* by Walter Ciciora, James Farmer and David Large. If you don't have this book among your references, you should. (See my review of same in the June 1999 issue of *Communications Technology*.) The book's available from the Society of Cable Telecommunications Engineers' bookstore—contact SCTE headquarters at (610) 363-6888 or visit www.scte.org for more information.

What it means for us, sort of

So, four nines is not necessarily what it appears to be. The Bellcore definition is not the same as end-user service availability because the Bellcore spec doesn't include availability of dial tone from the switch, or availability of interswitch or long distance circuits. It excludes in-home wiring and terminal equipment problems. Further, it's a goal that's averaged over the entire customer base. This latter statement means that a handful of customers can have consistently crappy service, but the carrier can still meet 99.99 percent if most customers have good service. Oh, yes ... carriers don't count unavailability from the loss of both primary and backup power. Finally, the length of an outage is measured from when it's reported, not when it actually occurs.

If we counted things the same way, we would leave out the headend (switch), everything past the ground block (in-home wiring and customer premises equipment), signals from the headend (dial tone), program sources (interswitch or long distance circuits), outages from loss of commercial power and dead batteries in our standby supplies (loss of primary and backup power), and we could average poor service areas with more reliable parts of the system.

Yeah, right. Just try to tell your subs that you meet 53 minutes maximum downtime per year when you don't count the headend, drop, program source, loss of both commercial and backup power

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and so on. "Yes, ma'am, someone did load our headend in a U-Haul and drive away with it, but that's not an outage."

Availability calculations

Seriously, availability is defined as the ratio of time that a service is available to total time. Reliability is the probability that something won't fail during some defined period of time. In the world of reliability and availability modeling, availability (A) is mathematically calculated from mean time between failure (MTBF) and mean time to repair (MTTR):

$$A = MTBF/(MTBF+MTTR)$$

System reliability (R) for simple, nonredundant connections can be calculated from failure rate (λ) and time (t):

$$R(t) = e^{-\lambda t}$$

There's a bunch more arithmetic that goes along with this, but I'll spare you and *CT*'s editors. If you're interested in learning more, I suggest you peruse Chapter 17 in *Modern Cable Television Technology*. The authors provide an excellent overview of the subject.

Let's see. Where was I?

Can we do it?

Oh, yes. Can cable TV systems meet a four nines objective? It depends on how you define an outage and do the math. And set up your network architecture. And powering. And operating and maintenance practices.

One important question in all of this is how we define an outage. In the early 1990s, CableLabs published the document "Outage Reduction." It included the following definition: "An outage is defined as any event in which two or more customers experience loss of reception on one or more channels arising from a common cause, regardless of the cause. Loss is defined as an interruption rather than degradation of signal. Loss of a single channel at the headend or hub site is included."

As you look at this definition you'll see that an outage is from the customer's perspective, as it should be, and takes into consideration almost everything except the drop.

"Outage Reduction" also included a recommended performance target for cable operators: "No customer should experience more than two outages in a three-month period." Using industry service restoration data, this performance target translates to approximately 99.7 percent availability.

As you can see, CableLabs' outage definition and performance guideline fit an entertainment model quite well. That is, they were intended for systems delivering plain old cable TV service at a time when there were few multichannel alternatives to cable.

> "A handful of customers can have consistently crappy service, but the carrier can still meet 99.99 percent if most customers have good service."

These days, we have added to the mix such things as cable modems, digital video and in some cases telephony. Combine these with a much more competitive entertainment environment and the need for a new outage definition and better availability is clear. I'm not here to propose a new definition, but whatever the definition is, it must be from the customer's viewpoint. We probably should include the drop and in-home equipment because when an outage is caused by, say, a defective set-top, it's still an outage as far as the customer is concerned.

What, then, should be included when tracking outages? There is no easy answer, but SCTE Chairman and Region 7 Director Jim Kuhns brought up a couple of interesting questions about this in a related discussion on the SCTE-List. Let's say you subscribe to regular cable service, and only the cable modem service is out. You won't know the data service isn't working, so does that count as an outage? Conversely, if a cable modem sub is surfing the net when HBO is off during a solar transit outage, did an outage occur even though the cable modem sub wasn't watching HBO at the time?

These are tough questions, but the bottom line is, yes, outages did occur in both cases and should be counted when calculating availability. Following this line of thinking, any loss of service for any reason is an outage, including planned outages. To the customer, it doesn't matter.

Yes, but ....

So, back to the earlier question, can cable TV systems meet a four nines objective? Well, some companies have modeled advanced network architectures and have found that while difficult, it is possible.

What about five nines (99.999 percent)? If you measure availability from the customer's perspective, the answer is no. 99.999 percent availability is equivalent to just over five minutes maximum outage time per year, and our March and October satellite channel solar transit outages will put us over that threshold.

Going the other way, 99.9 percent availability means a maximum annual outage time of 8.76 hours. That might make it for plain old cable service (I really doubt it), but data and telephony customers—especially those who have lifeline telephony—will find that much downtime quite unacceptable.

I think the cable TV industry must revisit the whole issue of what constitutes an outage, how outages ought to be measured and tracked, and an acceptable availability figure (maybe different figures for different services?). Things have changed a lot since CableLabs published "Outage Reduction." It's time for someone, whether that someone is CableLabs or SCTE, to tackle what is bound to be a controversial but important issue. Any takers? C_T

Ron Hranac is vice president of RF engineering for Denver-based High Speed Access Corp. He also is senior technical editor for "Communications Technology." He can be reached via e-mail at rhranac@aol.com.

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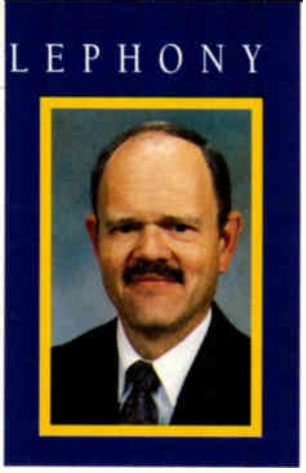
By Justin J. Junkus



Stop, Look, Listen: Lessons for Cable's Future

Because this is the last "Focus on Telephony" column of the year, it seems appropriate to look at what telephony's past can teach cable about its future. Engineers, don't turn to another page yet—what we are discussing here might affect how you approach technology.

Here follow some historical facts and lessons that we can learn from them.

Technology's only a start

Historical fact: Alexander Graham Bell's filing of a patent for "Improvements in Telegraphy" on Feb. 14, 1875, started the telephone industry.

History lesson: You never know exactly what will come from technology. Contrary to popular opinion, Bell's patent application was not for "the telephone." A device called the "harmonic telegraph" was the driving force behind Bell's research. Bell's idea was to place multiple tones on each telegraph line, with each tone transmitted as dots and dashes, to share a telegraph line between multiple messages. (Sounds like frequency division multiplexing, doesn't it?) We all know that Bell improved the technology, and it evolved into the phone, but that first patent became the basis for building a new industry.

Today, cable's engineers are working furiously to create commercial implementations of Internet protocol (IP) telephony. We need to remember that, like Bell's patent, IP telephony is only a beginning, a platform for new technology that will grow into a new industry.

Get it out there

Historical fact: Bell filed his patent in the early part of the day. Later the same day, Elisha Gray filed another patent application for a device that some say delivered telephony much better than Bell's device.

History lesson: When you have an idea, get it to the public early. Bell filed his patent even though his technology wasn't perfect. In 1876, only one year later, he was publicly demonstrating the telephone at the World's Fair in Philadelphia.

> "You never know exactly what will come from technology."

Today, cable is beginning to enter the telephony business. Although we have moved a lot faster in 1999 than in the past, many in cable still are waiting for technology to sort itself out. If Bell had done that, it would be Western Union that just merged with TCI.

Build lasting relationships

Historical fact: To grow the infant Bell System, Theodore Vail commissioned a sales force to find backers of new telephone businesses in growing, rural towns. In exchange for the right to use Bell's patents as the basis for their business, the Bell System required a 50-percent interest in the new company. After the patent rights expired, Bell still owned half of several very profitable businesses, in partnership with prominent local citizens of the communities in which the telephone business was established.

History lesson: Grow a business by win-win alliances that stand up over time. The local bankers became the new telephone company executives, and they were known and respected in their communities. This helped the businesses to grow and prosper, as well as to remain customer-oriented. Telephony subscribers knew the phone company personnel as friends as well as customers, and the phone company personnel similarly knew their customers.

Today, cable is seeing many new alliances, and our industry is converging with the traditional telephone industry. We need to build on the strengths of customer relationships that have formed in both industries and help our customers understand that their future service provider includes the best of both worlds.

Standards! Standards!

Historical fact: The Bell System eventually gained the patent rights to most of the telephone technology in the United States and created a system of standard procedures that spelled out how to run the telephone business, including installation, maintenance and customer support.

History lesson: Standardize on a technology, document the way you want it implemented, and train your personnel to the standards and documentation. Cable is headed in the right direction, but still has some work to do in this area. The Data Over Cable Service Interface Specification (DOCSIS) and PacketCable are recognized as cable industry guidelines for

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digital technology, and the Society of Cable Telecommunications Engineers has issued a number of digital standards. The missing piece, however, is the way cable companies will address the back-office processes, such as the integration of records for provisioning, maintenance and customer service.

Help the customer

Historical fact: Integrated services digital network (ISDN), a telephony technology that delivers 128 kbps of integrated voice and data capability, fell far short of market expectations.

History lesson: Make it easy for customers to embrace new capabilities. Telcos introduced ISDN into the market with little customer support. Potential subscribers needed to find sources of equipment and then locate the appropriate telephone company contact to order the service. Often, the normal point of contact for telephone service knew little about ISDN and could not assist in equipment selection or provide prices for the service.

The cable telecommunications industry faces a similar challenge with high-speed data service and future services built upon an IP platform. Making cable modems available at retail outlets is a good way to get them in front of consumers. With many personal computer (PC) manufacturers beginning to include network interface cards (NICs) as standard configurations, installation is relatively simple.

However, we still need to provide hotline support for our customers because, as Murphy stated years ago, "If it can go wrong, it will." That means training our customer service representatives (CSRs) so they can assist with installation advice, as well as provisioning the service after the subscriber has installed the cable modem.

Adapt or die

Historical fact: In a period of just 20 years, the Bell System changed from a 100-year-old centralized monopoly to a set of divested telephone companies competing with each other, their former parent company and several new service providers, including cable telecommunications companies.

History lesson: Adapt to change or die. Both society and technology have changed radically in the last 20 years. There is no reason to believe that the years to come will change any slower, or less. Both cable telecommunications companies and telephone companies will need to frequently re-evaluate their business strategies to adapt to the changes. As we have seen, even giant companies can completely disappear in less than a year. For cable's technical personnel, the implication is that your skills are what make you valuable, not your company affiliation. Ongoing training will be essential to your survival, and in many cases, it will be you, and not your employer, that will need to take the responsibility for updating your skills.

No promises

Historical fact: The cable business is not the only new business that AT&T has attempted to enter. In the 1980s, AT&T tried to become a force in the computer industry, first through alliances with Olivetti and then by a merger with NCR. It encountered difficulties when it tried to integrate management and products from the companies it acquired and eventually ended up leaving the computer business.

History lesson: There are no guarantees in business. While it is far more likely that AT&T will remain committed to the cable telecommunications industry because it needs the access that cable provides, things may change in the future. Before you form a permanent opinion of which companies will be the leaders of the cable industry in the next millennium, analyze the situation from multiple perspectives, including technology, management and regulation.

The last thing I claim to be is a prophet, so take these history lessons as my personal observations and form your own opinions. Both I and KnowledgeLink wish everyone in cable a happy 2000! CT

Justin Junkus is president of KnowledgeLink, a consulting and training firm specializing in the cable telecommunications industry. To discuss this topic further, or to find out more about KnowledgeLink, you may e-mail him at jjunkus@knowledgelinkinc.com.

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The 9580-TPX™. The 9580-TPX offers a very attractive alternative for monitoring a large number of return test points for ingress at a relatively low cost. The TPX is fully compatible with the 9580-SST, expanding capacity up to 64 test points.

The 9580-SST™. The SST headend unit collects balancing and ingress measurement data from one to eight test points, and transmits updated measurements to the SSR field units, the second component of the 9580 system. The SST operates as an ingress monitor, receiving 80 ingress samples per test point, per second.

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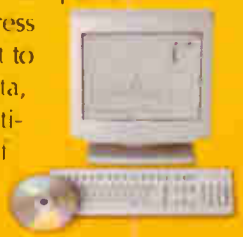

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By Jennifer Whalen

Set-Tops: On the Road to Retail

CableLabs is bullish on the industry's prospects for delivering retail set-tops with removable security by July. To spur those efforts, the research and development consortium released five OpenCable 1.0 interim specs and a new draft spec. It also established an aggressive schedule of interoperability events, including a demo at this month's Western Show.

By putting security and conditional access (CA) functions into a removable point of deployment (POD) module, the industry hopes to spur retail sales of interoperable set-tops and new host devices. The brisk pace is necessary to meet the milestones set by the Federal Communications Commission for achieving removable security by July.

"We feel a lot of pressure to get this done," said Julius Bagley, Scientific-Atlanta's director of engineering for digital subscriber networks, during a presentation at the Atlantic Cable Show. The main challenge is separating the security and out-of-band (OOB) signaling functions from the navigation features. The industry has accomplished this—at a price. "There are costs incurred by both the POD and host manufacturers to make this happen," Bagley said, adding that components such as central processing units (CPUs) and Moving Picture Experts Group (MPEG) demultiplexers must be duplicated in both the POD and host terminal.

Interoperability tests

Looming on the horizon is the FCC's January deadline for demonstrating interoperability of PODs in their correct form factor. Toward that end, CableLabs is holding its second FCC interoperability event early this month, said Paul Zimmerman, systems integration manager for CableLabs. Seven POD makers, nine host device vendors, and four headend manufactures (see sidebar) are expected to participate, he added.

By issuing the five specs in their interim form, CableLabs signaled manufacturers that the specs are relatively stable.

"This is the stage where we feel they are stable enough to build to them," Zimmerman explained. The interim specs include:

- Unidirectional Functional Requirements (for host devices that only receive OOB signaling)
- Bi-Directional Functional Requirements (for interactive host devices that both send and receive OOB signaling)
- Unidirectional Terminal Requirements (for integrated hosts such as TV sets with PODs)
- OpenCable Network Interface
- Host-POD Interface
- Host-POD Copy Protection System (draft spec)

Advantages of retail

As the July deadline approaches, the industry is looking more favorably at the retail market. "It's now seen as a way of achieving a strategic advantage over the competition," said Zimmerman.

Today's consumer electronics (CE) outlets heavily promote satellite receivers to consumers. "Once they buy, they are captured by that product," Zimmerman continued. "OpenCable allows us to have a cable box there to compete with satellite."

Attracting the likes of Panasonic and Samsung also is a plus. "A lot more innovation is possible. We can tap into the creative talents of the makers with this model," he added.

Some of that creative talent will be apparent in the new devices that will serve as the host device. CE makers are expected initially to introduce digital-compatible TV sets that feature an integrated slot for the POD module as well as the traditional set-top box, said Joseph Rodolico, technical marketer for Panasonic. Other potential consumer devices include home-based music servers and digital VHS video cassette recorders (VCRs).

The manufacturing muscle of CE makers will push equipment costs lower, too. "Our economies of scale for manufacturing are very competitive," Rodolico said. "CE vendors can produce a VCR for $64, vs. the current volumes of cable vendors."

CableLabs can't rest on its laurels if it hopes to meet the July deadline. "Our upcoming challenge is how to make the network applications portable to multiple CE devices," Zimmerman added.

To tackle that problem, CableLabs is reviewing proposals from 16 companies to develop OpenCable middleware and a common application programming interface (API). "This will allow you to write an application just once and run it on multiple set-tops and devices from different manufacturers," explained So Vang, software engineer with CableLabs.

CableLabs expects to begin OpenCable certification testing in March, with field trials occurring in April-June. CT

OpenCable Participants

PODs: General Instrument, MindPort, NDS, Philips, Scientific-Atlanta, NAGRA and SCM Microsystems

Host Terminals: General Instrument, LG Electronics, Microsoft, Motorola, Panasonic, Philips, Samsung, Scientific-Atlanta and Thomson

Headends: General Instrument, Scientific-Atlanta, Divicom and Harmonic

Source: CableLabs

Jennifer Whalen is editor of "Communications Technology." She can be reached via e-mail at jwhalen@phillips.com.

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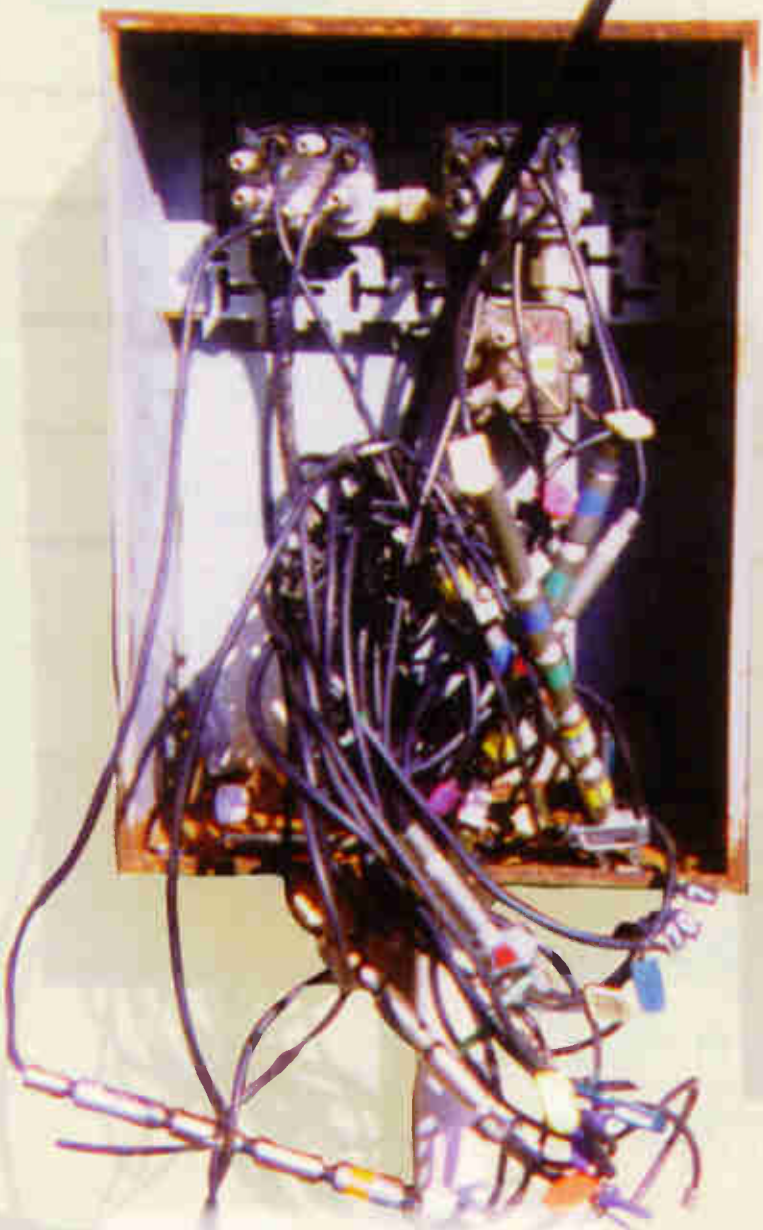

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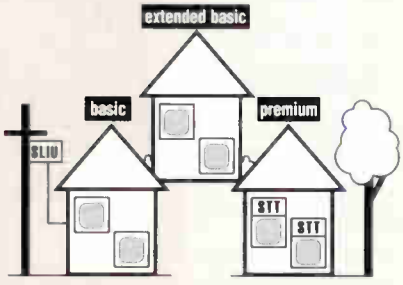

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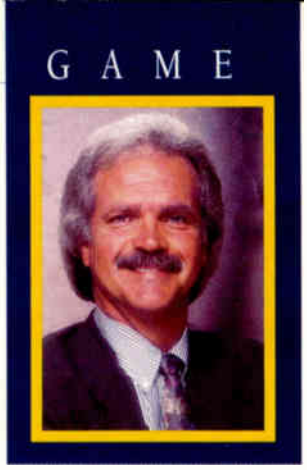
By Terry Wright



That Glow on the Horizon: Predictions Going Up in Smoke?

So is that glow on the horizon the dawn of a new millennium, an innocent comet destined to end humanity, or simply the glow of the cyber-brain rising from our increasingly wired world of structured electromagnetic radio and optical waves?

Because this is my last column of the year, I thought it might be fun to make some pertinent predictions for the cyber-climate I see emerging early in the next century. And by early, I don't mean decades; I mean the next three to seven years. Of course, I'm assuming that humanity survives the movement of the biggest hand on the cosmic clock, to the certain disappointment of many naysayers and doomsday advocates.

Careful . . .

Naturally, putting predictions on paper tends to put the predictor's credibility at risk, which is why most technologists either avoid the practice altogether, predict things already undergoing market trials, or caveat the heck out of anything they do put in writing. After all, modern-day seers can't blame a malfunctioning crystal ball—they have only their experiences, insights, understanding, and powers of deductive reasoning on which to blame "miscalculations" in their predictions.

It's actually quite a thankless task, this predicting-the-future stuff. Most folks will never remember where they read something first if predictions pan out, and errant predictions generally are just chalked up as wild speculative outbursts from another nutcase who believes the future can be rationalized.

I suppose you'd have to be at least a little crazy to speculate on something as dynamic as the evolution of cyberspace, especially today with so many issues yet to be identified and resolved, but I guess I'm comfortable wearing the "a little crazy" label.

While many of my previous predictions have come to pass, my timing has been lousy—not nearly aggressive enough. Probably the most ironic aspect of predicting (in 1990) something like the emergence of high-speed data over broadband cable by the late '90s was the look on peoples' faces when I did so. It wouldn't be fair to mention names, but we were laughed out of a number of Wall Street offices in the early '90s after making such predictions.

> "Custom TV services will be prevalent, and you likely will not know or care where they come from."

I suspect that those hecklers are no longer laughing. In fact, I would bet more than a paltry sum that most of them are hoping the cable industry weathers the turbulent, competitive and dynamic times ahead. Nevertheless, I've reminisced long enough—on with a few predictions.

Some assumptions first

Open mouth, insert foot—and most of a leg: No caveats, but a few assumptions are in order. If they hold, then the predictions to follow could very well come to be.

- Broadband network operators achieve parity with other data/Internet service providers in all nonperformance aspects, allowing them to continue leveraging broadband performance and command a premium fee relative to other access/distribution approaches
- Moore's Law (computers improve drastically every year) continues to hold for at least the next two years
- The Internet continues to operate and evolve without the imposition of major regulatory constraints
- The economy continues to hold its own
- Government does not impose regulations that would unfairly favor one form of data or Internet service access or distribution over another
- Known laws of physics persist
- World war does not break out
- All the big comets miss us

Let the predicting begin

Some of the following are rather obvious, while others may come as a bit of a surprise. It would be inappropriate to reveal the rationale underlying the speculations—we'd just argue about it anyway. You should know, however, that there actually is evidence (albeit not easy to find) suggesting that cyberspace will, by the end of the year 2007, have the following attributes:

- (Early) Integrated continuous voice recognition technology will reach a cost-effective sand-and-glass stage (silicon), and mice will join their real-world kin (along with 8-track audio tapes) in the attic.
- (Perhaps equally early) We will have cost-effective interchangeable flat-panel

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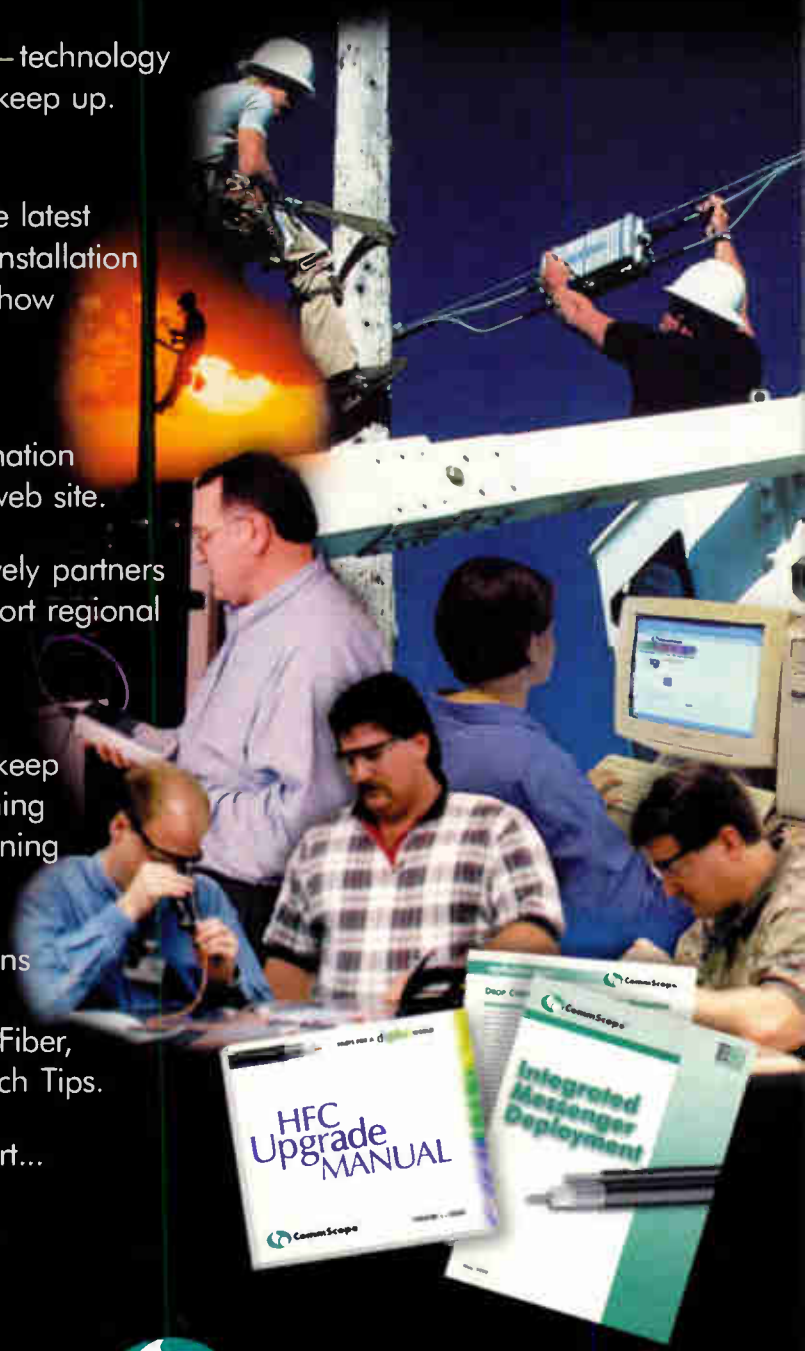

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displays—capable of functioning as TV sets, personal computer (PC) monitors, changeable wall art and real-time teleconferencing portals—that will be bigger, better and more power-efficient than today's liquid crystal displays (LCDs).
- All the consumer electronics, computing and entertainment equipment in your home will be integrated, and the basic enabling technologies likely will use wireless technology as well as existing coax in the home.
- New techniques in silicon fabrication will substantially reduce power consumption, resulting in wider applications.
- Wearable computers and implants will be commonplace (perpetual monitoring of our individual health).
- Multiple access/distribution network approaches, together with optically-switched core networks, will drive the location of a common packet-processing interface very near the edge of the network, either in the home or on the pole just outside.
- The core of Internet backbone networks will be optically switched; lambda routing will extend through the fiber in hybrid fiber/coax (HFC) networks.
- We will have Terahertz computers and virtually unlimited bandwidth between most places.
- Wafer-scale integrated circuits (analog chips) will emerge in visual processors linked with neural nets; the resulting combination will be capable of watching and directing things for us.
- Holographic telecommunications services will take the hassle out of meetings, substantially reducing business travel.
- Robots will design and manufacture other robots.
- Folks will offer software for your Internet appliances to immunize them against online marketing schemes from virtual marketer systems.
- At least one bewildered government body, somewhere on the planet, will attempt to tax the Internet, significantly mucking things up for a while. (Governments have to eat too, you know. That old e-commerce really takes a toll on the public coffers.)
- Custom TV services will be prevalent, and you likely will not know or care where they come from.
- A substantial part of cyberspace will be invisible to most, will be taken for granted by many, and will be far more secure than we ever imagined.

Wait and see

I know I can count on most of you to find and berate me if most of these things don't happen by the end of 2007. I hope you won't wager a lot of money on these things; after all, I did admit to being a little crazy. If most of them do emerge in that timeframe, you might mumble to yourself something on the order of "Gee, didn't I read something about this late in the last millennium?" CT

Terry Wright is chief technology officer for Atlanta-based C-COR.net Corp. He can be reached at (770) 416-9993 or via e-mail at tlwright@convergence.com.

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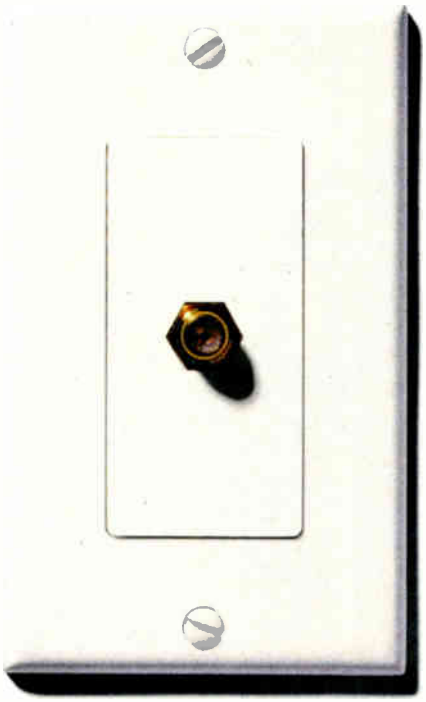

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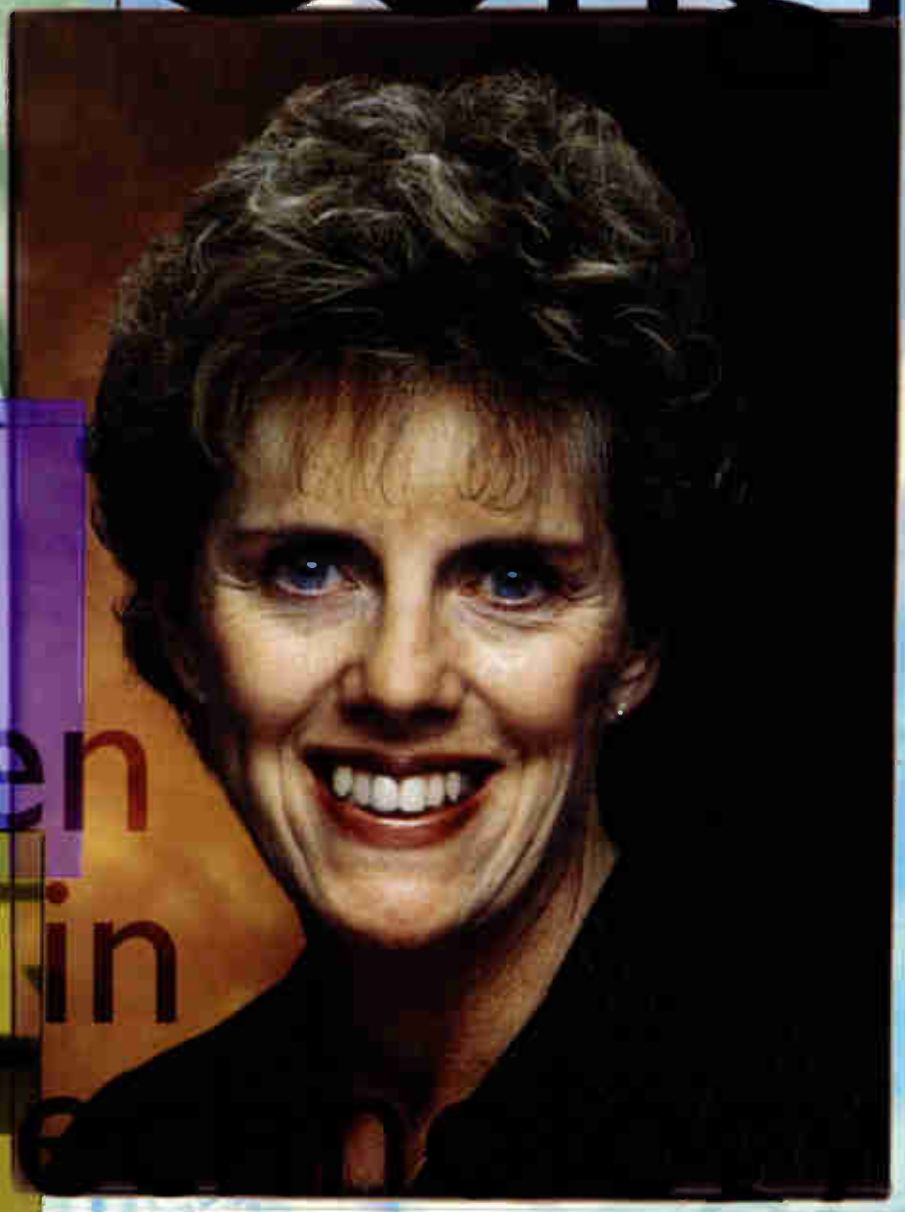


atulations

Sally Kinsman, General Instrument

By Sheri Stinchcomb

Sally Kinsman, the 1999 Women in Technology Award recipient, is a perfect role model for anyone on the road to success. Kinsman reached the top of her profession as a cable system designer without losing her respect for others, her sense of humor or her values.

When asked, she describes herself as honest, hardworking and a good friend. On review of her credentials, one could add that she's a pioneering, confident risk-taker and lover of challenge. These traits are clearly exemplified by her successful career running her own design firm and her dedicated support of the cable industry generally and especially the Society of Cable Telecommunications Engineers during its darkest days.

Of course, all of those traits may very well have been "in her blood" from the beginning. Kinsman was born in Seattle and has lived much of her life in the Pacific Northwest. Her great, great, great grandfather was one of four who settled in that area around 1851. Her father was a Navy commander who flew PBYs in the Aleutians. Pioneering, risk-taking and challenge have run in her family for quite some time.

Starting out in cable

Kinsman's career in the cable industry had an inauspicious beginning. "I answered a blind post office box ad," she recalls. "I'd never heard of cable television." That was November 1972, and ATC (now Time Warner Cable) hired Kinsman for a drafting position. She quickly turned the job into more.

"I was always curious. I kept hanging around the designers, and I started picking it up. I played around with it on my lunch hour. Within six months, I was doing system design," Kinsman says.

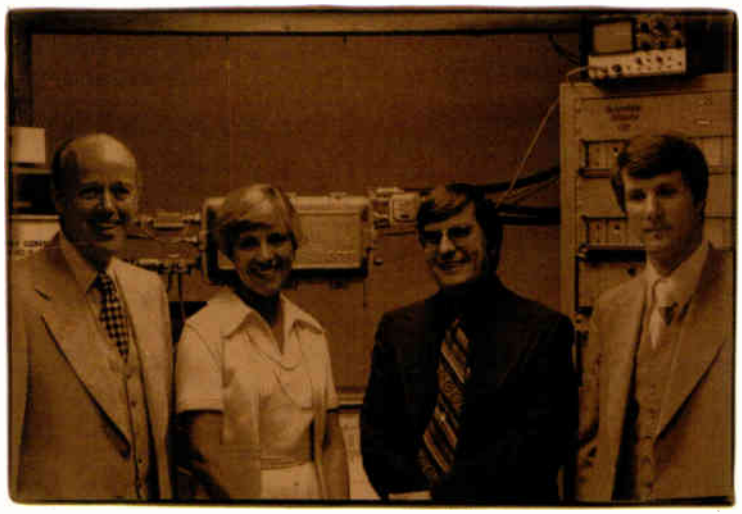
She spent five years with ATC honing her design skills. She entered cable in its formative years and has primarily held technical positions where, even today, there are few females. "I don't think about being a woman in a highly male-dominated field. I like to prove I can do a job and, at the same time, stay in tune with being a woman," she firmly states.

A firm of her own

In 1980, at the urging of some close friends and contacts in the cable industry, she took a risk and began her own design company called Kinsman Design Associates. Those cable friends came through by bringing "more than enough" work to her firm, which in 11 years did 20,000 miles of system design.

Getting a design firm started in 1980 wasn't easy. "I had to write all of my own design program, because there was no Lode Data or any of today's programs available to be bought," Kinsman says.

"My dad lent me $1,000 to buy a



Old Friends: From left to right, Jack Forde, Sally Kinsman, Bob Vallerand and Bob Luff celebrate the grand opening of ATC's (now Time Warner Cable's) Durham, N.C., system in 1977.

computer, and I sat in my kitchen for six weeks writing programs. I would be reading the program language book in one hand and writing something that made sense with the other hand. I really didn't know what I was doing, but my programs mathematically worked, created good maps for the systems, and kept my people employed," she explains.

A dedicated volunteer

In addition to her design work, the cable industry has benefited from Kinsman's efforts in various industry forums. She is a senior member of the SCTE and won Member of the Year in 1985. She was the first woman elected to the SCTE National Board, serving there from 1983 to 1987. She was the 1985 accolade recipient for Women in Cable and Telecommunications and was inducted into the Cable TV Pioneers in 1996.

Kinsman joined the SCTE as a way to repay those in the industry who had helped her, she recalls. And it certainly wasn't all fun and games.

"At the first or second board meeting, it became apparent that SCTE was on the verge of bankruptcy. We were $75,000 in debt, and we had to solve some big problems," she says. "We all really worked hard, especially Tom Polis, who was the president.... It was fun to watch it grow from this organization that was working out of the back room of Polis' company to buying our own building."

Kinsman was instrumental in helping to turn the organization around. "When we were in financial difficulty, we'd sit in the board meetings trying to figure out how to expand the membership because it was very low... We came up with this huge list of questions to ask the members," she says. Kinsman spent $3,000 of her own money to conduct the member research.

"We used the responses to formulate ideas for the subject matter for the various meeting groups," she says. Kinsman won the Member of the Year award for that job.

The survey and revitalized meeting groups were a huge success, and soon the SCTE board tapped Kinsman for her next challenge. Membership started to explode and meeting groups were springing up across the country. "The board of directors in each region couldn't cover all the meeting groups anymore, so they asked me to expand the regions from about 8 to 12," she says. "That may sound simple, but you had to sit down and count up how many members were in each state, and look for where the growth might be coming from, and where the MSOs (multiple system operators) were building. It took several months for everyone on the board to finally agree on where the new region lines were going to go."

Through her dedication, Kinsman has gained the respect of many members of these organizations. "Sally has a knack for finding the very best in people, even when she's not given much reason to. She always has something cheerful to say and is always a pleasure to be with. I can't think of a more worthy recipient," says Ron Cotten, vice president and director of technology at Communications Group, CH2MHill, and the first SCTE president.

New challenges to conquer

In 1991, Kinsman again moved on to tackle new projects. She became the broadband product manager for Augat (now Thomas & Betts), a manufacturer of fiber node and RF amplifier equipment. She joined Texscan in 1995 as a director of technical sales to gain the sales perspective in the industry. She brought all of her management, technical sales, and system design experience together when she rejoined Augat in 1997 as its director of technical customer support.

Today, Kinsman is the program manager of Transmission Network Systems at

GI's David Grubb and Sally Kinsman find innovative ways to solve technical challenges for customers.

General Instrument in Kirkland, Wash. She is primarily responsible for coordinating product qualification and approval for three key MSO accounts: Time Warner, MediaOne and Charter Communications. This role includes matching specifications and products for RF amplifiers, fiber-optic transmitters and receivers, and passive products. She also supports the director of marketing with product management.

"People are still trying to do the same things that they were trying to do in the '70s and '80s—that is, building the most efficient plant they can," Kinsman says. "You sit down with maps, analyze what they've got, and determine what works to solve their problems. We do chamber tests and prove the analyses out with real equipment."

By helping her customers to build the most technologically advanced systems, Kinsman has impacted many people in the industry.

"Each and every person that I run into that knows her shares the same high opinion of her. She is the best ally an operator—or anyone faced with a technical challenge—can have when brainstorming on solutions," says Tim Schermerhorn, director of marketing for General Instrument's North America Transmission Network Systems group. "She is a pleasure to work with both on a personal and professional basis. I am not the least bit surprised that she has won this honor."

Continuous education

Kinsman has traveled through a rich career path that includes receiving her bachelor of science degree in business, *magna cum laude*, from the University of Colorado at Boulder in 1979, and completing all but the last 30 hours of an MBA program. She also has enhanced her education through a multitude of technical training courses from the SCTE, National Cable Television Institute, General Instrument, Wang and Philips.

Training is essential for everyone involved in cable today, she says, especially as systems launch new services such as cable modems and telephony.

"These guys and gals aren't just out on the line taking care of a few amplifiers anymore. Now they have really sophisticated plant to take care of," she says. "We have to make sure the system people can be allowed to come and attend training sessions."

Sally Kinsman poses in front of one of the industry's first earth stations. "Thankfully, they've been reduced in size over the years," she says.

Kinsman acknowledges that historically it's been difficult for managers to allow personnel to attend training because of the associated financial costs and lost time away from the workplace.

"But, there will be a huge cost if we don't keep trained and up with new technology," she warns. "As we go forward, maybe more of the training can be done in real time over the Internet .... The manager would still have to give people time off, to be able to sit at the computer and do the training, but it sure would beat the time and money involved trying to fly somewhere."

> "There will be a huge cost if we don't keep trained and up with the technology."
>
> —Sally Kinsman

Accolades from friends

Kinsman is thankful for the support of many of her friends and peers in the industry. "I have been successful because of all of the friends I have made in cable," she says, adding that she is grateful to each for giving her the opportunity to succeed and for the opportunity to have them as friends.

Early in her career working for ATC in the 1970s, she realized that cable was in its infancy. At ATC, nobody cared if she was a woman in this new industry, but they all learned together and gained experience around the new experience called cable TV. She began building long-standing friendships from the start of her career through mutual respect, hard work and loyalty.

It is obvious that her peers and friends possess a tremendous respect for her. Dave Franklin, director of plant engineering at Time Warner Cable's Corporate Engineering Group, first met Kinsman when they were both on the board of the SCTE. "She has a discipline of mind, confidence of self and resolve of will to get the job done, whatever it takes," he says.

Bill Ellis, a longtime cable engineering veteran who is now retired, had the privilege of working with Kinsman twice in his career.

"What most impresses me about Sally is that she is a very intelligent person who has the ability to have a wonderful grasp of detail," Ellis recalls. "She is also a very thoughtful person who never meets a stranger and is respected by a great many people in the cable industry." ➤

Who said cable engineers are all wet? SCTE board members toast the town and tub at the 1984 Cable-Tec Expo in Nashville: From left to right are John Warner, Bob Vogel, Dick Kreeger, John Kurpinski, Sally Kinsman, Tom Polis, Jim Emerson and Richard Covell.

New endeavors also form a part of Kinsman's personal life. Last fall, she went swimming with the dolphins in Key Largo, Fla. She says: "It was incredible. It's at the top of my list of newfound enjoyments in life." Kinsman says she also enjoys skiing, yoga and just relaxing on a nice beach.

The future of the industry

Communications Technology in conjunction with Women in Cable and Telecommunications and SCTE created the annual Women in Technology award in 1995. The award is designed to recognize and honor leading women in technology positions within the cable and telecommunications community and to create visibility for all women in technical careers.

Kinsman clearly has been a player in the industry for almost 30 years. She is optimistic about the future of the cable and telecommunications industry, confident that the industry will continue to present new opportunities and new challenges, much like the ones she's experienced since the 1970s.

Please join me in congratulating Sally Kinsman, a great role model and very deserving candidate, for this year's Women in Technology Award. CT

Sheri Stinchcomb is vice president of new product operations for Cox Communications and was the recipient of the 1998 Women in Technology Award.

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BONUS—A textbook that focuses on cable modem installation and configuration, and a CD-ROM with video and installation simulations are also included in the A+ Career Pack.

Where is DOCSIS Now?

Entering the Brave New World of Interoperability

By Rouzbeh Yassini

Cable's high-speed data business finally is taking off. Industry analysts report that total North American cable modem service subscribers hit the 1 million mark in mid-1999. Looking forward, they see the pace quickening sharply, with another 7 million subscribers signing on by year-end 2002.

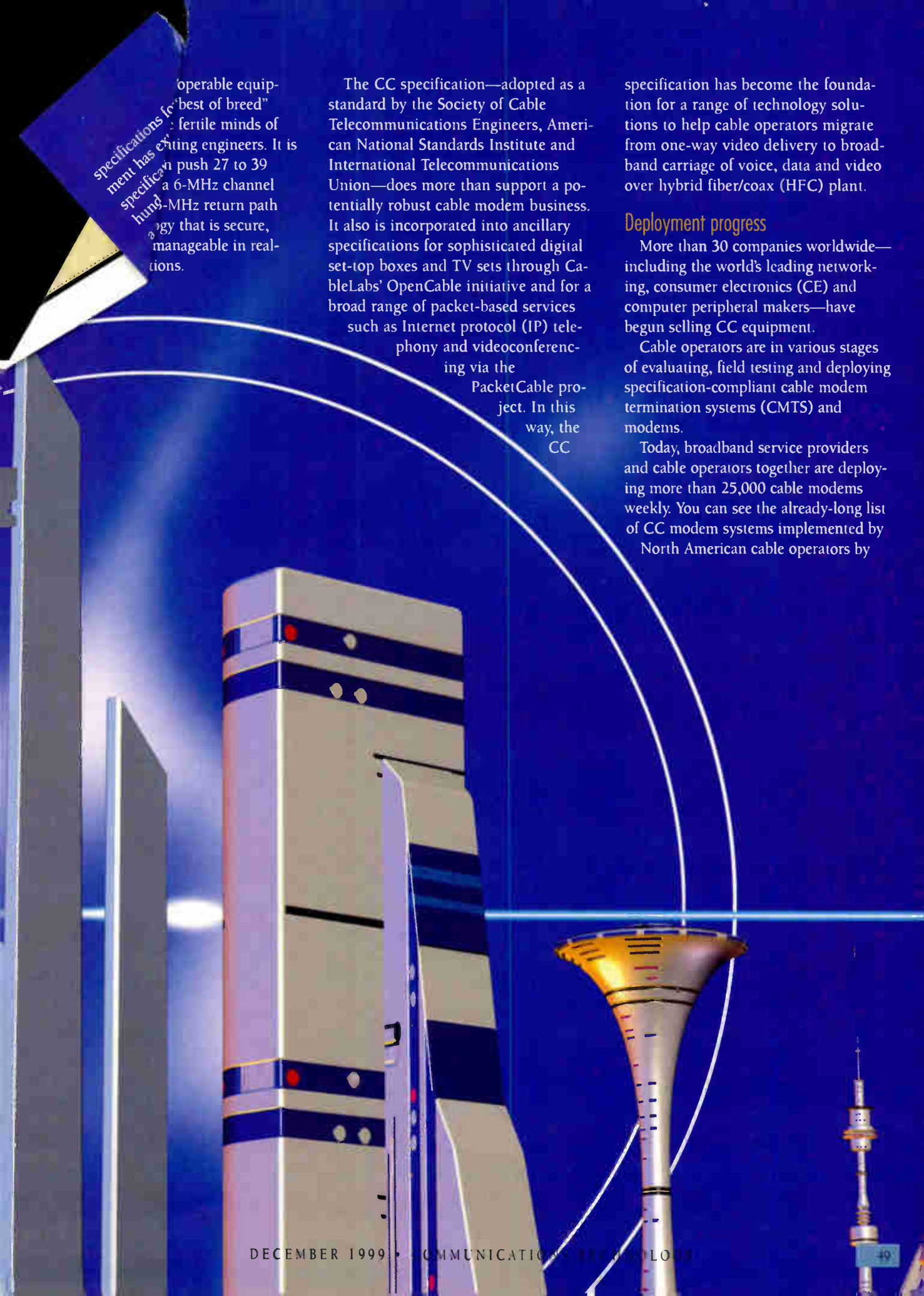
One key element of this projected rapid growth is the growing availability of interoperable equipment—both cable modems and headend components—made possible by the Data Over Cable Service Interface Specification (DOCSIS) project. This effort is a collaboration of cable operators and vendors (see sidebar on page 55) fostered by Cable Television Laboratories Inc., or CableLabs, the cable operator-funded research and development consortium.

In a nutshell, the effort focuses on defining interface requirements for cable modems involved in high-speed data distribution over hybrid fiber/coax (HFC) networks. The DOCSIS initiative also provides cable modem vendors with a fast, market-oriented method for attaining cable industry acknowledgment of DOCSIS compliance and paves the way for availability of cable modems through retail outlets such as Circuit City.

Same spec, different name

First, an aside on terminology. The marketers have spoken, and the DOCSIS name is on the way out, being replaced by a more consumer-friendly label, "CableLabs Certified," to be used in advertisements and retail store displays. Here, we'll call it CC for short.

Whatever its name, the long struggle to define



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tions.

The CC specification—adopted as a standard by the Society of Cable Telecommunications Engineers, American National Standards Institute and International Telecommunications Union—does more than support a potentially robust cable modem business. It also is incorporated into ancillary specifications for sophisticated digital set-top boxes and TV sets through CableLabs' OpenCable initiative and for a broad range of packet-based services such as Internet protocol (IP) telephony and videoconferencing via the PacketCable project. In this way, the CC specification has become the foundation for a range of technology solutions to help cable operators migrate from one-way video delivery to broadband carriage of voice, data and video over hybrid fiber/coax (HFC) plant.

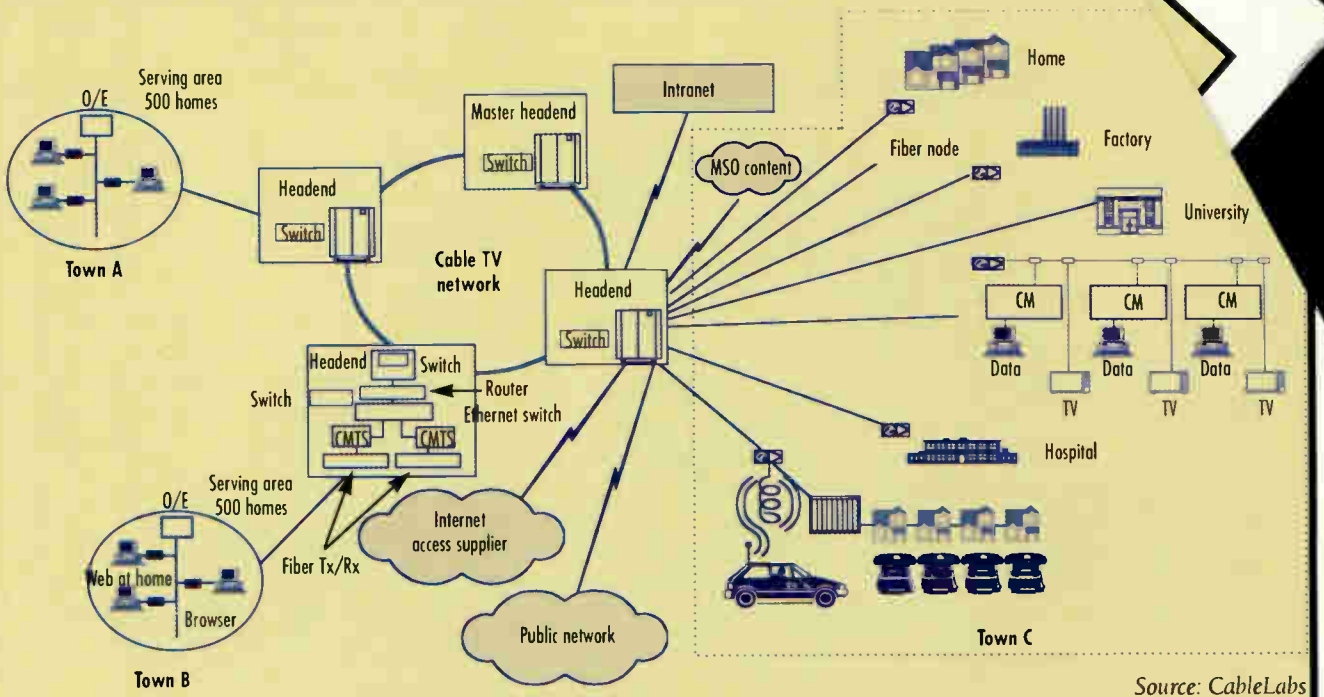
Deployment progress

More than 30 companies worldwide—including the world's leading networking, consumer electronics (CE) and computer peripheral makers—have begun selling CC equipment.

Cable operators are in various stages of evaluating, field testing and deploying specification-compliant cable modem termination systems (CMTS) and modems.

Today, broadband service providers and cable operators together are deploying more than 25,000 cable modems weekly. You can see the already-long list of CC modem systems implemented by North American cable operators by

End-to-end architecture



Source: CableLabs

visiting www.cabledatacomnews.com/cmic/cmic8.html.

A look at layers

The CC specification (available at www.cablemodem.com) is rich in features and capabilities. What's presented here is an overview of one possible implementation of a CC environment.

The following section makes reference to Chart 1 (on page 52), which relates the protocols chosen for the CC specification to the traditional seven-layer open system interconnection (OSI) protocol stack. The lower four protocols are specific to cable data networks, while the higher-layer protocols, IP and above, are more commonly used protocols.

Physical layer (PHY): Starting with the seventh, or physical, layer of the model, the CC specification includes flexible and robust forward and return path modulation schemes. It was designed specifically to work on all cable plants in North America, from those with long cascades of amplifiers to those with the newest HFC topologies.

The forward path uses the ITU J83.B modulation scheme (same as SCTE DVS-031), which includes both 64-QAM (quadrature amplitude modulation) and 256-QAM, with fixed forward error correction (FEC) and variable interleave depths.

The return path uses both quadrature phase shift keying (QPSK) and 16-QAM, at any of five signal rates, making for 10 possible channels ranging from 200-kHz wide (320 kbps), all the way up to 3.2-MHz wide (10 Mbps). On the return path, a variable depth FEC is available with T=0 to 10, and code word sizes from 16 to 253 bytes. A variable length preamble is available.

> "It is the operator's responsibility to integrate the CableLabs Certified toolkit into an existing provisioning environment."

The CC specification also includes the ITU J83.A modulation scheme, which accommodates 8-MHz-wide forward channels and a 5- to 65-MHz return path with essentially all the same features as J83.B.

Media access control (MAC) layer: The MAC layer, which controls access to return-path bandwidth, is a fourth-generation implementation, incorporating years of learning from legacy cable data systems. The CC MAC makes optimal use of return path bandwidth.

Beyond CC 1.0: Beyond the CC specification's version 1.0, which is stable and being implemented by multiple vendors, CableLabs is defining version 1.1 and evaluating future versions of the specification. (See Chart 2 on page 52.)

Extensions of the protocol in v1.1 facilitate such enhanced services as voice over IP (VoIP), video over IP and guaranteed/differentiated quality of service (QoS) levels supporting various types of activities. Also supported is MAC layer fragmentation, by which the CMTS can fragment large upstream frames to achieve greater flexibility in scheduling time-critical transmissions, such as voice or synchronized video and audio.

The key features of CC specification v1.0 and v1.1 are summarized in the accompanying table (on page 54). ➤

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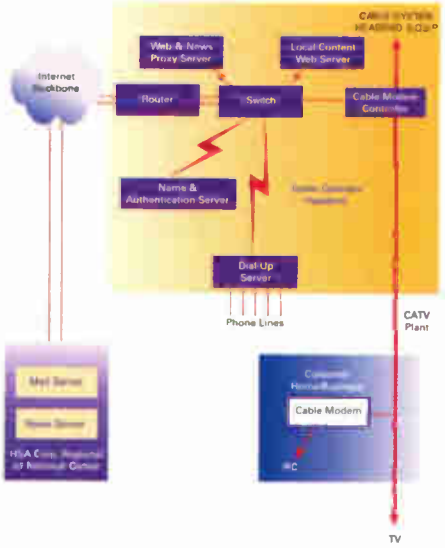

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the Rivest, Shamir, Adelman (RSA) encryption algorithm for the secure exchange of encryption keys between the cable modem and CMTS.
- To detect "cloned" cable modems so that theft of service can be prevented: Here, the CC specification supports the same range of policing functions (filtering) available in the remote access servers employed by traditional dedicated-line network service providers.

Fault management (SNMP): Fault management includes the remote detection, diagnosis and correction of network problems. CC modems support SNMP management traffic across both the customer's and cable-system's interfaces. Installers can use SNMP to perform onsite diagnostics and fault isolation on both the cable modem and cable TV plant. The information made available to them under the specification includes signal-to-noise (S/N) ratios, transmit and receive power levels, propagation delays, micro-reflections, and packet counts.

Fault management (event logging): Events can be reported via log entries in a management information block (MIB), the Syslog facility and SNMP traps. Reporting of events may be fully configurable by priority class and may be disabled completely. Modems implement a local event log that is available via SNMP and that persists across reboots. Events also may be sent to a network event log server for tracking by the operator.

Reaping the rewards

Cable operators who implement CC modem systems can rely on extensive documentation provided by CableLabs and on partnerships with vendors, many of whom have themselves been involved in the specification's creation. Many elements must be tailored successfully, but few are inordinately subtle or tricky.

The rewards—access to interoperable equipment, the migration of modems into retail stores and more—are, arguably, worth the effort. CT

Rouzbeh Yassini is chief executive officer of YAS Corp. and executive consultant, through his YAS Corp., to CabeLabs in Louisville, Colo. He may be reached via e-mail at rouzbeh@yas.com.

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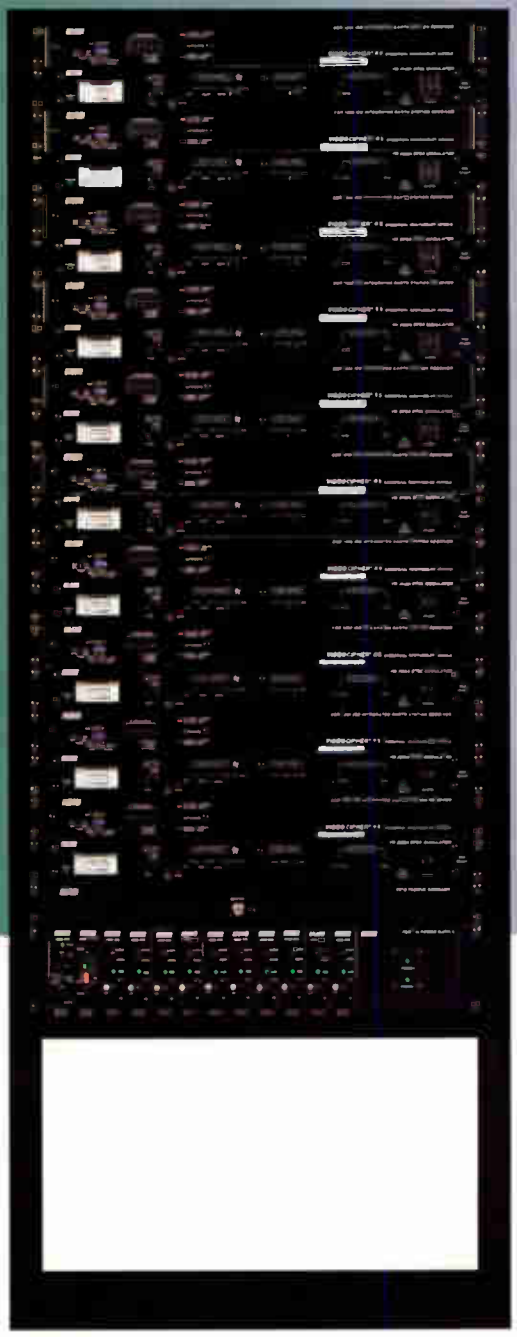

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DWDM Transport Networks

Advanced Services Require Advanced Architectures

By Esteban Sandino and John Trail

Advanced two-way services such as Internet access and telephony are driving the remarkable growth we see in the cable industry today. In the last 18 months, AT&T Broadband and Internet Services has extensively deployed dense wavelength division multiplexing (DWDM) technology to provide these advanced services.

DWDM is a cost-effective method of providing the high degree of forward and return segmentation required for robust two-way performance in a hybrid fiber/coax (HFC) plant. When designing and deploying transport architectures based on DWDM technology, remember you'll need to first consider the available forward and return channel bandwidth, the new services you intend to offer, expected penetration levels, and desired number of homes per node.

The way things were

Traditional HFC architectures are optimized for the delivery of broadcast services. The basic architecture consists of a master headend providing services to a number of primary hub sites arranged in a fiber ring configuration to allow for redundant signal transmission to large clusters of homes.

Broadcast lineups are assembled at the primary hubs for further distribution over primary and redundant fiber paths to secondary hub locations, also arranged in a ring configuration. Out of the secondary hubs, broadcast lineups are retransmitted to individual fiber node areas. Optical-to-electrical (O/E) conversion takes place at the fiber node prior to last-mile distribution to homes over coaxial busses.

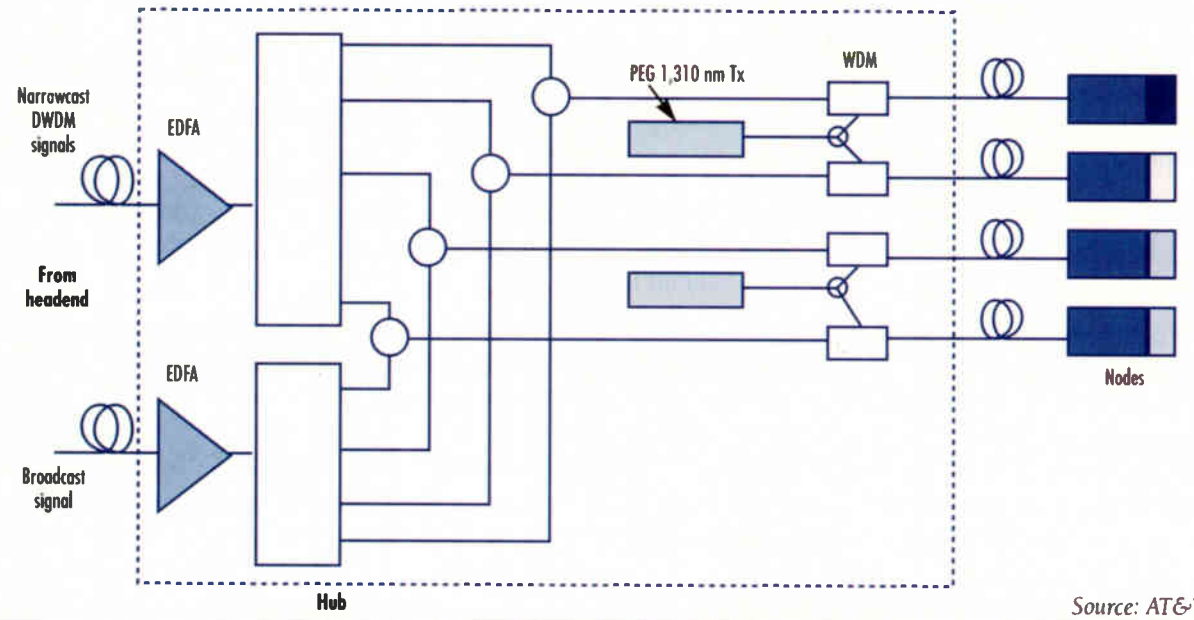
This traditional approach keeps fiber counts low from master headends to primary and secondary hubs. It also reduces failure group sizes by limiting the number of homes that are affected by service disruptions as a result of fiber cuts or other problems.

What they're becoming

As more sophisticated services emerge for delivery over HFC networks, operators must face a new set of challenges. Chief among these is the requirement to target service delivery to increasingly small fiber node service areas.

HFC networks must support both forward and reverse frequency re-use to allow delivery of interactive services to a multiplicity of service areas. Such space division multiplexing results in increasing amounts of bandwidth allocated to smaller groups of customers. However, it also increases the number of fibers required on the portion of the network between primary and secondary hubs to support the higher

Figure 2: Optical insertion of PEG channels at the hub (three wavelengths to the node)



Source: AT&T/Harmonic

desired HFC plant segmentation levels, and the expected rates of penetration for bandwidth-intensive applications and services that will be supported over the two-way HFC network.

Every market has unique requirements that must be addressed prior to deciding on a particular architecture implementation.

The fundamental design decision concerns the number of wavelengths to be deployed initially in a system. Each DWDM wavelength typically can transport between eight and 10 quadrature amplitude modulation (QAM) RF carriers. (48 MHz to 60 MHz worth of bandwidth is available for targeted delivery of advanced data service.) Newer systems are coming to market that will support up to 200 MHz of targeted service bandwidth.

Let's look at the planning process in the deployment and activation of DWDM transport networks. The first step is to examine current segmentation levels for the HFC physical plant. Are those levels adequate to support the level of penetration expected of data services?

Service variables: The new generation of interactive services requires allocation of fixed amounts of bandwidth in the forward and return directions. This allocation will vary by service: High-speed Internet access will not be as bandwidth-intensive as circuit-switched telephony or future Internet protocol (IP)-based telephony applications.

Growth: The bandwidth allocation process must take into account expected rates of growth for individual services. Moreover, the required amount of allocated bandwidth increases proportionally to the size of individual service areas and projected number of customers. The goal of this process is to generate a targeted or narrowcast service lineup where the available bandwidth per DWDM wavelength is allocated to various services according to need.

As an example, multiple system operator (MSO) No. 1 may choose to allocate two 6-MHz channels for Internet access and perhaps four more 6-MHz channels for telephony services, with the remaining bandwidth allocated to other services. Throughout this process, the MSO may discover that the level of plant segmentation for a particular system is not enough to support the required bandwidth per service area. The upper limit on the number of homes, and potential data customers, that an individual DWDM wavelength can support will be exceeded. A reduction in the size of the fiber service areas to a level that can be serviced by a single DWDM wavelength is in order.

Alternatively, MSO No. 2 may offer only a limited number of data services and decide to use only a portion of the available narrowcast lineup for a given service area. This is the opposite situation, where allocation of a single DWDM wavelength per

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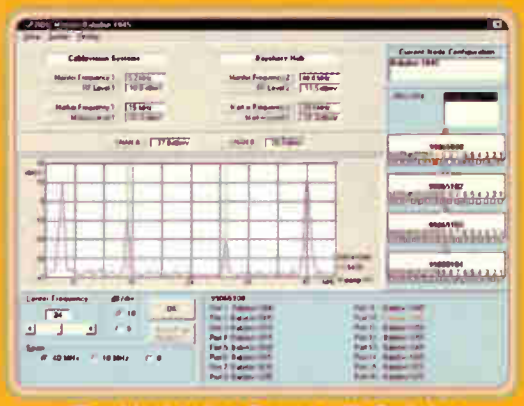
DWDM for Today and the Future

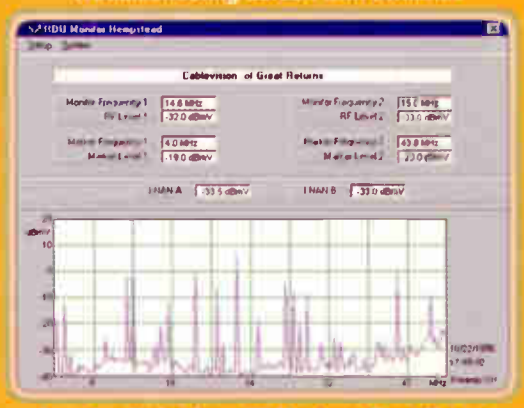
Advanced two-way services are driving cable industry growth. Dense wavelength division multiplexing (DWDM) technology can be a good way to provide these advanced services. DWDM can cost-effectively provide the high degree of forward and return segmentation required for robust two-way performance in a hybrid fiber/coax (HFC) plant.

Key design considerations are type and level of services planned, RF bandwidth available, and number of homes per node. DWDM systems can be installed quickly over legacy networks, with minor or no infrastructure construction. Additional DWDM wavelengths can be added easily.

Down the road, the systems can evolve and incorporate new technologies, enabling multiple system operators (MSOs) to grow their networks to continue meeting customers' ever-increasing demands.



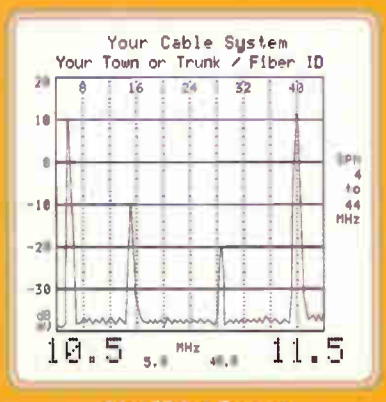
Troubleshooting Screen with Switches



Impulse Noise from 65 Mustang Door Buzzer

The RDU is a new type of return test system. You "see" the live condition of the return spectrum and RF level in dBmV at the HE, from any subscriber's terminal, amplifier, tap or fiber node.

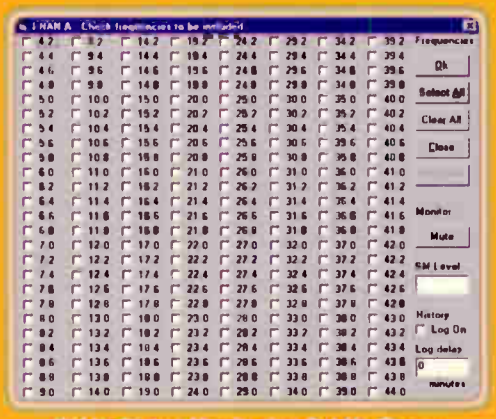
The RDU provides a real time visual display of Carriers, Ingress, Noise, Impulse Noise and Common Path Distortion.



Live Video Screen

With integrated RF switches, the RDU system allows you to select and monitor a single node, a group of nodes or all the nodes in the Hub. Node configurations are created and named by you insuring an intuitive, easy to implement Return Management System.

RDU's Status Monitor the noise floor, where you designate, by frequency. The RDU averages the energy and displays your benchmark *I-NAN* number. You gauge the noise floor's condition from a trackable number!



I-NAN Status Monitoring Set Up Screen

I-NAN numbers allow you to judge return performance over time by node or system. *I-NAN* is a flexible, cost effective tool for proactive maintenance of return networks.

The RDU provides frequency agile level cursors with a Delta in dBmV and a time / date stamp for accurate Carrier to Ingress / Noise Ratio tests. Save the results and print later for cost effective engineering operations.

Cycle through your nodes overnight, isolating the problems for morning attention. The RDU insures engineers have a tool for effective maintenance.

See your return system on a TV channel and / or use the high speed, networked data port and access the RDU over Cable or Intranet modems. Up to 384 nodes can be monitored from a single Controller!

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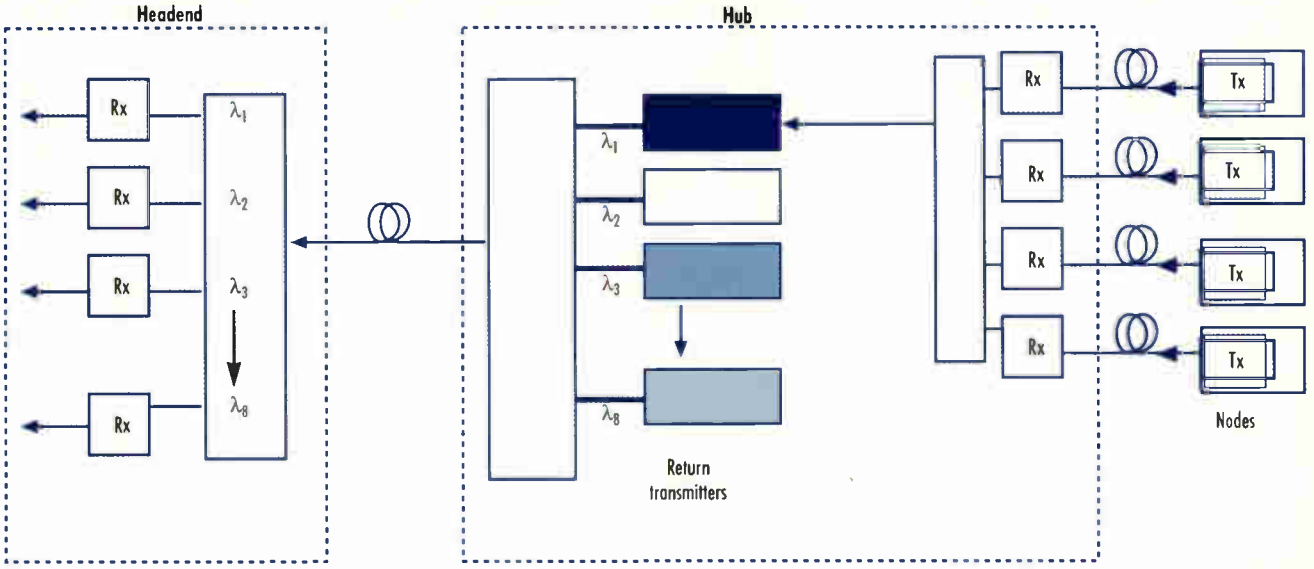
Figure 3: DWDM return with a 5,000-home segmentation

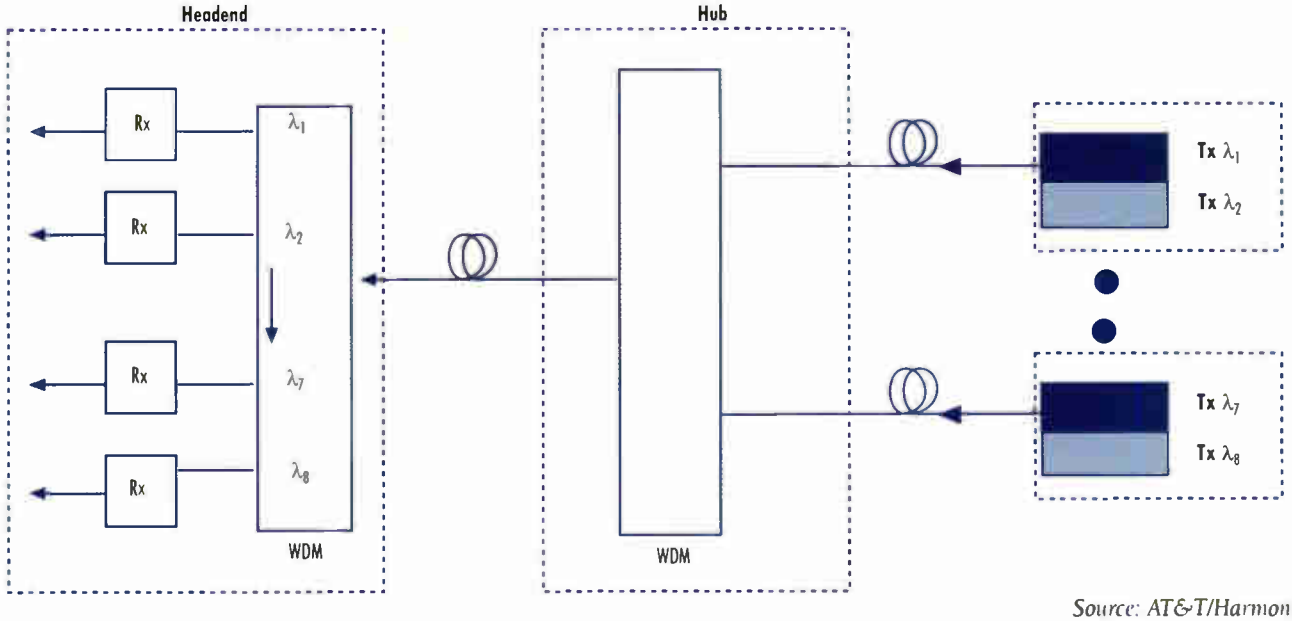


Source: AT&T/Harmonic

service area results in under-utilization of the available narrowcast lineup.

To avoid this situation, the selected DWDM architecture would enable sharing of one DWDM wavelength across multiple service areas. The only caveat is that individual service areas must have enough RF bandwidth to support the entire narrowcast lineup—even when only a portion of that lineup is utilized. To illustrate, two service areas may share a full 60-MHz narrowcast lineup, but each utilizes only half. The advantage here is that the cost of deploying dedicated DWDM wavelengths is halved.

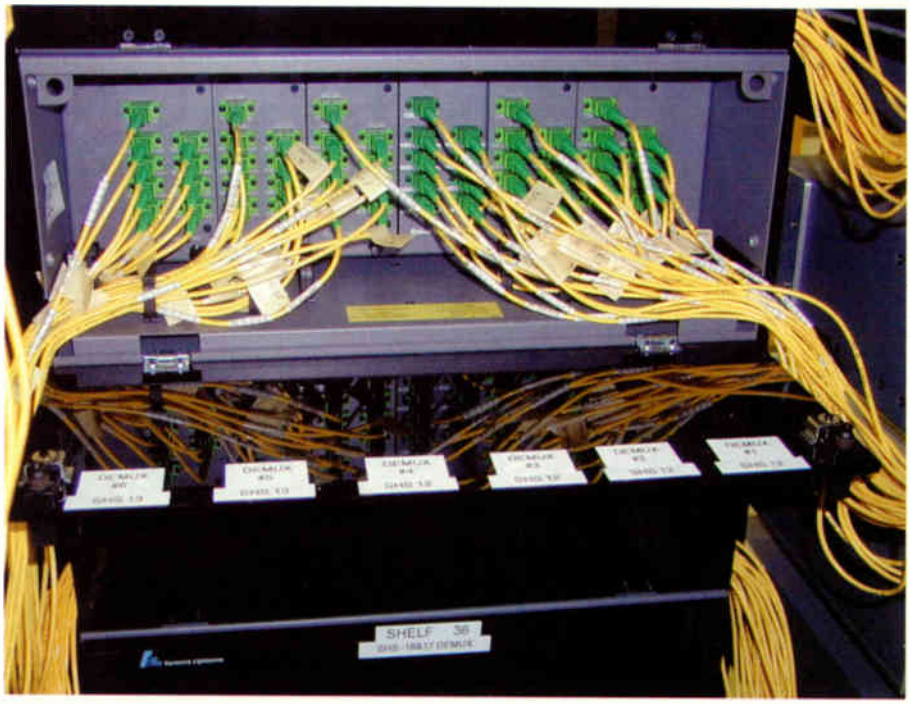
Figure 4: High return segmentation with WDM in the node



Source: AT&T/Harmonic

Implementation of DWDM transport networks for AT&T B&IS systems falls into two broad categories. The first category covers those systems where only high-speed Internet access services are deployed initially. In these systems, the segmented service areas support a full narrowcast lineup but utilize only a portion of it.

Activation of additional data services is not immediately required; therefore, a dedicated DWDM wavelength per fiber node and service area from day one may



A rack of 1 x 8 passive optical multiplexers and demultiplexers at an AT&T B&IS primary hub for its Aurora, Colo, system. Photo courtesy of Harmonic Inc.

not be economical. Initial DWDM deployment cost is minimized if a single DWDM wavelength is shared across multiple service areas. The starting point is one DWDM wavelength for every 10,000 homes, or a maximum of eight fiber nodes. Because a single narrowcast wavelength can transport up to 10 QAM RF carriers in the forward direction, plenty of bandwidth is available for service growth within each 10,000-home area.

The resulting architecture is flexible enough to revert to the single-DWDM-wavelength-per-node model with minimal disruption once additional services drive the need for dedicated narrowcast lineups per node.

The second category of AT&T systems comprises those markets where service activation includes high-speed Internet access and other bandwidth-intensive applications such as telephony and other interactive services. This situation is straightforward because a narrowcast service lineup will be allocated and fully utilized per fiber node: A DWDM wavelength per service area is required from the start.

Additional design considerations

The final DWDM architecture deployed in a system is further defined by a number of factors.

Legacy broadcast fiber distribution: This includes 1,310 nm-based broadcast distribution as well as legacy 1,550 nm implementations. In the former situation where 1,310 nm transmitters exist at the secondary hub, broadcast service performance at the node must be maintained. Insertion losses from multiplexing additional 1,550 nm wavelengths are minimized through use of standard 1,310/1,550 nm WDM couplers to preserve optical broadcast levels at the input to the optical node. In the latter situation where legacy 1,550 nm broadcast lasers are already in service, take care to ensure the legacy 1,550 nm wavelength does not interfere with additional 1,550 nm narrowcast wavelengths at the node.

Average fiber node size: Low home counts increase the number of fiber nodes. This increases the number of optical amplifiers for broadcast services. The number of DWDM narrowcast lasers also increases unless the output of a single laser is split to feed two or more small nodes.

Specialty analog services: Broadcast lineups may have to accommodate transport of public, educational and government (PEG) channels targeted to specific communities or franchise areas. Lower-cost 1,310 nm transmitters sometimes are used to transport these services to the secondary hubs over dedicated fibers. At the secondary hub, a regenerated 1,310 nm signal is optically multiplexed with 1,550 nm broadcast and narrowcast wavelengths

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Fax: 972.915.3994

r transmission to fiber nodes. (See Fig-
:e 2 on page 62.)

This minimizes the number of more
›stly dedicated 1,550 nm broadcast feeds
nd implementation costs while allowing
›r lineup customization at the secondary
ub level. Having up to three different
/avelengths at the node (1,550 nm broad-
ast and narrowcast plus 1,310 nm for
›cal content) introduces only marginal
›erformance degradation for broadcast
ervices.

)WDM for return transport

Reliable two-way service requires a ro-
›ust return path—that is, a return path
hat has a very low bit error rate (BER),
ven under high load and ingress noise.
)WDM provides a node-to-headend re-
urn path that is robust and uses minimal
iber between the hub and the headend.

"DWDM transport networks have been deployed throughout AT&T systems since early 1998."

Figure 3 on page 64 shows a typical
)WDM return path with a segmentation
›f 5,000 homes passed. The link from the
›ode to the hub is achieved with standard
1,310 nm return. At the hub, the return
signals from four nodes are RF combined
and then routed to one of the wavelength-
specific return transmitters. As in the for-
/ard path discussed earlier, the outputs
from several return transmitters are opti-
:ally combined for transport over fiber to
:he headend. At the headend, the wave-
lengths are unbundled and fed to separate
receivers.

The design of the return path depends
›n the services provided and the home
count per node. For the provision of

In another look at the AT&T B&IS Aurora system, at left, a technician mounts a narrowcast forward path transmitter module. Below, the tech tests the RF signal level on a return path receiver. Both photos courtesy of Harmonic Inc.

Internet service at moderate penetration levels, it is sufficient to have a return segmentation of 5,000 homes passed. For the provision of telephony service, it is necessary to increase the return segmentation to 600 homes passed.

The increased segmentation is achieved by adding return path transmitters to the node. This can be done either with standard 1,310 nm return transmitters and multiple fibers back to the hub or using WDM transmitters in the node and a single fiber back to the hub.

This WDM in the node has the added advantage that now you can optically combine the return signals in the hub. The hub now becomes almost completely passive, with only optical multiplexing/demultiplexing and optical amplification—there is now no relasing or conversion to electrical signals at the hub. (See Figure 4 on page 65.)

Deploying DWDM systems

Setting up a DWDM system in the field is straightforward and relatively fast—a typical hub serving 20,000 homes passed usually takes two or three people two to three days to install.

In the forward path, the typical sequence would be to first rack the transmitters, amplifiers, multiplexers and demultiplexers in the headend and hub; check the RF input levels; then verify optical power levels at various points up to the combining point with the legacy network. (At the combining point, the narrowcast power should be 8-10 dB below the broadcast power.) Lastly, at the node location, again check the broadcast and narrowcast optical power levels and then finally the combined RF spectrum.

Similarly, setting up the DWDM return path is straightforward. The key goal is to

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When designing systems, consider the type and level of services to be introduced, RF bandwidth available for allocation, and the number of homes off each node.

set the RF and optical levels to maximize the usable dynamic range. Dynamic range is defined as the range of input signals over which a given carrier-to-noise ratio (C/N) is maintained. A high dynamic range means the return path can tolerate a high return load or moderate ingress noise before C/N is impaired to the point of generating poor BER.

A typical field installation involves first making sure that the optical power levels of the DWDM transport section are within proper range, then using a continuous wave (CW) return test signal to set the return path RF levels to the minimum power density point of the dynamic range.

Future developments

One of the advantages of DWDM technology is the large degree to which it is "future-proof." The capability and capacity can be increased while utilizing much of the existing equipment.

In the forward path, there are a number of ways to add capacity. One method is by adding wavelengths—either more wavelengths at the current spacing of 200 GHz, or in the near future by increasing the density of wavelengths by moving to 100-GHz spacing. A second method is to use dual receivers plus a WDM demultiplexer in the node so that the narrowcast wavelength has its own receiver. In such a system, the modulation index of the narrowcast channels is much lower than the single-receiver case and so can carry many more narrowcast channels.

In the return path, the key will continue to be smaller return segmentation. We can expect a movement toward digitized returns, plus time division multiplexing (TDM) to concentrate return signals without degrading the signal-to-noise ratio (S/N).

With a simple change in return transmitters, these TDM baseband signals can easily be transported on the DWDM return path networks now being deployed. These optically transparent DWDM hubs are eminently suitable for use with high-speed baseband digital returns (see Oct. 1999 *Communications Technology*, page 76) and so can cope with changing return protocols for years to come.

Prepare for the future

DWDM transport networks have been successfully deployed in a number of AT&T B&IS systems. These networks enable targeted delivery of high-speed data and other interactive services, flexible network segmentation, and a relocation of most active electronics to the system headend or primary hub.

In designing systems, the key considerations defining the designs are type and level of services to be introduced, RF bandwidth available for allocation, and the number of homes off each node. The DWDM systems can be installed relatively quickly over a variety of legacy networks with minor or no infrastructure construction. Additional DWDM wavelengths can be added with minimal service interruption.

Looking to the future, these DWDM systems appear very capable of evolving and incorporating new technologies, enabling systems to grow their networks to meet the ever-increasing demands of their customers. CT

Esteban Sandino is manager of advanced network technologies at AT&T Broadband & Internet Services. He may be reached at (303) 267-5974. John Trail, Ph.D., is director of product line management for Harmonic's transmitter systems group. He may be reached at (408) 542-2641.

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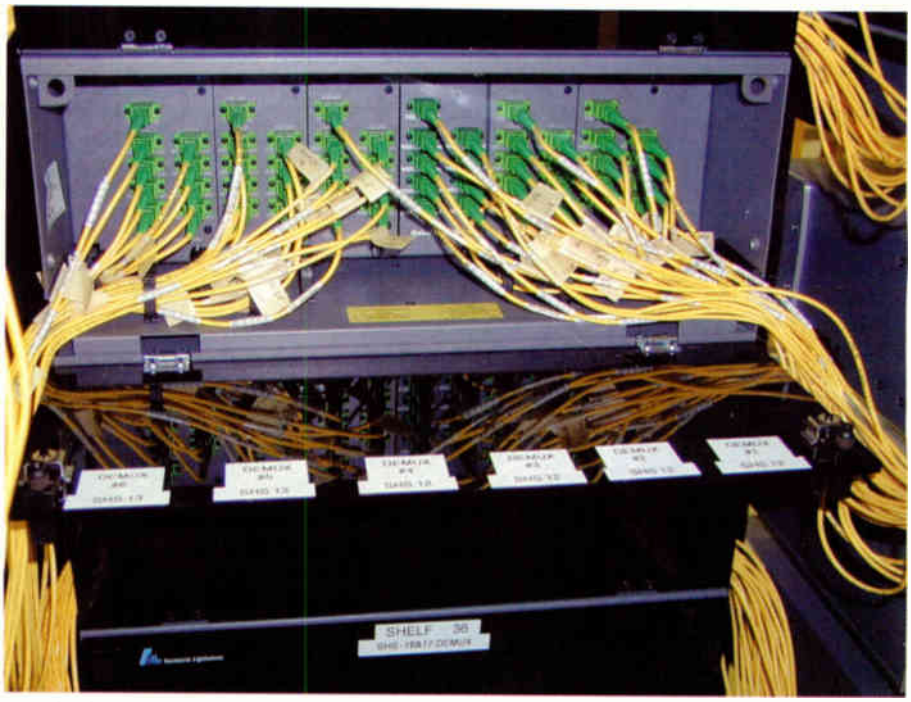


A rack of 1 x 8 passive optical multiplexers and demultiplexers at an AT&T B&IS primary hub for its Aurora, Colo, system. Photo courtesy of Harmonic Inc.

not be economical. Initial DWDM deployment cost is minimized if a single DWDM wavelength is shared across multiple service areas. The starting point is one DWDM wavelength for every 10,000 homes, or a maximum of eight fiber nodes. Because a single narrowcast wavelength can transport up to 10 QAM RF carriers in the forward direction, plenty of bandwidth is available for service growth within each 10,000-home area.

The resulting architecture is flexible enough to revert to the single-DWDM-wavelength-per-node model with minimal disruption once additional services drive the need for dedicated narrowcast lineups per node.

The second category of AT&T systems comprises those markets where service activation includes high-speed Internet access and other bandwidth-intensive applications such as telephony and other interactive services. This situation is straightforward because a narrowcast service lineup will be allocated and fully utilized per fiber node: A DWDM wavelength per service area is required from the start.

Additional design considerations

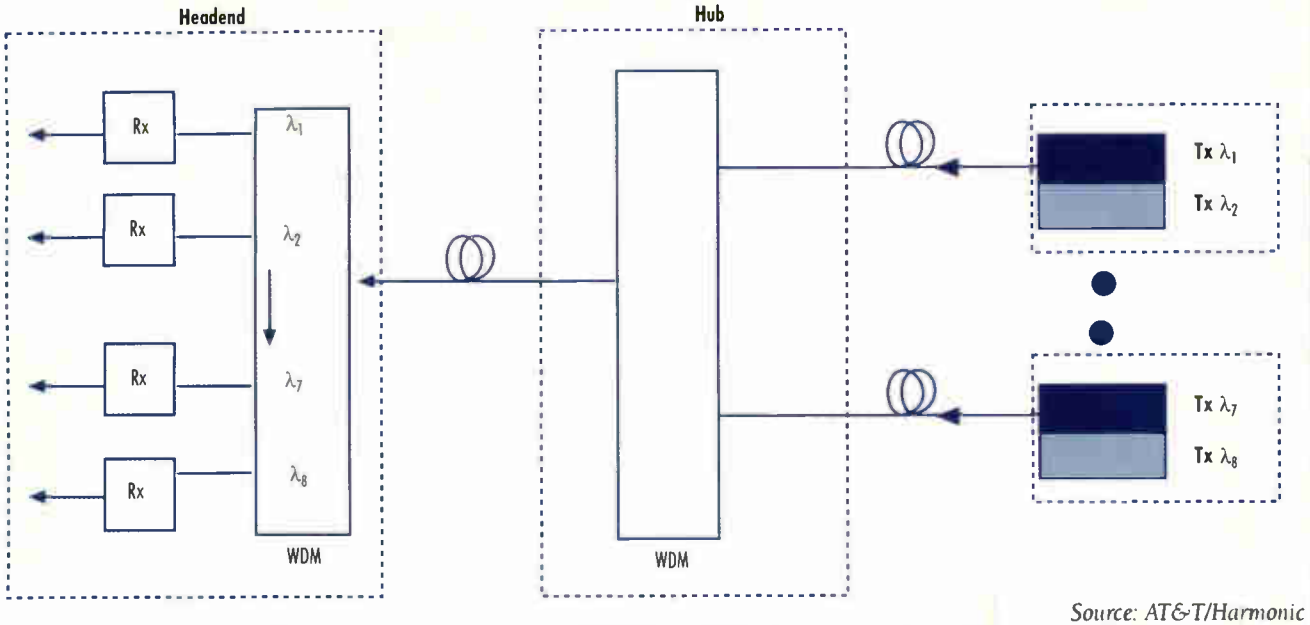
The final DWDM architecture deployed in a system is further defined by a number of factors.

Legacy broadcast fiber distribution: This includes 1,310 nm-based broadcast distribution as well as legacy 1,550 nm implementations. In the former situation where 1,310 nm transmitters exist at the secondary hub, broadcast service performance at the node must be maintained. Insertion losses from multiplexing additional 1,550 nm wavelengths are minimized through use of standard 1,310/1,550 nm WDM couplers to preserve optical broadcast levels at the input to the optical node. In the latter situation where legacy 1,550 nm broadcast lasers are already in service, take care to ensure the legacy 1,550 nm wavelength does not interfere with additional 1,550 nm narrowcast wavelengths at the node.

Average fiber node size: Low home counts increase the number of fiber nodes. This increases the number of optical amplifiers for broadcast services. The number of DWDM narrowcast lasers also increases unless the output of a single laser is split to feed two or more small nodes.

Specialty analog services: Broadcast lineups may have to accommodate transport of public, educational and government (PEG) channels targeted to specific communities or franchise areas. Lower-cost 1,310 nm transmitters sometimes are used to transport these services to the secondary hubs over dedicated fibers. At the secondary hub, a regenerated 1,310 nm signal is optically multiplexed with 1,550 nm broadcast and narrowcast wavelengths

Figure 4: High return segmentation with WDM in the node



Source: AT&T/Harmonic

Implementation of DWDM transport networks for AT&T B&IS systems falls into two broad categories. The first category covers those systems where only high-speed Internet access services are deployed initially. In these systems, the segmented service areas support a full narrowcast lineup but utilize only a portion of it.

Activation of additional data services is not immediately required; therefore, a dedicated DWDM wavelength per fiber node and service area from day one may

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The IP Connection

Data and Telephony Can Share Resources

By Martin J. Glapa

Internet protocol (IP) technologies for the cable TV industry have gotten a lot of recent attention, and understandably so. IP technology offers cost advantages for network convergence—another topic discussed with considerable frequency. It also can help cable operators deliver a rich suite of services spanning the range of visual media, voice and data with carrier-class reliability, security, and quality of service (QoS).

However, many cable operators are unclear on the architectural requirements and impact these new services will have on their networks and their bottom lines.

A little background

Historically, IP technologies, which provide inexpensive voice over IP (VoIP) communication capabilities—particularly because they use the same platform as "best effort" high-speed data services—often did not provide the quality most users expect. In particular, VoIP calls usually had very little security, reliability was questionable, and providers using the technology lacked comprehensive end-user services such as the ability to deliver a single integrated bill to consumers or the network management systems to control, provision and manage service delivery.

Today, the industry is experiencing rapid change. CableLabs, in conjunction with a great many industry leaders, is driving the PacketCable initiative to develop interoperable interface specifications using IP technology. Additionally, industry vendors are rapidly accelerating their research and development efforts to resolve the historical concerns mentioned previously.

Cost and capability benefits

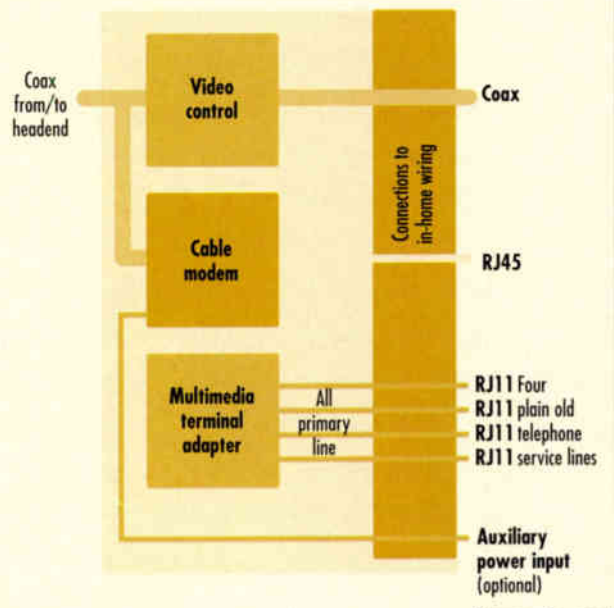
Carrier-class IP telephony can deliver true cost advantages with security and reliability, giving subscribers access to a wide range of basic and enhanced telephony features through the use of standard telephones (a 2500-type telephone set) and eventually personal computers (PCs). These services are enabled by building the architecture on top of a high-speed cable data modem infrastructure, rather than implementing a secondary, overlay network circuit-switched-based solution for cable telephony.

Bottom line economics demonstrate that a converged IP-based solution for both telephony and high-speed data can reduce the capital costs of deployment by 30 to 50 percent. Because IP telephony solutions use the same equipment resources as high-speed data systems to transport traffic, the need for two separate systems is eliminated, leading to economies of scale.

Also, because IP telephony solutions are inherently scalable, cable operators can expect to experience only a fractional cost of adding additional IP telephony capacity; again, equipment requirements are minimized, and no new truck rolls are required to activate additional lines at a customer location.

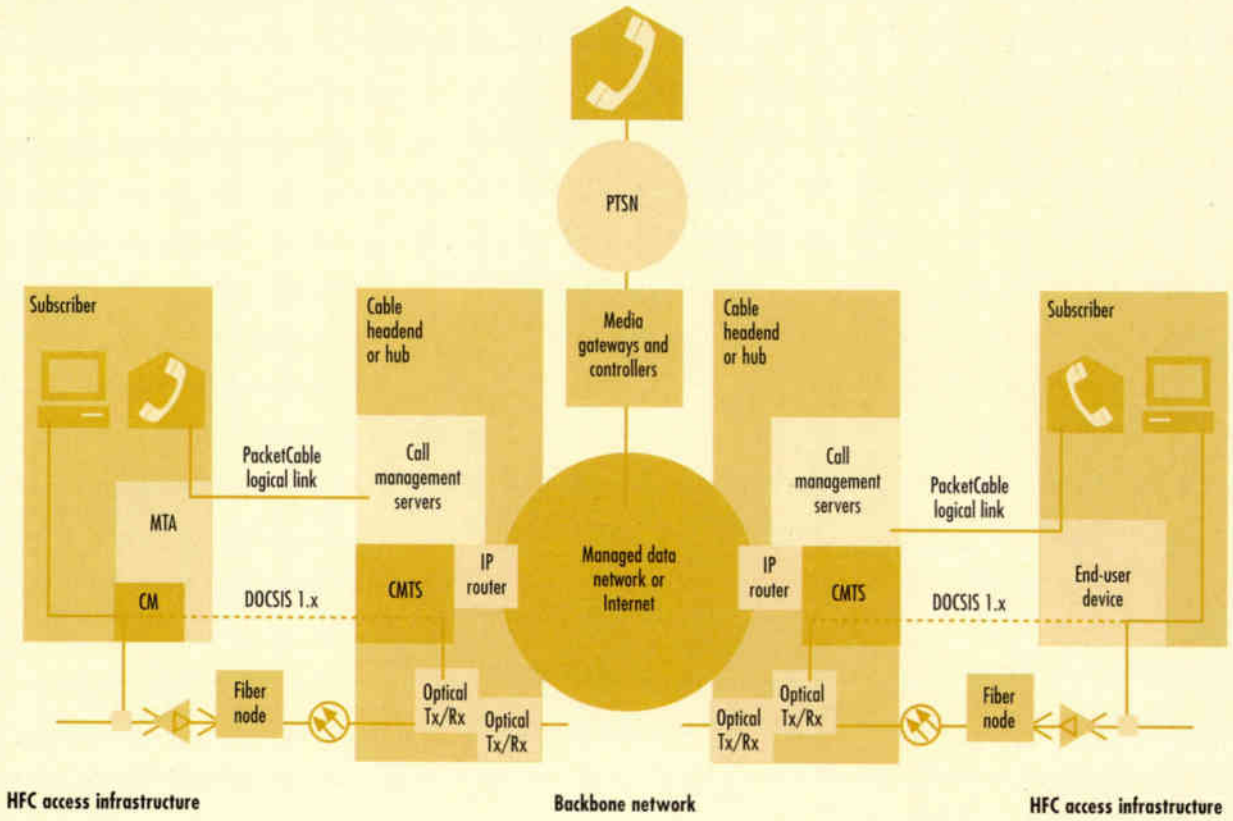
The benefits of this technology are clear.

Figure 1: End-user device



Source: Lucent

Figure 2: Converged IP telephony/data access network



Source: Lucent

Integrating IP telephony networks with high-speed data services, using common transport equipment both at the headend and an integrated end-user device at the customer location, saves money and increases efficiency in local and backbone transport.

The IP platform also provides a common logical layer foundation for many services, such as videoconferencing, virtual private networks (VPNs) and the like. In essence, an IP infrastructure makes it easy to deploy new services to end-users as they become viable.

Network architecture build-out

In today's world, the hybrid fiber/coax (HFC) access network build-out by multiple system operators (MSOs) has focused on bringing fiber-optic connectivity closer to the cable subscriber. With a large percentage of HFC systems already upgraded or in the process of being upgraded to 750 MHz or higher capacity, fiber optics have been driven into the cable plant to position systems to serve smaller nodes—typically 500 homes each.

Additional "dark" fiber also has been installed to these existing nodes to allow fiber to be extended even further into neighborhoods when bandwidth becomes an issue. In some systems, nodes can be subdivided to serve as few as 50 homes.

Now that a significant portion of the upgrade has been completed, operators are conducting trials to determine both the technical feasibility and customer acceptance of offering data networking and IP telephony over the cable infrastructure. By the year 2003, industry experts expect that more than 80 percent of the outside plant will be fully upgraded. One recent study projects that MSOs will capture nearly 1 million new cable modem customers in 1999.

Vendors are quickly bringing functional network architecture components to market. Operators, therefore, are faced with the challenge of determining the best distribution of devices throughout the network and at subscriber locations to achieve a high performance, cost-effective network that can scale as subscriber numbers increase.

Bringing IP telephony aboard

Today's standard for providing IP over HFC is CableLabs' Data Over Cable Service Interface Specification (DOCSIS). This suite of protocols originates in the cable modem software and terminates in the cable modem termination system (CMTS), located at a distribution hub or headend in the network, depending on the architecture. The CMTS provides access to the local IP network and takes the packets from the cable network, strips the DOCSIS signaling off and transports IP packets.

These packets are then either routed "on-network"—traffic destined to stay within the IP network—or "off-network"—traffic using the traditional telephone network—as determined by the IP addressing. The data architecture also typically requires an edge router capability to provide aggregation of traffic at the edge of the IP network, taking IP packets and routing them to the appropriate server in the headend.

There are different options for service providers to deploy IP telephony depending on existing network architecture. One

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is where there is an existing embedded base of cable modems that can be used to provide both high-speed data and IP telephony. The other is the "green field environment" where no high-speed data services exist yet, but there is a desire to deploy either IP telephony or high-speed data, or ultimately both.

In the first scenario, standard analog telephones are connected to the cable modem, which in turn is connected to a terminal adapter device. This terminal adapter provides a gateway between the circuit and IP networks and telephony functions such as audible ringing, tones and conversion of circuit to packet traffic. Cable modems provide IP packet transport using a digital RF format for transmission over the HFC system. Cable modems also provide an Ethernet port for interfacing with PCs to provide high-speed Internet services or other IP packet services, such as videoconferencing.

The stand-alone approach for connecting the cable modem to the IP network through the terminal adapter is used for several reasons, including:

- The subscriber market for IP telephony services will increase rapidly over time. Stand-alone devices will allow IP telecommunications services to quickly penetrate and seed the market by leveraging the growing base of cable modems.
- DOCSIS is a key specification being championed by the industry for cable modem standards. DOCSIS 1.0 is being deployed, and later versions will add real-time, delay-sensitive traffic enhancements to provide better QoS for services such as voice. Thus, the stand-alone device approach allows IP telephony to work both with today's proprietary modems as well as DOCSIS-compliant modems in the future. ➤

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IP-Based Services: Closer Than You Think

As Internet protocol (IP) technology has matured, so too have the opportunities for cable operators to provide several new services, thus generating new revenue and growing the customer base.

Certainly, adding IP-based services means having to deploy new equipment and procedures in your system. But the good news is that much of the new stuff is the same as that used to provide cable modem services. Effectively, if you're already offering or planning to offer data, you're much closer to offering IP-based services, such as telephony, than you might think.

By leveraging the build-out of two-way cable networks, operators can use a common logical IP layer to deliver high-speed data and voice services over a single network. This will reduce costs and simplify network management. Also, such a system can support new and emerging services.

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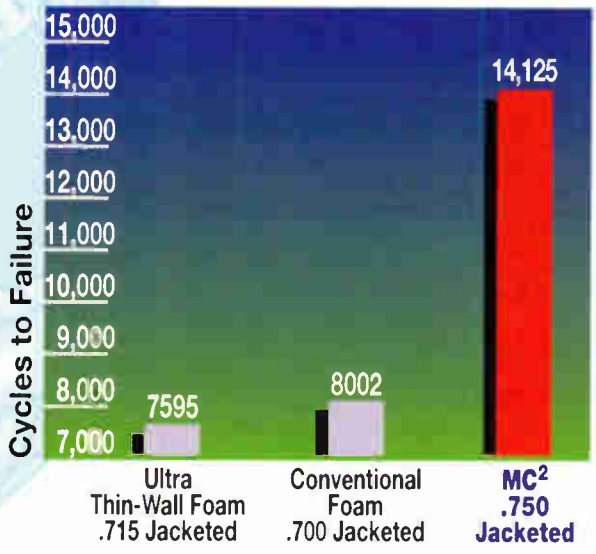

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Integrating the end-user device

Another deployment possibility lies in an advanced integrated IP telephony/high-speed data device. This device has several names, including network interface unit (NIU), multimedia terminal adapter (MTA) and many others. For the sake of discussion, let's call it the "end-user device," which typically goes on the side of the customer's home. This device, as illustrated in Figure 1 (on page 75), provides multiple IP line terminations as well as high-speed data termination. Note that the device's gateway function provides the bridge between circuit telephony and IP telephony, providing up to four primary telephony lines and various powering options (battery, wall power and network power).

In either scenario described earlier, the CMTS provides the bridge between the RF-based HFC access network that is transporting IP packets containing voice or data and the IP network that connects to the Internet or to a managed data network. From here, you'll need several other key functional architecture components:

- Call management servers: These provide a call processing engine to control end-user devices and provide services to the customer. The end-user device at the customer's home communicates with these servers, which establish calls, provide the features, and tear down calls for the end-user devices. This server handles the routing of "on-net" calls—those that remain within the IP network—and routes calls back into the network to the recipient end-user telephone as required. Call management servers communicate with media gateway controllers (MGCs) for "off-net" call handling.

> "A converged IP-based solution for both telephony and high-speed data can reduce the capital costs of deployment by 30 to 50 percent."

- Media gateway controllers and media gateways: The MGCs manage the media gateways (MGs) to control the origination and termination of calls through the public switched telephone network (PSTN). MGs handle "off-net" telephone traffic—those voice calls to or from the PSTN. The MGs provide the connectivity to move voice traffic to and from the PSTN and convert between circuit traffic and IP traffic. A circuit interface (PRI, DS1, DS3) is used to connect the MG to the PSTN via a circuit-switch trunk

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interface. MGCs and MGs may be located anywhere within a cable network, such as in a headend or distribution hub. The architecture supports location flexibility depending upon a number of factors, including performance, penetration, usage, services offered, topography and so on.

- SS-7 signaling gateways: These provide connectivity to the Signaling System 7 (SS-7) network for integrated services digital network user part (ISUP)- and transactional capabilities application part (TCAP)-based services. These services can be leveraged and reused in IP-based networks through the use of gateways. For example, the SS-7 network is used to provide call signaling for calls to and from the PSTN, while voice traffic to and from the PSTN is handled by the MG. This type of architecture is illustrated in Figure 2 (on page 76).

Get the service up and running

Cable telephony, as well as data, relies on network management systems (NMS) as a key component to success. The NMS provides the network intelligence for the operator to plan, monitor, deliver and bill for customer services on the network. The NMS also must include the capabilities necessary to install, operate and maintain the network. Based on the telecommunications management network (TMN) model, telephony network management is by far the most complex in satisfying an elaborate set of requirements while remaining robust and complete.

Several key functions in the management arena include:

- Provisioning services and end-user devices
- Network management for elements providing voice and data services
- Generating records for input into billing systems
- A registration database that holds records of all authenticated devices
- Address management for address reconciliation within the network—examples include a server to assign and manage IP addresses and devices, domain name servers for domain-name-to-IP-address resolution, and a server to map telephone numbers to IP addresses.

Typically, provisioning consists of two separate parts. The network first must be provisioned so that services can be provided to subscribers. Customer service provisioning begins by establishing a customer record containing all the information needed to deliver service, bill and collect payment from a customer, be it through customer contact with a customer service representative (CSR) or Web site sign-in and activation.

Once the customer information is captured, the second provisioning step can take place. It basically involves setting up the equipment itself. This process is likely to be handled during the customer call or via the Web activation sequence, which would begin delivering service and provide any software updates needed to the overall system.

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Opportunities abound

Clearly, technology is changing at a rapid pace. As IP technology has matured, so too have the opportunities for cable operators to generate new revenue by providing multiple services to new and existing customers.

By leveraging the build-out of two-way cable networks, cable operators can use a common logical IP layer to deliver high-speed data and voice services over a single network, to reduce costs and to simplify network management.

More importantly, cable operators will need a flexible, IP-based network in the future to support and provide new and emerging services. CT

Marty Glapa is Lucent's Cable Communications Group chief technical officer. He can be reached at (303) 409-3432 or at glapa@lucent.com.

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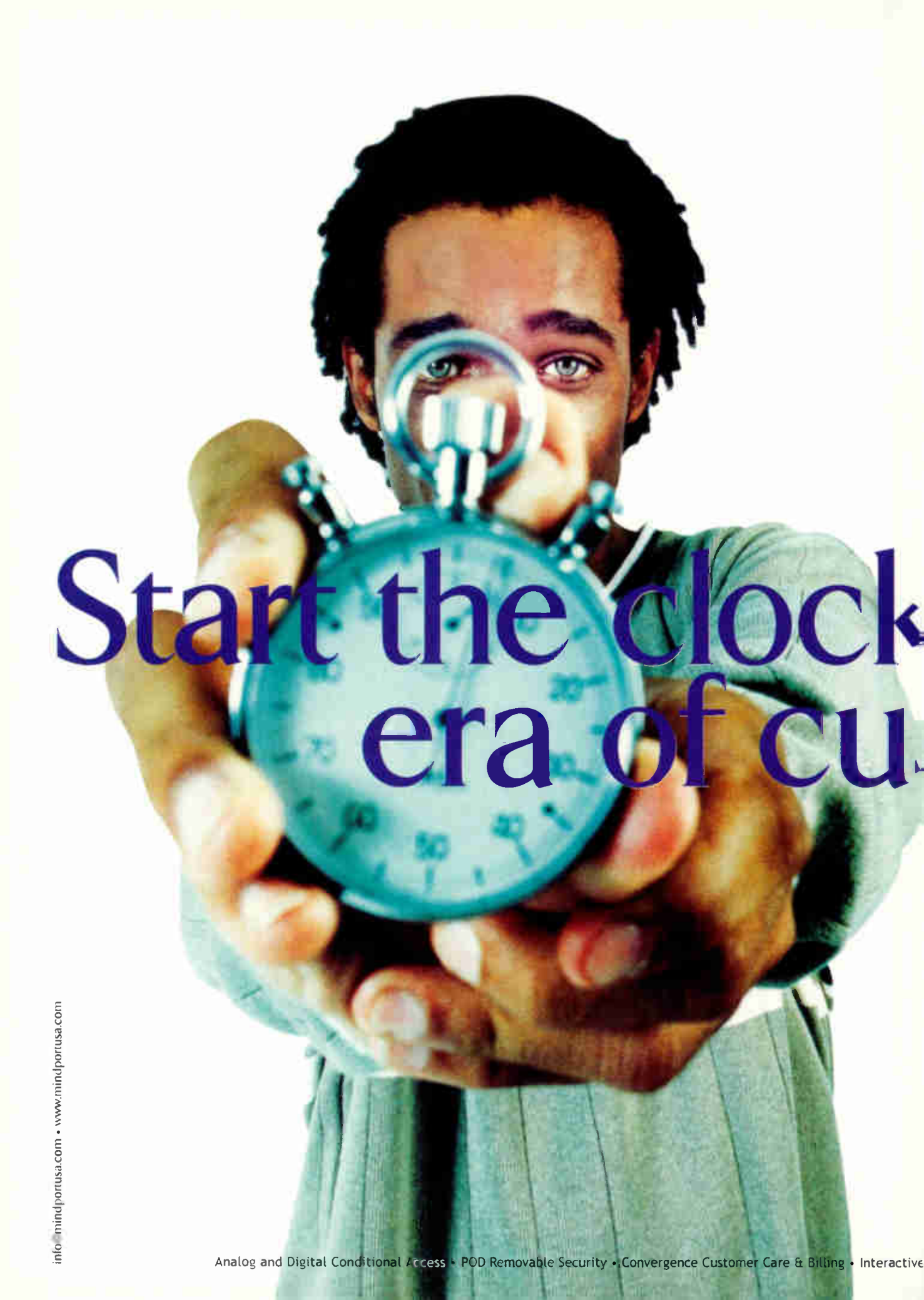

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Reader Service Number 51

Building the Advanced Services Pyramid

PacketCable Initiative Gathers Momentum

By Doug Larson

At the CableLabs facility in Louisville, Colo., the architects of tomorrow's advanced hybrid fiber/coax (HFC) architecture continue to push forward with their fast-track PacketCable initiative aimed at developing interface specifications for delivering advanced, real-time, packet-based multimedia services.

While the initial focus is being placed on delivering Internet protocol (IP) telephony services—seeking to create a smooth transition from a circuit-switched environment to a packet-based world—the PacketCable mandate goes much further. In the mid- to long-term scenario, PacketCable protocols and interfaces will enable a gamut of services, including multimedia conferencing, integrated Web/audio/video communication, network-based gaming and enhanced e-commerce, and a host of other multimedia applications.

In short, the effort focuses on developing a complete architecture for a full suite of packet-based services.

Building the Great Pyramid

Although distinct from CableLabs' Data Over Cable Service Interface Specification (DOCSIS) effort, the PacketCable initiative has not been developed in a vacuum. "If you picture it as a three-layer stack, the first layer is DOCSIS 1.1; the second layer is what we call core services, and those include security, device provisioning, network management and billing events," says David Bukovinsky, vice president of broadband services for CableLabs. (See diagram on page 96.) "The third layer is the application layer, and on that layer right now we have the IP telephony protocols, which are the MGCP (multimedia gateway control protocol)-based call signaling and then all of the PSTN (public switched telephone network) interfaces.

"The goal of the process going forward is to add additional applications on that third layer to allow things like video-on-demand (VOD), network-based gaming—almost any real-time multimedia application," adds Bukovinsky.

Similar to the DOCSIS initiative, CableLabs has broken out the PacketCable architecture into discrete component interfaces. For each of those interfaces, CableLabs formed roughly 14 focus teams of eight to 10 experts from its royalty-free intellectual property rights (IPR) pool, which currently numbers about 52. Each of these teams has gone through and either adopted existing interface standards, as in the case of the call signaling interface, or developed new interfaces based on their own individual work.

The latest and greatest

In mid-September, the research and development consortium followed up the release of its first interim spec in March with the release of seven PacketCable 1.0 draft specifications for review and comment to approximately 240 participating vendor companies.

These seven specs, along with the previously released network-based call signaling specification, will account for the lion's share of the PacketCable 1.0 solution. The specs address the following areas of the core services layer:

- Call signaling: Based on AT&T Labs' Distributed Open Signaling Architecture (DOSA), this protocol is responsible for performing call setup, call routing, call teardown, and feature activation (*69, caller identification and so on).
- Quality of service (QoS) control: This protocol allocates guaranteed levels of bandwidth, latency and jitter for transmission of voice packets across a DOCSIS network, utilizing DOCSIS 1.1 QoS mechanisms. CableLabs originally had focused on provisioned QoS, but interest from the vendor community in implementing a single solution coupled with accelerated development of dynamic QoS (DQoS), which offers more flexibility and tighter integration with the billing mechanism, has led to DQoS being the preferred approach.
- PSTN interconnectivity: This specification consists of two different components—media signaling to specify how packets are converted into analog signals for carriage on public switched telephone network (PSTN) trunk circuits and Signaling System 7 (SS7) to specify how packet-based call signaling is converted into the equivalent PSTN call signaling to allow calls to be placed between a packet-based network and a traditional phone network.
- Security: This specification addresses end-to-end security for both the signaling and media packets. It includes authentication, encryption and key management for all end-to-end packet network components. The specified protocols protect the network from various kinds of data network attacks, including theft of service, denial of service, eavesdropping and cloning.
- Network management: This specification defines the SNMP (simple network management protocol) MIB (management information base) objects for PacketCable client devices to allow them to be managed on a network utilizing standard, off-the-shelf SNMP management systems. ➤

PacketCable's Participating Companies

The following companies participated in PacketCable's interoperability testing through October 1999. Some companies demonstrated equipment in more thon one category.

Call Agents

Clarent Corporation
700 Chesapeoke Drive
Redwood City, CA 94063
(650) 306-7511
Fax: (650) 306-7512
www.clarent.com

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Richardson, TX 75081
(972) 671-2355
Fax: (972) 671-2937
www.ipcell.com

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Murray Hill, NJ 07974
(877) 534-9182
Fax: (908) 582-5311
www.lucent.com/cableconnect

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Boca Raton, FL 33487-2846
(561) 998-8700
Fax: (561) 997-2401
www.netspeak.com

Telcordia Technologies
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Morristown, NJ 07960-6438
(973) 829-2000
www.telcordia.com

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Fax: (972) 783-4684
www.xybridge.com

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Fax: (949) 450-8710
www.broodcom.com

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San Jose, CA 95134
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www.cisco.com

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www.tekelec.com

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Santa Clara, CA 95054
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Palo Alto, CA 94304-1185
Phone: (650) 857-1501
Fax: (650) 857-5518
www.hp.com

Catapult Communications
160 S. Whisman Rood
Mountain View, CA 94041
(650) 960-1025
Fax: (650) 960-1029
www.catapult.com

- Codec support: This specification mandates specific encoding/decoding techniques for digitizing the analog voice media.
- Billing event messages: This specification defines standard messages that each network component must implement to record events that may be of interest from a billing perspective. These events are collected at a central location (record-keeping server), which allows operators to interface their billing systems at a single point in the network vs. having to interface to every other network component.
- Network announcements: This spec addresses how the call signaling and media paths are done to play standard network announcements ("that number is no longer in service") from a packet-based announcement server.

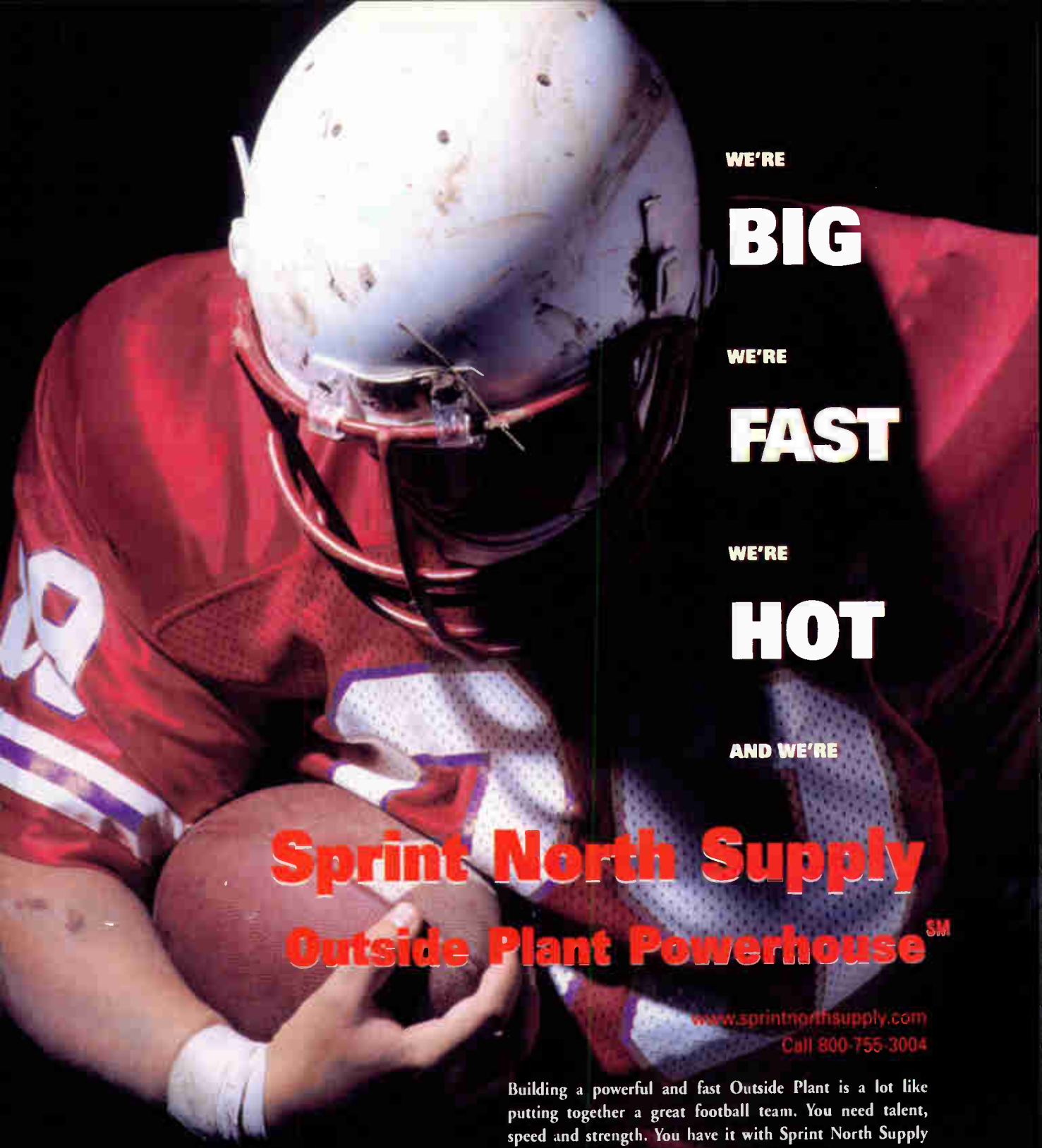
A step in the right direction

The draft spec moves CableLabs one step closer to its goal of having PacketCable-compliant product in the field by the latter half of 2000.

"We think, based on the interoperability initiative that Tom Thompson is in charge of, that we stand a good chance of hitting that date, although there's some question from the vendors of how reliable do you want this carrier-class redundancy by then," says Bukovinsky. "We're still targeting the June 2000 date, but in all honesty, it's really up to the vendor community."

"We also have a critical pass with DOCSIS 1.1," says Tom Thompson, PacketCable's interoperability program leader. "The testing program for 1.1 actually kicks off in March of 2000, and 1.1 is required to deliver IP telephony if we're going to have security and quality of service. So, if we have a 1.1 modem and CMTS (cable modem termination system) combination roll-out in the first cycle, which is March, that gives the vendors 90 days to finish the PacketCable 1.0 solution."

Bukovinsky adds, "We're kind of where DOCSIS was two years ago where you have alpha and beta products in the lab



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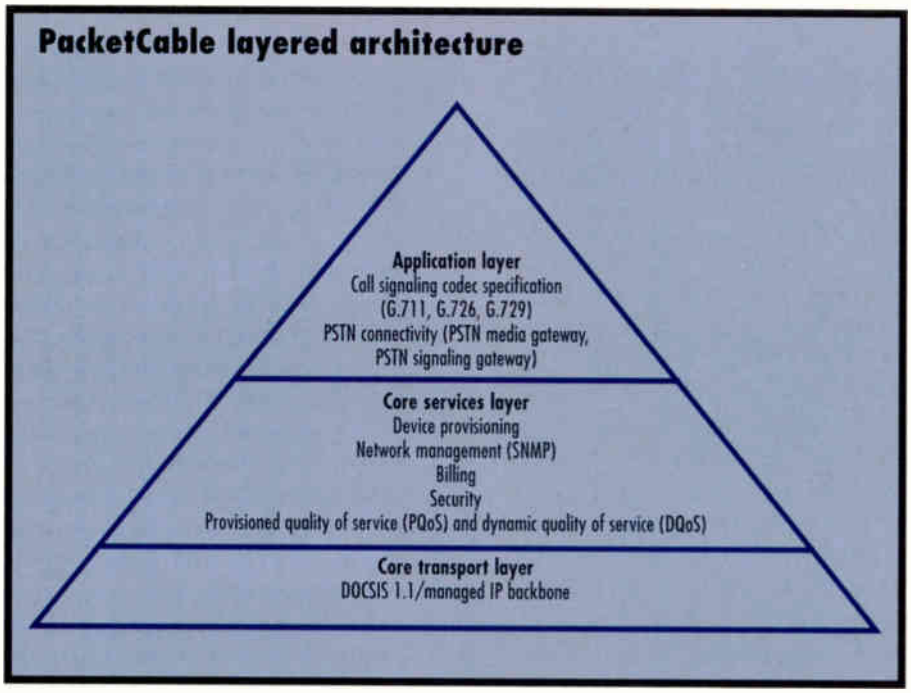

and you're starting to work through all of the issues associated with interoperabilty."

Tests, tests and more tests

CableLabs launched the first cycle of interoperability tests in June, which included equipment entries from 8x8, Arris Interactive, Com21, HotHaus, Telogy, Clarent, IPCell, NetSpeak, Telcordia, Hewlett-Packard, and Catapult Communications. The combined group represented five multimedia terminal adapters (MTAs), four call agents and two test equipment platforms, with tests focused on the network-based call signaling (NCS) and codec specifications.

The second and third cycles of testing took place at CableLabs' facilities in September and October and included participation from 8x8, AP Engines, Arris, Telogy, Cisco, Clarent, CSG, Ericsson, General Instrument, IPCell, NetSpeak, Broadcom, AudioCodes, Lucent, Telcordia, Tekelec, RADVision, Samsung, Texas Instruments, Toshiba, Xybridge, Motorola and Catapult Communications.

In total, CableLabs conducted more than 75 experiments in September, including voice calls, multi-codec calls, fax transmissions, modem transmissions, class feature demonstrations and testing over the virtual private network (VPN). Participating equipment included five MTAs, five call agents, three gateways and two test equipment platforms.

Telogy, for example, successfully tested basic calls, modem calls and fax calls using its NCS software with call agents from IPCell, Clarent, Netspeak and Xybridge. The company also successfully tested three-way conferencing with IPCell.

In the grander scheme of things, these three test cycles are just the tip of the iceberg, with five additional cycles scheduled for 2000. (See sidebar on page 90.) As the project progresses, Thompson says the interoperability testing will move its way up the network and away from the customer premise.

In the second and third testing cycles, CableLabs added some provisioning services onto the local area network (LAN), as well as some media gateways, which terminated into the test equipment, explains Thompson.

"Next time, we would like to terminate them onto a 5E switch. At that point, we'll have most of the components in our lab, or in the testing program, and it will just be a matter of getting all of the functionality and all of the security, QoS and provisioning."

Remote testing

CableLabs also is enabling remote testing. "We're extending our lab facilities out to the vendor community through a VPN, and we're also working to extend out to some of the MSOs (multiple system opera-

tors) so we can access their 5E (switches) and their signaling gateways," says Thompson.

CableLabs expects the VPN to play an increasingly larger role in the interoperability testing and speed up the overall pace of the initiative, a luxury not afforded to the DOCSIS initiative, which relied on access to the cable TV plant.

"We're actually seeing incredible interest from the vendor community, and although they still want to come here every six to eight weeks to actually physically try to hook up the equipment—because 90 percent of our protocols ride above the IP layer—there's tremendous interest in

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CableLabs on Track With PacketCable

CableLabs continues to push forward with its PacketCable initiative aimed at developing interface specifications for delivering advanced, real-time, packet-based multimedia services.

While the initial focus is being placed on delivering Internet protocol (IP) telephony services, the PacketCable mandate goes much further. In the mid- to long-term scenario, PacketCable protocols and interfaces will enable many services, including multimedia conferencing, integrated Web/audio/video communication, enhanced e-commerce, and a host of other applications. In short, the effort focuses on developing a complete architecture for a full suite of packet-based services.

In mid-September, CableLabs released seven PacketCable 1.0 draft specifications for call signaling, quality of service (QoS), public switched telephone network (PSTN) interconnectivity, network management, security, codec support, network announcements and billing event management. CableLabs already has completed three rounds of interoperability testing and has extended its testing capabilities to the vendor community via its virtual private network (VPN). All indications are that CableLabs will hit its target of having interoperable equipment in the field by the middle of next year.

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Can You Predict the Interactive Future?

By Arthur Cole

We've all heard it before. Cable operators are gearing up their networks to provide more channels, video-on-demand (VOD), telephony and other interactive services as the market demands.

But does anyone really know what those services are? Or exactly what the market will demand?

Unfortunately, if anyone's crystal ball has predicted a clear future, they're not talking. Undaunted, bunches of companies and capital investment firms are putting their money and reputations on the line to figure it out.

Clearly, we are entering a new era for cable, so we here at *Communications Technology* decided the time was right to examine some of the interactive fare that content providers are gearing to the high-speed universe.

Tomorrow, today

The first thing to understand about interactive services is that this is not stuff of the future. Most content providers for today's Internet are ready to roll with high-speed content and are waiting for you, Mr. Cable Operator, and your digital subscriber line (DSL) competitor to connect the pipe. In fact, interactive services are closer to becoming reality than cable telephony, which will require a more symmetrical network than cable generally can provide.

"Voice is a more advanced technology and is further out," says Rajesh Amin, business development manager of digital subscriber networks at Scientific-Atlanta's Creative Developers Program, which is lining up content providers for the Explorer line of digital set-tops. "Near-term services are VOD and Internet applications, some delivered via MPEG (Moving Picture Experts Group) I-frame technology and others with pure IP (Internet protocol) communications."

"Killer app," indeed

The second thing to remember about interactive services is that there is no way to predict the so-called "killer application," if there ever is one. The diverse nature of the Web results in a very segmented marketplace, where even a 5-percent user rate is considered a hit. So you probably will find it fair to partly tricky to determine exactly what services, in what mixture, will deserve space on your local server.

"Everyone is looking for that killer service," says Eric Chu, manager of strategic markets for consumer and embedded technologies at Sun Microsystems. "I don't think it's going to be any one thing. It will vary region by region, daytime or nighttime, and for different audiences."

So here is our short list of what we think will make up the lion's share of high-speed interactive services. But be forewarned, as Charlie Tritschler of operating system developer Liberate Technologies puts it: "If anyone says they know, they're lying."

E-commerce and interactive ads

This is the one that has Madison Avenue drooling: the ability to order right from your TV set. The hottest application in this category is ordering directly from a TV show or sporting event: Jennifer Aniston's new sweater, team jerseys and so on. Use the remote control to take you directly to the retailer's Web site, hit the buy

Top Players in Interactive TV

All these companies have active development partnerships with General Instrument, Scientific-Atlanta or both.

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www.aviodigital.com
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Fax: (650) 701-4999
www.liberate.com
DTV Navigator provides Internet, hypertext markup language (HTML)-enhanced video and other interactive applications.

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www.peach-networks.com
Access Channel delivers software, games, Internet and other services via compressed data and video streams.

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WebTV Networks
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Wink Communications
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(510) 337-2950
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Provides interactive programming and advertisements for information and e-commerce.

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"There will doubtless be an army of content providers ready to take advantage of the new interactive platforms."

button, and it's yours via Federal Express in a day or two.

"This is a new opportunity for advertisers to engage consumers and remove a barrier in the purchase of a product," says Sun's Chu.

Traditional commercials also will undergo a revolution as the focus shifts from mere brand-name recognition to impulse purchasing. This will drastically change the dynamics of advertising and the way people watch television. Instead of just surfing when a commercial comes on, the spot can now deliver real entertainment value because people will be able to interact with it. And because interactivity is a two-way street, the cable operator will be able to deliver consumer information back to the advertiser.

"As the operator acquires more data, it can send to the consumer more targeted advertising," says Vincent Dureau, chief technology officer of OpenTV, an interactive platform. "Properly targeted advertising is not advertising anymore. It becomes information."

Electronic program guides

According to OpenTV's Dureau, electronic program guides (EPGs) were the first hit application in Europe, where the company has amassed about 4.5 million subscribers in the past three years.

"Think of it as a database/browser," Dureau says. "People need it to browse through a large number of channels over an extended period of time."

In addition to run times and details of the evening's episode, content providers are looking to foster all manner of choices for the viewer: links to chat rooms, bulletin boards, Web sites and so on. And of course there will be plenty of opportunities to show clips of the evening's pay-per-view (PPV) and VOD offerings.

Not surprisingly, Prevue Network and TV Guide Channel are quickly ramping up their current service to take advantage of two-way cable. For a forecast of EPGs' future, check out the accompanying figure (on pages 106 and 107.)

Online gaming

From interactive game shows to networked multiplayer video and arcade games, online gaming holds enormous

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promise as a revenue generator. Everyone from Acclaim to Mattel and Hasbro is looking to get in on the action.

The question is, what type of gaming will viewers be interested in? For some, it is interactive game shows because they combine the new online environment in a familiar TV setting.

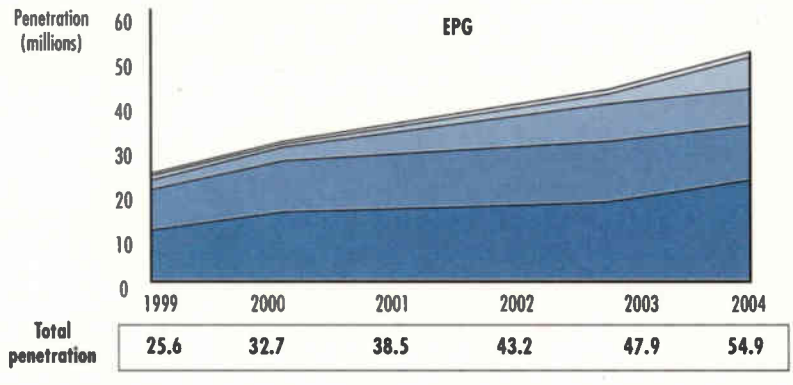
"I don't see it as so much doom, crush, kill and destroy," says Liberate's Tritschler. "It is games based on the TV experience."

Others, however, argue that high speed will solve a major dilemma for traditional online gamers: slow response. Either way, this category could take up a huge portion of cable customers' online time.

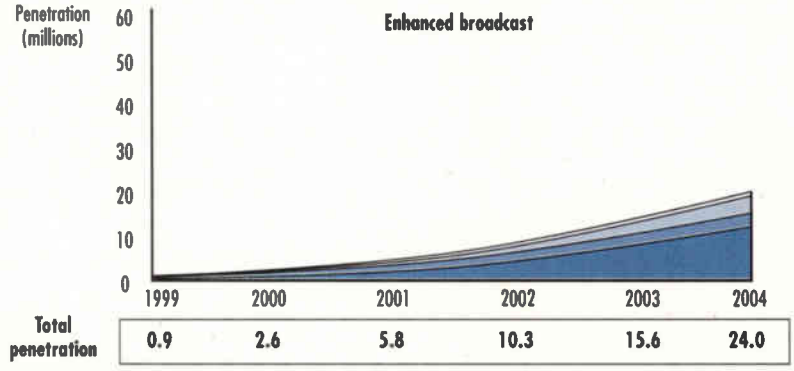
Niche applications

This is where the real fun begins. There will doubtless be an army of content providers ready to take advantage of the new interactive platforms, and it's anyone's guess who'll come out on top. For the most part, however, many of these services will be pretty seamless for the cable operator. Viewers surfing through their TV sets

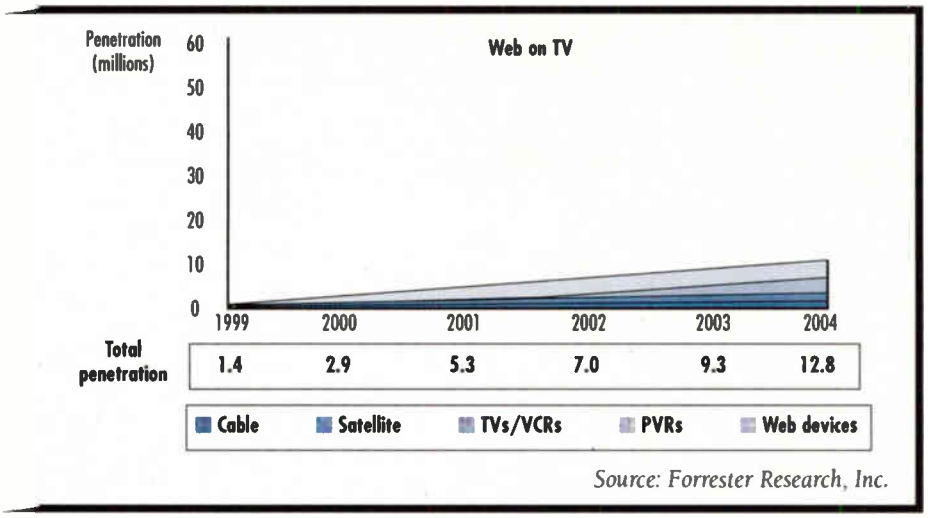
Figure 1: Projected interactive TV device penetration



Total penetration	25.6	32.7	38.5	43.2	47.9	54.9



Total penetration	0.9	2.6	5.8	10.3	15.6	24.0



Source: Forrester Research, Inc.

"If anyone says they know (the killer app), they're lying."

—Charlie Tritschler, Liberate Technologies

can go to pretty much any Web site that offers high-speed content. Of course, there's no guarantee that high-speed access can be maintained once they're on the Internet at large, which again brings up the possibility of hosting content on the cable server.

One company, Arepa.com, has developed what it calls the PlayNow system, a technology that provides a "virtual CD-ROM drive" on a desktop. The idea is to provide a broadband link to a local server that allows users to run software without having to install it on their own computers.

The company rents out software titles for games, word processing, tax preparation—most anything you'd find in a computer store—for a limited number of days.

"Think of video-on-demand as a content application; this is software-on-demand," says Bill Holding, Arepa.com's vice president of marketing.

The company already is deployed in Comcast@Home in Union, N.J., and is looking to expand elsewhere.

Another interesting system is the Tranzsend Broadcast Network, which offers nearly 2,000 movie titles at its Web site

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What's Next Online?

Interactive services are poised at the gate, ready to tap into willing customers through cable's high-speed pipe. But is there any way to tell which applications will be a big hit among consumers and, therefore, deserve the lion's share of support by cable operators?

Not really, say the experts. But there are a host of services that many believe will be the vanguard of the new interactive age. If these services don't catch on, it's a pretty good bet that nothing will.

We've polled the experts and come up with a list of interactive services that stand a good chance of making it in the high-speed world. Not surprisingly, all of them offer the familiar feel of television along with functionality of the Internet. Things such as e-commerce and chat rooms are familiar to everyone with a modem, but when blended with television, they create a whole new experience that we think will be hard to resist.

So let's take a look at what the experts think, keeping in mind of course that experts have been wrong before.

(www.quickmovie.com) that viewers can access via the company's Transcast technology.

Company Chief Executive Officer Scott Redmond says Transcast is a proprietary technology that is more efficient than streaming or multicasting and thus provides a VOD service at lower cost than a traditional Moving Picture Experts Group (MPEG-2) solution. He says a $25,000 server can deliver programming to upwards of 50 million homes.

"We're the first company to offer this technology globally," Redmond says. "We don't need a high-speed network, but it will certainly excel with cable modems and DSL. We're network agnostic."

Redmond says the company is set to deploy its system with two large cable companies, but he declined to name them.

A bright future

If one thing can be said about the interactive market, it is that it's not static. Already, set-top manufacturers are lining up their next generation boxes with more powerful processors, digital memory and other gadgets that in essence will turn them into mini-computers. And if Moore's law continues to hold true, you'll see the power of the set-tops double every 18 months or so.

That suits the content providers just fine. They've been pushing the envelope of the 56k world for some time, and they're just chomping at the bit, waiting for high-speed networks to come online. CT

Art Cole is a contributing editor to "Communications Technology."

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Test Tools for the

Photo courtesy of Wavetek Wandel Goltermann

By Monta Monaco Hernon

21st Century

Vendors Add Features for New Services

Test equipment manufacturers are trying to meet the demands of the coming decades, just like everybody else. This means they must stay in tune with the needs of cable engineers who are under constant pressure to upgrade their networks to carry more bandwidth and deliver advanced services.

With optical time domain reflectometers (OTDRs) and metallic TDRs, things are looking very good indeed. Today's instruments work extremely well and run the gamut from field grade units for technicians' use all the way up to lab-grade units that can cost tens of thousands of dollars. "You get what you pay for" is the rule in terms of capabilities. It's mainly a matter of deciding which capabilities you need from a given instrument.

More capability = less disruption

OTDR manufacturers, for example, say operators are clamoring for 1,625 nm testing capability. With the ubiquitous presence of fiber in the network, it's likely your system is carrying data at 1,310 nm or 1,550 nm, which means that a standard OTDR testing at those wavelengths would require you to interrupt service, says Sanjay Sudeora, Tektronix's product marketing manager for optical products. On the other hand, using the 1,625 nm wavelength allows for nondisruptive testing.

Testing the network while it's up and running becomes important as the use of dense wavelength division multiplexing (DWDM) technology grows. "With DWDM, traffic is increased," Sudeora says. "When you stop traffic, you are stopping revenues."

> "Testing the network while it's up and running becomes important as the use of DWDM technology grows."

Given the amount of traffic carried on a fiber and the money involved, operators also are interested in the concept of an embedded OTDR. If OTDR capabilities were located within the transmission equipment, operators could remotely monitor the fiber, Sudeora explains. He adds, however, that while embedded OTDRs are "being talked about at this time, they are not being implemented widely yet."

Faster is better

Operators also say they want to cut down test time. This can be accomplished with a very high dynamic range OTDR, says Steve Wolszczak, market development manager for Wavetek Wandel Goltermann.

"Conventional wisdom was that high dynamic range modules were only for people with long (fiber runs) or submarine cable systems. This is not the case now," he says, explaining that people have begun to use these modules for conventional, medium or short systems.

"They can get a good trace or good result in one-sixth of the time they could do so with a conventional medium range module," he adds.

This means that on a 240-fiber cable, testing at one wavelength using a high dynamic range module can save four hours, while testing at two wavelengths can save eight hours.

"Purchasing a high dynamic range module vs. a medium range module can make 16 hours of testing four hours of testing (for one wavelength)," Wolszczak says.

Wavetek offers modules with a dynamic

Using an OTDR with a high dynamic range can help you speed the time it takes to get a good trace.

range of 43 dB at 1,550 nm and 42 dB at 1,625 nm.

Wolszczak and Sudeora both remind engineers, however, that a high dynamic range is not the only important spec.

"There is a race for putting a higher number (dynamic range) on data sheets. We think it is important that the customer understands that other features go with (dynamic range) to help in the application. When we talk to customers, we talk of features like accuracy and repeatability," Sudeora notes.

Mixing old and new

Metallic TDR manufacturers have discovered that their test tools are proving quite useful to customers rolling out digital services, including video, high-speed data or voice.

"As you get into higher bandwidths, the signals are more susceptible to defects in the cable. Cables need to be higher quality. (Cable companies) are using the TDR to see if there are minor faults," says Doug Aitken, owner of Instronics.

However, the importance of finding these minor faults means that TDRs have had to become more sensitive.

"For the newer services, especially in the digital world, the coax (plant) has to be as error-free as we can get it. In our TDR, we need something that will be sensitive enough to pick up the slightest glitch," says Mark Bailous, network services manager for Media General. Things such as water damage, corrosion, and open and short circuits need to be eliminated for digital services to run smoothly.

Aitken says TDRs with narrower repeatable pulsewidths are better able to detect these faults.

"Some TDRs use software to generate pulsewidth. According to (some users),

BOTTOM • LINE

Test Gear for the Ages

As cable systems become more capable and complex, test equipment has to keep pace. Because optical time domain reflectometers (OTDRs) and metallic TDRs can be costly, it pays to know what you need and what to look for in terms of equipment features and capabilities.

You really do get what you pay for. Better units allow the ability to select a wide range of different pulsewidths, which is very important. For instance, the narrower the pulsewidth, the better the resolution. On the other hand, a wider pulsewidth will allow measurements over longer distances. You typically can get accuracy within a few feet with field-grade units, and some lab-grade units can get you to within fractions of an inch.

Things to think about (in no particular order) as you go shopping for field test gear include:

- Ability to test without disrupting service
- Speed
- Resolution
- Repeatability
- Sensitivity
- Robustness
- Storage capability and computer software compatibility
- Simplicity of operation
- Dynamic range
- Portability
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TDRs and OTDRs feature a variety of options for storing, analyzing, and displaying waveforms.

these are not as sensitive as those generated by hardware," he adds.

Jerry Harris, product marketing manager for Tektronix, points out that a TDR's ability to measure return loss also can be very important. Digital signals respond differently to microreflections, which occur as a result of impedance mismatches in the cable and other network components. Poor installation, damage and physical abuse of a cable can cause these microreflections, he explains.

When the cable is impaired, the signal doesn't pass correctly through the damaged point. Rather, some of the signal's energy is bounced back or reflected, says Harris.

"The measurement is return loss. TDRs are used to provide an estimated return loss number," he says.

It's not your father's TDR

While some of the TDR's time-tested functions are proving useful to operators rolling out new services, the industry constantly is trying to fine-tune the whole package and to bring the cost down.

Flat panel displays, for example, were introduced as an alternative to cathode ray tubes. Among other things, the flat panel display allows for more information to be viewed on one screen, is less prone to breakage, and is less expensive, says Aitken. In fact, they can bring the cost of a TDR down by 10 percent, he explains.

"However, there are certain problems with flat screen displays. The major one is that they are not as robust over temperature," Aitken adds.

The most common of the flat panel displays cannot withstand temperatures of 0°C, he reports. This can be fixed by installing a heater on the panel, but the heaters consume a lot of the battery power. In addition, the popular NiCd batteries, used for many tools, also are susceptible to bad weather.

Manufacturers, therefore, are working on ways to make both panels and power packs that can operate in colder temperatures. Instronics, for example, markets products manufactured by Bicotest. The Bicotest T810 uses a standard alkaline battery. Both it and the flat panel display used on this model have a temperature spec of -20°C, Aitken says.

Another move the industry has seen recently is toward TDRs capable of storing more information and those that are personal computer (PC)-compatible. If more traces can be stored in the unit, the technician can do comparisons right in the field, Aitken says. With compatible software, the technician later can download

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the traces into a PC and store them for future reference and analysis.

"This allows a cable TV company to do a shoot at a new installation and store the trace," Aitken says. "They can go back after a year and compare the difference. This allows them to check to see if people are using illegal splitters, for example."

The new storage capabilities of TDRs have proved to be invaluable to field technicians. The ability to store and print traces provides tangible evidence for technicians to bring to the table as evidence that a cable needs to be replaced or repaired, Media General's Bailous says.

The use of a PC with the test tools allows cable companies the convenience of archiving and cataloging results while eliminating the need to store paper strips.

"Plus you don't want to burden the test instrument with the apparatus to store all of the information," says Harris. "The computer is the perfect application."

Striving for simplicity

Manufacturers and users alike stress the need for simplicity in testing equipment.

OTDR and TDR makers recognize the rapidly changing nature of today's workforce and are designing easy-to-use test gear.

"We want something that is simple for the technician to use so that he doesn't have to fumble around with it," Media General's Bailous says. "We don't look for anything over-complicated."

Rick Puckett, a product marketing manager at Tektronix, says: "The workforce is getting turned over more frequently as corporate America in general downsizes and farms different services out. (Businesses sometimes) lay off more experienced technicians .... They are replaced with less experienced technicians (who) need a product that is easy to use, walks them through the test, and gives them information in a logical fashion."

The manufacturers are addressing this concern with products that involve very few steps. For example, Siecor's OTDR Plus Multitester II, has an autoincrement mode, says Sean Pons, technical support engineer for Siecor's Test Equipment Group.

After a technician sets up certain parameters, he or she needs to simply hook up the first fiber and hit the test button, Pons explains. The machine will run the test, save the results and prompt the technician to hook up the second fiber. As far as analyzing tools, Siecor's OTDR can do things such as build an event table, calculate loss from end to end, calculate total length of the system, show the location of each individual event, and calculate the dB loss across the event.

As our networks, systems and services grow in capability and complexity, TDRs and OTDRs are becoming increasingly indispensable tools. They're keeping up well, becoming easier to use and adapting to new technologies and applications. CT

Monta Monaco Hernon is a freelance writer specializing in telecommunications.

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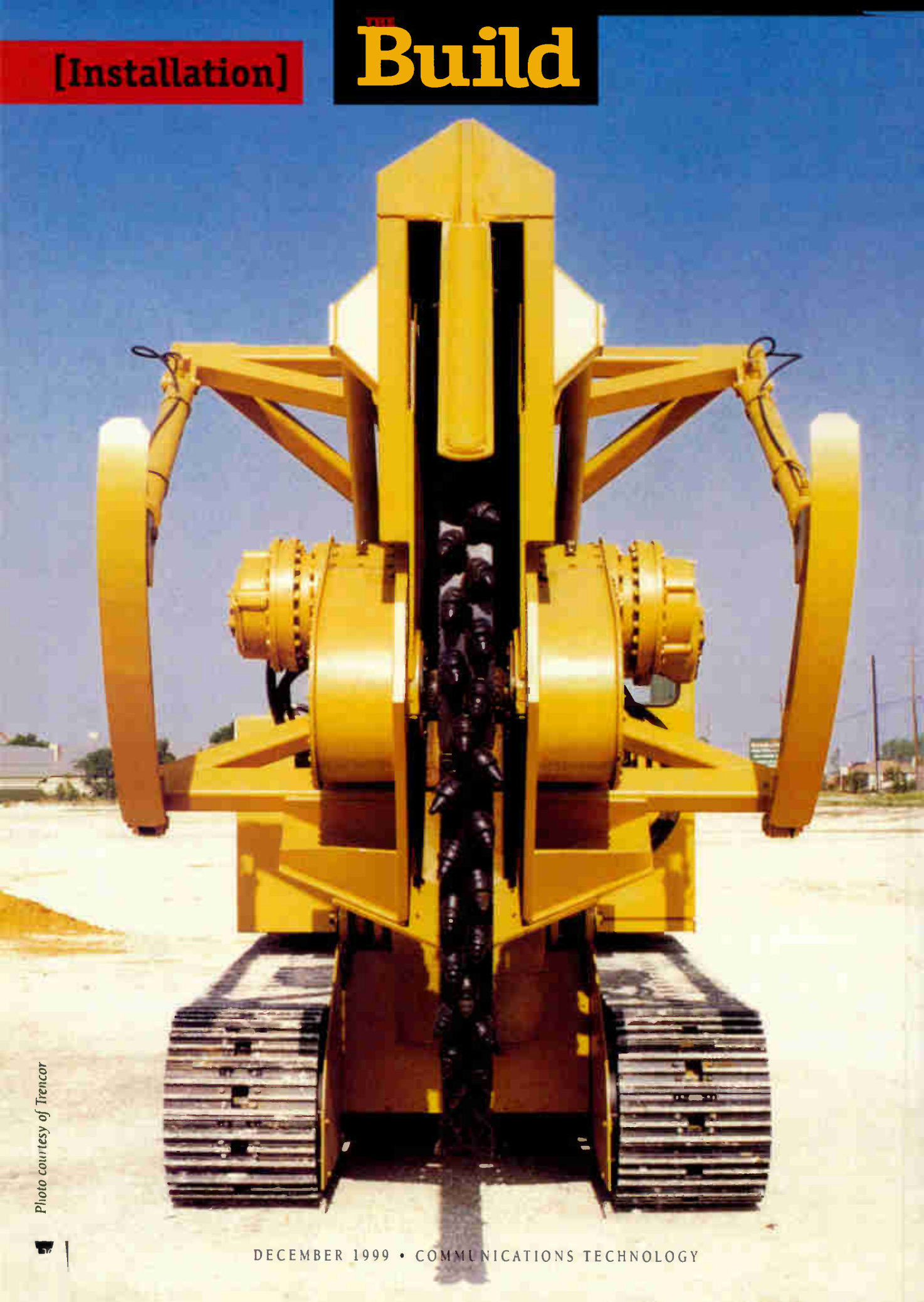


Photo courtesy of Trencor

Beware the Construction Menace

Plan Rights-of-Way the Right Way

By Jerry Marks

More than one homeowner has carefully planned, paid for, planted and nurtured the perfect backyard landscape only to see it uprooted by cable TV and telecommunications providers installing cable lines.

This scenario has become almost commonplace since the Telecommunications Act of 1996 deregulated services, which allowed people to choose their carriers. While it has been a boon for the cable TV and telecommunications industries, it has literally been open-trench warfare against backyard enthusiasts.

While the price of replacing perennials can be high for homeowners, compare that expense to the 30.5-mile swatch of landscape that Dublin, Ohio, maintains around its corporate corridor.

Stop the madness

Dublin is a suburb of 29,000 residents located 20 minutes northwest of Ohio's state capital in Columbus. Best known for being the host city of professional golf's Memorial Tournament, Dublin has seen more than its share of construction in its 23-square-mile municipality during the past 20 years. Since 1980, Dublin's residential population has increased more than 750 percent, while its workforce has grown from 40,000 to 60,000 in just the last three years.

Spending at least $600,000 per mile in street beautification, Dublin didn't want to see its plantings plucked for telecommunications progress more than once. So city officials came up with a state-of-the-art concept called DubLink, a multiconduit system linking Dublin's business district with communication networks.

"DubLink was the brainchild of a group started by the Dublin city manager and director of services about two years ago," says Eric Smith, president of The Fishel Company, an underground utility construction company headquartered in Columbus. "They had seen how Columbus and other cities in the area had been dug up a number of times, many times in the same place, to accommodate alternative cable TV and telecommunication providers."

Says Dublin City Director of Services Dana McDaniel: "The city is concerned about the number of telecommunication companies coming and deploying their system in our rights-of-way. On the one hand, we want to get them deployed rapidly in the city so we have a good environment for competition, but on the other hand we want to protect the $70 million of road improvements we've made in the last five years."

Smith adds: "Dublin is very sensitive about its rights-of-way and beauty. When the city (managers) realized they would have to allow alternative cable TV and telephone service providers access to the city, they set specific objectives to protect their rights-of-way. First, they only wanted them to be dug up once to accommodate all service providers. Second, they wanted the system to be open to all service providers. Third, they wanted the project to be revenue-neutral for the city. Finally, the city did not want to become a public utility."

The plan

The city contacted Fishel to serve as a consultant in planning the conduit system that would cover Dublin's ever-growing business community, as well as provide an ingress and egress for providers already using loops in Columbus.

Initially, the city planned to build, manage and own the system, but planners decided an independent developer—and somebody that wasn't a communications provider—should direct this first-of-its-kind endeavor. DubLink, a subsidiary of Fishel—which was the low-responsible bidder during a request for quote (RFQ)—formed a public/private partnership with the city.

Dublin gave Fishel a 25-year exclusive franchise to build and maintain the network as well as a 25-year renewal option. In exchange, Fishel gave the city one duct

DubLink in action: At left, DubLink crews work right along with road construction crews widening Rings Road in Dublin, Ohio. The municipality is installing its own telecommunications infrastructure, on which providers can lease space. The arrangement is designed to prevent having the city's landscaped rights of way, such as the one at right along Emerald Parkway, continually dug up for new telecommunications construction.

for its exclusive use through the system.

The $10 million project is fully funded by Fishel and will be installed in three phases by the end of 2000.

Operational details

The conduit system has room for 11 providers, not including the city of Dublin's duct, which can potentially connect multiple municipal facilities with city schools, public libraries and intelligent highway systems. The cost to providers per linear foot ranges from $7.27 to $9.80, depending on location and what phase it links with DubLink.

"DubLink is like a condominium development," says Smith. "Service providers will lease duct space. Expenses for maintenance and repair will be shared by all the (lessees). Because this is the first of its kind, we're in true entrepreneurial waters here."

Along with installing the conduit, DubLink is in charge of selling the service to providers as well as to Dublin businesses to tie into the system. Early interest is strong from both sides. Seven providers have shown interest, and one business, Air Touch, decided to stay in Dublin for its expansion because of DubLink.

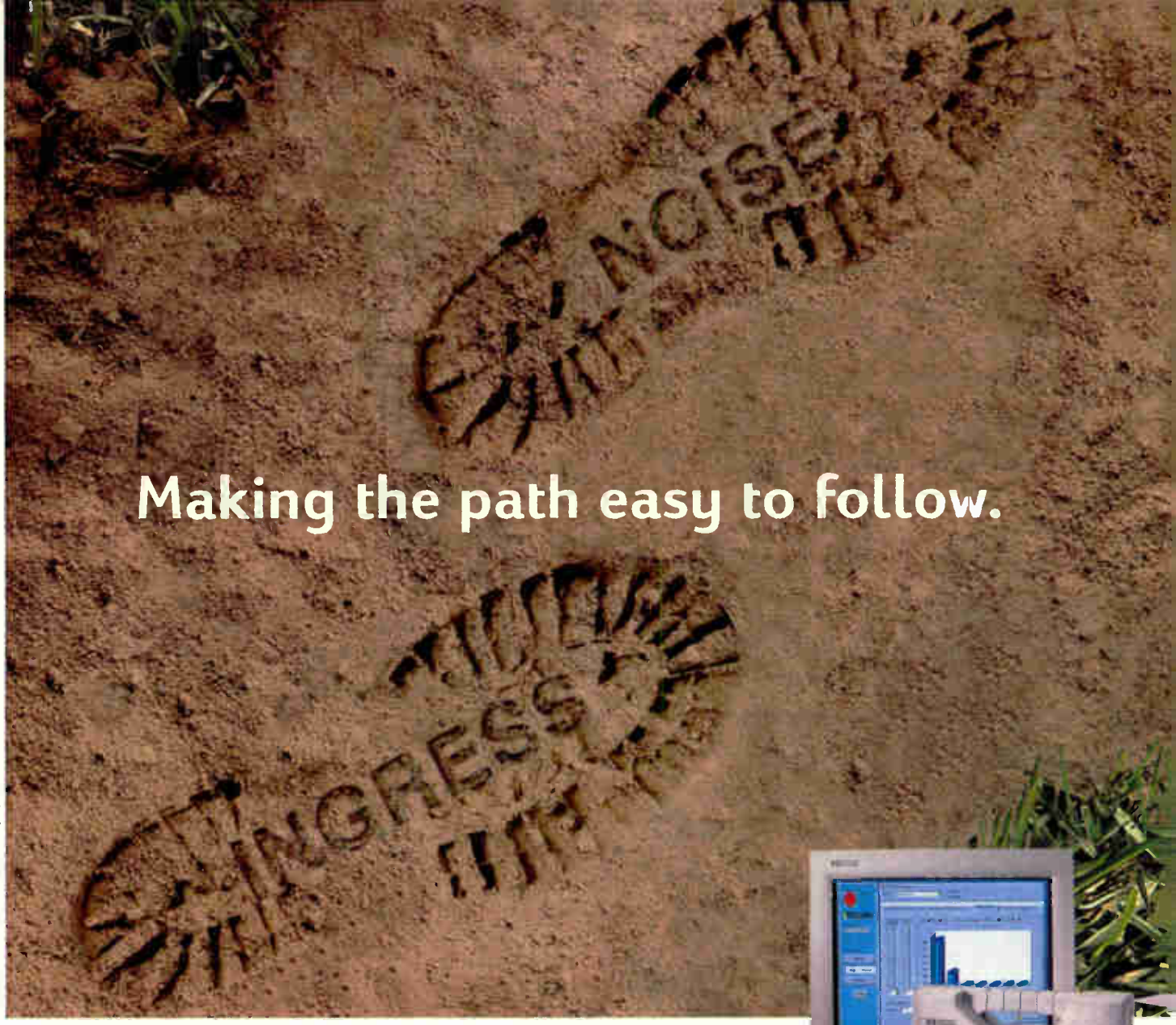
"The outcome of DubLink is that our city's rights-of-way ordinance allows us to process permits and permit requests. It's better planned and managed. DubLink is changing the culture of the telecommunication industry," adds McDaniel.

Save the roads

Constant digging for cable TV and telecom providers is a concern for municipalities—and an inconvenience to the public. Cities around the country are dealing with the increased request for permits and continual destruction of streets and sidewalks. In 1998, Washington, D.C., alone processed 15,000 permits for requests to install underground lines. Studies indicate that cutting pavement to install lines not only costs cities an average of $20,000 a mile in resurfacing but also results in uneven surfaces, an increase in the number of potholes and reduction of the life span of a street by one-third.

By using the city's rights-of-way, DubLink's system of 12 1.25-inch interducts can provide a fiber-optic highway around the city's business community without being disruptive to city streets.

"At this point, we're not placing conduit inside the road lane," says DubLink Account Executive Dean Pence. "It's all in utility easements and rights-of-way easements. We've had a couple road crossings, but we've tried to do the work at off-peak times or in conjunction with ongoing road projects." ➤



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Smith says Fischel is careful even in the rights-of-way.

"Where possible, we like to use directional drilling so it doesn't interfere with existing rights-of-way landscaping."

Challenges and benefits

The DubLink path has provided installation challenges, though, because it has had to navigate an overabundance of rock, a river, an environmental easement and winter weather.

Smith believes the benefits for the city, the service providers and the businesses located in Dublin far outweigh any installation hurdles.

"There are two real, definite benefits of DubLink. The first is the city takes control of their rights-of-way and minimizes disruptions in their community. The second benefit is to the actual service providers—the CLECs (competitive local exchange carriers) and cable TV providers. These service providers will not have to design, build or maintain their own duct system in Dublin. They can get where they want to go easily and quickly using the DubLink duct system.

"Also, once this thing is built, the probability that the lines get cut because someone else is coming in and overlaying another system is slim," he adds.

To Smith's surprise, DubLink has piqued the interest of groups not initially considered for the conduit system.

"Originally, the intent was that our customer base would be the CLECs. What's actually transpiring is that we have a developer that is interested in using this

The Bottom Line

Linking Providers With Customers

The Telecommunications Act of 1996 has allowed more choice for consumers, more opportunities for service providers and more headaches for city officials who are being inundated with permit requests to install underground lines.

For officials in Dublin, Ohio, relief is being spelled D-U-B-L-I-N-K.

This innovative concept is laying the (under)ground work for 11 cable TV and telecommunication providers along this central Ohio city's 30.5-mile business corridor. By installing a system of 12 1.25-inch conduits, the city reduces accidental telecommunications service disruption caused by continuous construction, and it saves money on street resurfacing and landscaping. That's big bucks for Dublin, which recently spent $600,000 to beautify a half-mile stretch of road.

The DubLink conduit system not only reduces the time and paperwork needed for digging permits; it also allows cable TV and telecommunications providers easy access to businesses, a choice of providers for those businesses and peace of mind for residents.

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"Dublin didn't want to see its plantings plucked for telecommunications progress more than once."

system to tie together all his rental spaces. We have an Internet service provider (ISP) who wants to provide high-speed access to users in the Dublin area; we also have some long-line carriers and cable TV companies showing interest. There's a lot more interest than just CLECs," Smith says.

With DubLink's conduit in place, it's only a few weeks before a provider can be serving Dublin.

"Once a telecom provider decides to penetrate the Dublin market, they can build out to Dublin in literally days instead of months because we have already provided the engineering and construction," says Pence. "Once they have a check and the proper insurance and a franchise agreement, they can be up and running in Dublin in a matter of weeks instead of months.

"If we engineer to buildings that aren't in the planned DubLink route, we have to go through several procedures. We would have to go through typical engineering, permitting and construction processes."

Outside interest

Though DubLink was franchised as recently as December 1998, word of its benefits spread far and wide nearly as quickly as Dublin businesses have benefited from the system. Dublin has received inquiries from officials in Columbus as well as California, Texas, Virginia and even some in Europe.

McDaniel says cities interested in a similar system must be attractive to potential providers.

"I think you're going to have to have the type of market that cable TV and telecommunication companies want to go after," McDaniel says. "We have such a market in Dublin, where we've had as many as six telecommunications companies want to come in and build their own system. That's a good indication that you have a pretty good market."

Smith says: "Other cities could benefit from the DubLink approach. Those cities that have a defined business district, that want to protect their rights-of-way, and that have been approached by more than one CLEC or cable TV provider to offer service in their city are all candidates for this approach. DubLink will prove to be a win-win-win situation where the city can protect its rights-of-way, service providers have a cost-effective pre-built path to potential customers, and businesses will have choices in who supplies their communication needs." TB

Jerry Marks is a writer with Triad Inc., specialists in construction communications, and can be reached at triadinc@aol.com or (614) 846-8761.

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Reader Service Number 78

An Inside Job:

By John Bisset

10 Indoor Maintenance Tips

Now that the weather has taken a turn for the worse, your outdoor maintenance and construction projects have probably slowed. System emergencies will require some outside work, but these winter months are good ones for getting caught up on indoor issues. The tips that follow can be assigned to any size workforce and will help ensure that you have a safety net in place for both your main and remote sites.

1. Filters

If you don't already have a spreadsheet program that lists all the types of filters you use, their part numbers, order quantities, locations and frequency of replacement, now's a good time to prepare one. You also can include pricing and vendor information to speed restocking.

As you develop your spreadsheet, don't overlook air handlers that may be located in ceilings or closets, foam filters that are mounted on the rear or bottom of rack-mounted equipment, and fuel and air filters used on generators or hydraulic equipment. Preparing a comprehensive list is the first step toward getting control of your routine maintenance costs. A $6 filter here and a $10 filter there add up—don't rob your operating budget by forgetting these items.

Once you prepare a replacement spreadsheet, consider the frequency of replacement. If air filters have to be replaced on a quarterly basis, this job can be figured into regular maintenance routines. If this kind of work is handled by a subcontractor, provide a means of checking up to ensure the work has been performed.

I once had a client who called us in to evaluate a catastrophic failure caused by loss of air conditioning. The client thought the AC contractor was making quarterly site visits, but when we studied the contract, we realized it was the client's responsibility, not the AC contractor's, to call and set up these visits. The client assumed the maintenance visits were being scheduled, but the AC contractor was waiting for the call, which never came.

2. Backup power

I can't overstate the importance of generator maintenance and testing. Why have a backup system that fails when it needs to perform? But the issue of backup power extends beyond the generator to uninterruptible power supply (UPS) systems as well.

There are two schools of thought here—one big UPS that powers the entire site, or multiple smaller UPS units, powering a rack or two. In either case, you have to test and maintain them.

Some UPS systems have fans with filters. Others require periodic battery testing or replacement. At least one manufacturer sends out reminder cards when batteries need to be replaced.

Turn to your spreadsheet again, and list the type and location of these batteries. Another good idea is to record when the battery was last changed and when the next change is due. I've seen sites where this information is printed on a self-stick label and affixed to the front panel—further ensuring timely replacement.

3. Memory batteries

While we're on the subject of batteries, don't forget those little lithium batteries that are supposed to last "forever," keeping memory alive when power goes down. A thorough inspection of all equipment to determine where these little fellas are hiding will save you hours of reprogramming. These batteries can be found in the strangest places and in the most unusual types of equipment. Again, these batteries are supposed to help you—but if forgotten, they can cause you a lot of grief.

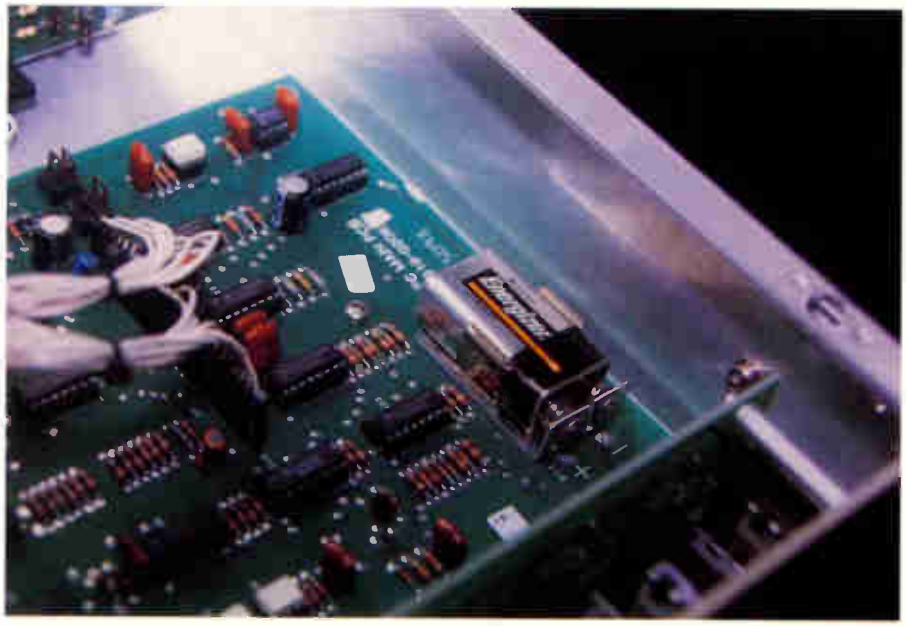
4. Water problems

Water can play havoc with your equipment, so it's essential to add this item to your indoor checklist. Problems can range from plugged condensate drains (place an anti-fungal tablet in the condensate pan to prevent algae growth) to rooftop drains that are clogged, to torn rubber thresholds that let water enter a remote building.

Most remote sites have some type of alarm system, and an inexpensive water detector—picked up at a retail store or electronics parts house—tied into the alarm system can avert disaster.

The key here is to have staff give each site a thorough visual inspection. Help them learn to anticipate problems based on your site history. I've helped clients develop a site checklist, which goes a long

These lithium batteries lurk in the most unexpected places. Locate and replace them, to avoid reprogramming your equipment in case they fail.



way to making sure everything is inspected. Such a list also helps the less-experienced technicians know what they need to check. A signed, complete checklist is your assurance that the technician has taken responsibility for the site.

For facilities with a technician who maintains numerous remote sites, formulating this checklist into a laptop document helps guarantee that the technician will complete the form and fax or e-mail it back to the main site routinely.

5. Tool inspection

Now is a good time to inspect, clean, sharpen and distribute outdoor hand tools. These include shovels, picks, axes and the like.

To be sure each crew has a complete set of outdoor tools, we've adopted a color-marking system, using a different painted color band for each crew. This marking technique makes tool identification easy when multiple crews are at a common site and ensures that no one will be short-changed when the big construction jobs start after another couple of months.

6. Emergency numbers

Are your emergency call sheets accurate and up to date? Do they reflect current pager and cellular numbers? If one individual is not responsible for periodically updating these documents, assign someone. Depending on your facility size, this

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WAVETEK WANDEL GOLTERMANN
Communications Test Solutions

Reader Service Number 81

Be sure to replace dirty air filters. Six bucks for a new filter beats the heck out of a catastrophic loss of air conditioning.

may be a monthly or quarterly exercise.

One of the easiest ways to start this process, which also can be adapted to a spreadsheet, is simply to call all the numbers on the sheet. When someone is paged, does that person return the call? Are the mobile phone numbers in service? Do site numbers auto-answer?

After you are assured all of your telephone numbers are correct, now check your site's auto-dialers. What is the priority of calls made? Promotions, resignations and other staff changes may impact the list of people to be called.

A few months back, a state instituted 10-digit dialing—requiring an area code for local calls. Imagine the surprise when several remote sites failed, but no one was notified because the auto-dialers were not reprogrammed to reflect the new dialing rules.

7. In-service training

Many years ago, a sage engineer told me that when you stop learning in this business, it's time to get out.

In-service training will keep your staff sharp and aware of changing technology. Local associations may sponsor classes, and so will many manufacturers—inquire now as to what is available. Keep training in mind when you make major equipment purchases. Some manufacturers will include a training session free or at reduced charge to get the sale.

Having your most experienced technicians talk about their "worst nightmares" and how they handled those problems is

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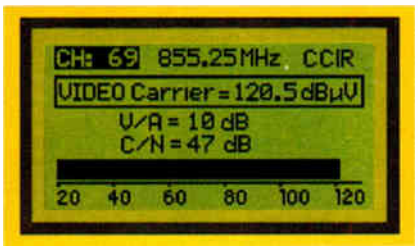
The instrument can be tuned by frequency or by channel by means of a channel plan which can be configured and adapted to the needs of the user. Once the channel to be analyzed has been tuned, the equipment offers the possibility to measure the signal LEVEL of the video carrier, the VIDEO / AUDIO RATIO or the CARRIER / NOISE RATIO. It is possible to choose what measurements we want to carry out (carrier level or level + V/A + C/N) so as not to waste time, for example, taking measurements that we do not need. The PROMAX-8 will tell us whether or not the measurements taken come within PASS / FAIL acceptance limits which can be programmed by means of the configuration menus. It has a GRAPHIC BAR for the interpretation, adjustment and convenient optimization of any cable television system, microwave link or land-based aerial. It is also possible to tune the audio carrier, allowing the demodulation and audition of the sound by means of the loudspeaker incorporated.



The equipment can also be configured for measurements on digital channels, giving us the value of the digital CHANNEL POWER as a figure and also on the graphic bar.

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Reader Service Number 83

"When you stop learning in this business, it's time to get out."

great food for thought for your entry-level personnel. Sponsoring a Friday pizza lunch once a month to review safety procedures, talk about using equipment, or how to handle specific problems is a small cost that will pay big dividends. Your employees will see your investment in them and your desire to get the job done right the first time.

8. Lighting

The subject of lighting seems simple, but it's often forgotten. When was the last time you checked all of your site lighting? This includes not only indoor and outdoor lighting, but rack lighting, trouble lamps and equipment indicator lights. The frustration of turning on a trouble lamp when you're looking for a major problem, only to find you can't see because the bulb is burned out, can be avoided. Are spare bulbs on hand? Although today's trend is for most manufacturers to use light emitting diode (LED) indicators, burned-out incandescent bulbs can cause alarms or faults to be missed, sometimes with serious consequences.

Maintain and test your uninterruptible power supplies (UPSs).

9. Test jigs and fixtures

You can prevent idle hands and improve your test procedures by taking the time to make up specific test fixtures and cables. Using a ready-made plug, instead of coaxing clip leads onto a connector, will speed tests. Building up specific test fixtures to allow in-place equipment testing improves your staff's efficiency. Taking the time to check all test cables for continuity, worn connectors or broken wires also will help to improve your people's productivity.

While on the subject of test fixtures, when was the last time someone calibrated your test equipment? Routine calibrations can easily be forgotten and lead even the most experienced technician down the wrong path. ➤

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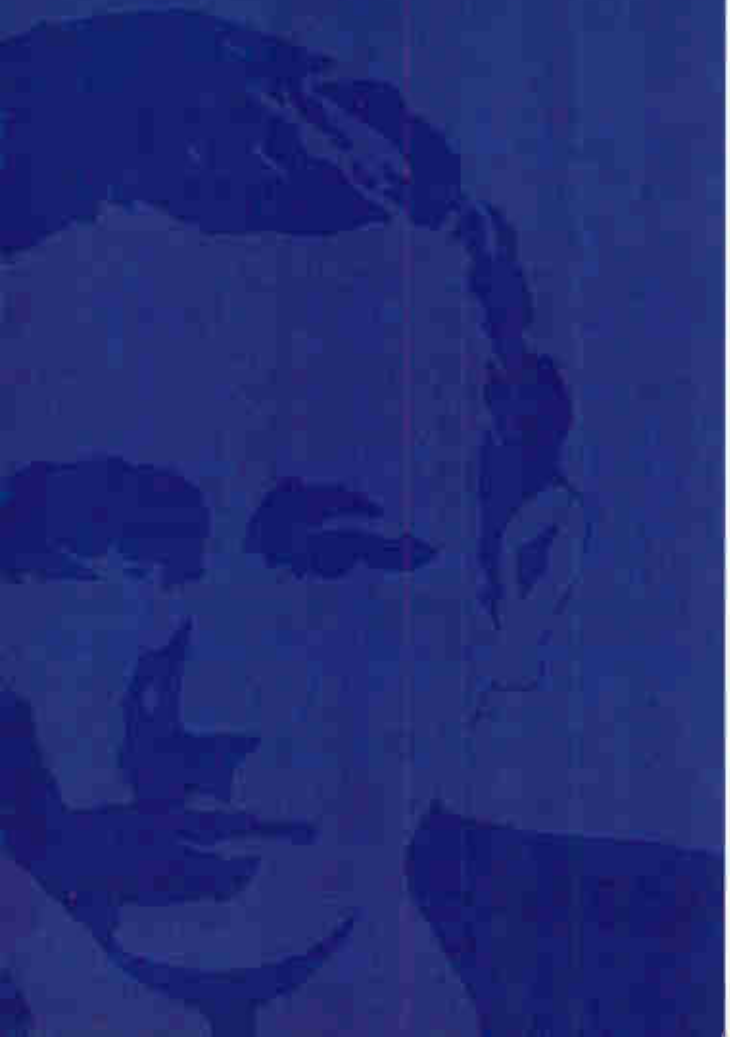

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Reader Service Number 85

10. Documentation

We'll wrap up our "Top 10" list with a good inside job—a thorough review and compilation of all manuals and cabling documentation.

In the rush to get things up and running, too many times complete documentation is supplanted with scribbled marginal notes. Ensuring that all feeder drawings, site plans or system documentation is current and correct will help to prevent unpleasant surprises later on—especially when you experience staff turnover.

It's a good idea to contact the manufacturers of major systems (such as line amplifiers, transmitters, receivers or frame switchers) annually and inquire about any technical bulletins or field modification notices. Most manufacturers are pretty good about sending this documentation to the proper customers.

However, a few years ago, I encountered a facility that was in dismal shape—nothing had been updated. The reason? The general manager was intercepting the field modification notices. Because he viewed them as an added operating expense, he tossed them in the circular file, thinking this would save him a little money. It certainly did, but not much, and only for the short term; the long-term payback was a cost he would not soon forget.

John Bisset is a district sales manager with Harris Corp. He can be reached at (703) 323-8011 or online at jbisset@harris.com.

The Bottom Line

Beat Cabin Fever

With winter upon us, now is the time to tackle all those indoor chores that you won't have time for this summer. Our top 10 list includes:

1. Replace or clean air filters.
2. Test all backup generators, batteries and uninterruptible power supplies (UPSs).
3. Replace those lithium batteries that keep the memory alive in your equipment.
4. Check to make sure rooftop drains are unclogged, condensate pans are free of fungus, and rubber thresholds are intact.
5. Inspect, clean, sharpen and distribute outdoor hand tools.
6. Update all emergency call lists and remote site auto-dialers.
7. Encourage crews to take classes to keep their skills sharp.
8. Check the lighting at all of your sites, and refresh your supply of spare bulbs.
9. Prepare test cables and fixtures in advance to speed your testing time. Calibrate your test equipment.
10. Thoroughly review and update all your equipment's documentation and manuals.

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Reader Service Number 87

[Installation] THE Build

Corral Cable Breakage

A History of Expansion Loops Designs

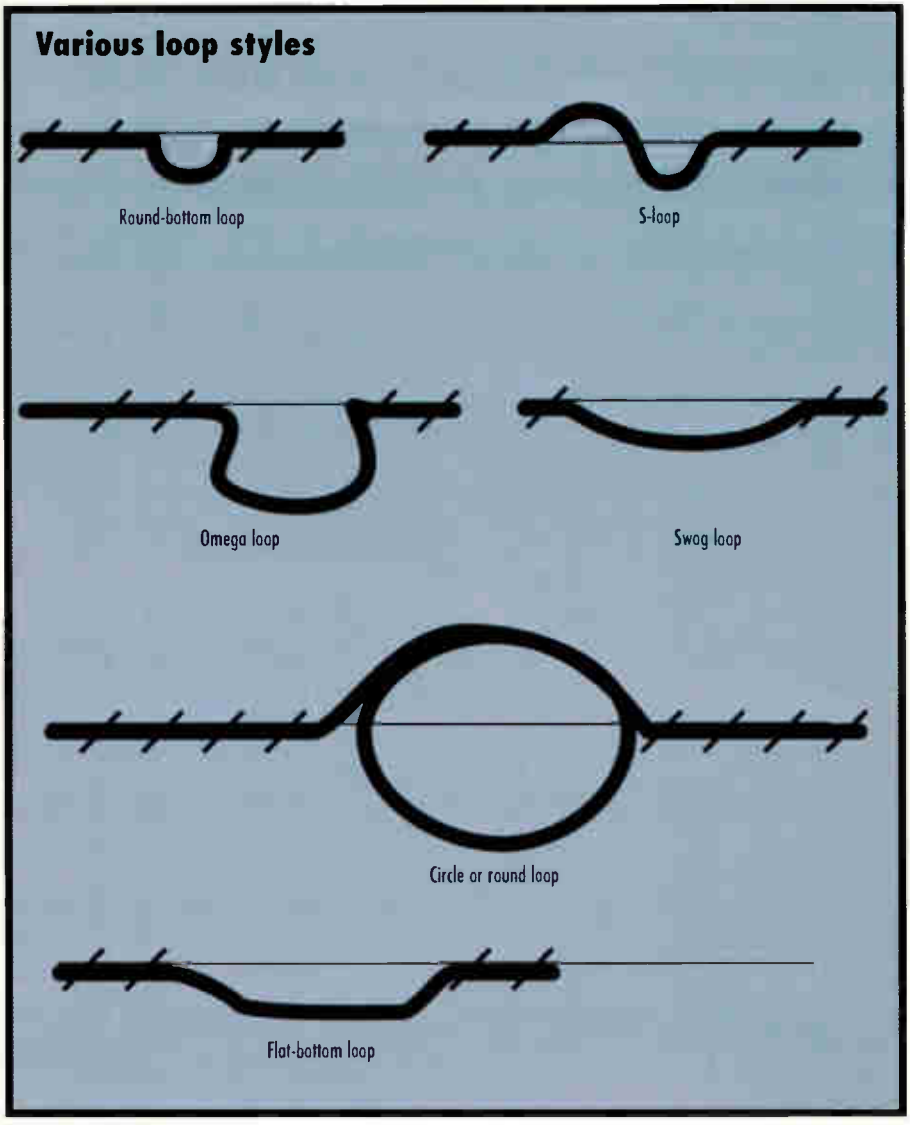
By Rex Porter

Before walking through the history of various loops, bear in mind that originally we had no expansion loops. They were not required — both trunk and feeder cables were flexible. Basically, the trunk was RG-11, and the feeder was either RG-6 or RG-59. (I have seen some systems where the drop was twin lead into the home.)

All of these cables were solid copper, both center conductor and braid. We didn't need expansion loops, but we did loop an extra few feet of cable right before the entry into amplifiers. The dielectric always was solid polyethylene because we hadn't discovered how to manufacture foam by using blowing agents in the extruders at that time.

We left the loop at the amplifiers because the connectors were not very secure (some had no o-rings) and none were truly compressed/seizure. So the braid under the jacket would suck water back for an inch or two into the cable. We simply cut off some of the loop until the copper wasn't green, re-dressed the cable and put it back into the connector.

When manufacturers introduced aluminum sheathed cables, the dielectric continued to be solid for some years. These cables were not flexible and could



not be sold as such. Early marketing called aluminum sheathed cables "semi-rigid." But the "rigid" part scared everyone, so a smart marketing guy by the name of Larry DeGeorge decided people would be more receptive if the cable was called something less ominous, so he began to sell it as "semi-flexible," and that was cut short to become "semi-flex."

At first, cable operators tried to string the strand and cable tightly with no loops for flexure, which was catastrophic. Lashing wire broke, cables pulled back out of connectors, and in some cases either trunk or feeder cables actually broke their sheaths or pulled the amplifiers apart.

Another basic problem we didn't consider was that foam dielectrics might lose their support for the aluminum sheath with changes in temperature and pull-tensions applied during their stringing at original construction of the plant. There was no center-conductor seizure in the connectors; in fact, the old AM and UHF connectors required either crimping tools or soldering of the center conductors. Murphy's Law was in its heyday.

Head-scratching

By the '70s, cable manufacturers had their engineering laboratories print notes and studies on problems with expansion and contraction of cables. The result was a series of papers that identified the expansion coefficient for each of the different materials within the cable. The strand wire is steel, and so is the lashing wire, and they expand and contract at a given rate. The expansion coefficient for the foam polyethylene dielectric is different. The expansion coefficient for copper is different from the first two materials. And finally, the thermal coefficient of linear expansion for aluminum (22.9×10^{-6}) was again different from those of all the other various materials.

So, in effect, you had a multitude of materials moving at different rates, but bound together. The question of proper sag for strand and cable generally was governed by clearances over streets. And even when crews properly sagged the spans, cable moved erratically because it wanted to keep moving when the steel strand and lashing wire had stopped.

Every spring, summer and fall, crews would hang cable as more systems became

The Bottom Line

Expansion Loop Genesis

Back in the days of yore, we didn't have expansion loops. Cable was flexible, so there was no need. Those happy days came to a screeching halt, however, with the debut of aluminum-sheathed cable.

Suddenly, we had several different materials working together, all with different coefficients of expansion. Cable cracked and pulled out of connectors, and occasionally even ripped amplifiers apart. Obviously, we had to do something, and swearing just wasn't good enough.

The solution was the addition of expansion loops. Early attempts took various interesting shapes, none of which worked especially well. The cable either cracked from too-tight radii or interfered with other lines, such as phone or power, running on the same poles. Complicating things still further, different diameters of cable needed loops of different sizes.

All the failed attempts did serve a purpose, though; we narrowed things down to what had the fewest problems. What we ended up with after much trial and error, coupled with some solid engineering, was a standardized flat-bottomed loop sized for the largest cables in use. So long as the largest and most stressed cables were happy, the smaller ones would fall in line as well. The system worked, and we still use it today.

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franchised. And every winter, the same cable would pull apart, and the systems would go off the air. So cable operators began to demand that expansion loops be developed for cable movement stemming from temperature changes.

Early attempts

Neither cable operators nor the construction companies knew how these expansion loops should be formed, how they should look or how large they should be. Early expansion loops were an assortment of guesses. (See the accompanying figure on page 140.)

Some were completely round, formed by using rims from small bicycles or tricycles. S-loops were formed by creating a loop looking much like a sine wave. Round-bottom loops were just that. You simply formed a loop downward and back up to the strand by hand. A variation of the round-bottom loop was the Omega loop. This was a variation of the round-bottom loop, which was formed to look like the omega symbol by hand. Of course, loops were necessary, but none of them performed properly.

The circle or round loop could be formed easily, but the advent of larger cables (0.750- and 1.0-inch) would not allow their formation while allowing for clearance between power and telephone. The S-loop suffered the same clearance problems.

Construction people did not understand how tightly they could form the loops. In most instances, they caused the outer sheath to wrinkle within the loops. Later, as the cable moved back and forth, the sheath would see the wrinkle as a weak spot and break. This usually occurred at the bottom of the loop.

The Omega loop simply moved the wrinkles from the bottom of the loop to the start and end of the loop excursion, and the cable would break there. Of all of these loops, the circle and the Omega loops were reportedly most free from breaks. Then engineers and construction people discovered that cable broke less often as the size of the bottom of the loop was increased. Construction crews were instructed to install flat-bottom loops. But they damaged the cable by forming it in and out of the strand plane.

One company seemed to overcome the problem by insisting on what they identified as a "swag" loop. With this loop, the cable would not be formed by hand at all but would use a swag-loop spacer to locate the cable away from the strand and back toward it as the cable was lashed forward. Now the construction people had a different board for each size of cable. And that brought a new confusing element because different cable sizes were being pulled into the same run. And no one wanted different loops for different size cables within the same bundles.

A solution

In the late '70s, I visited with the late Richard Schneider. He was the vice president of engineering for United and worked at its engineering headquarters in Casper, Wyo., and we discussed the need for standard loop formation for the cable industry. Schneider held a mechanical engineering degree from the University of Texas, and he began to remove reference books from his shelves. He invited me to return to his offices the next day. When I returned, he had designed a flat-bottom loop drawing at his desk.

I remarked that his dimensions seemed to be those for a 1.0-inch cable and asked, "What about the smaller trunk and feeders?" He replied that no matter what smaller sized cables might be in the bundle, the maximum tensions would be toward the largest cable in the bundle. If we formed the loop with the maximum tension considered, cables should not fatigue and break. Whether accidentally or by design, dimensions of loops today seem to follow the drawings I took from Schneider's office that day.

As we drive or walk under today's expansion loops, perhaps we should give a salute to the engineering ability of the late Richard Schneider. This is one of his many solutions, which solved problems that had plagued cable systems for many years. TB

Rex Porter is editor-in-chief of "Communications Technology." He may be reached via e-mail at tvrex@earthlink.net.

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Reader Service Number 90

Detecting Signal Leakage, Part 5

This month's installment continues a series on detecting signal leakage in the drop system. The material is adapted from a lesson in NCTI's Installer Technician Course. © NCTI.

When using a signal leakage detector at the customer drop, the detector may sound an alarm tone and show a red alarm light when receiving a signal that is not actual cable signal leakage. When careful monitoring and locating procedures find no specific source of cable signal leakage, you should suspect a false alarm from one of many different noncable signals.

Listening to the sound of the alarm tone, reducing the detector's sensitivity, and, when possible, monitoring channels selectively are the techniques for identifying and avoiding false alarms. Disconnect the drop from the tap port and remonitor the area producing the alarm. If the alarm still is present, it is a false alarm. When using a detector, be aware that an alarm may be triggered by any sufficiently strong noncable over-the-air signal at a frequency in the VHF or UHF ranges to which the detector is tuned.

Table 1: Typical RF noise sources that cause false alarms

- Automobile ignition
- High tension wires
- Industrial equipment
- Personal or business computers

Identifying RF noise sources

When monitoring near sources of broadband RF noise, watch out for false alarms. Such noise in the frequency range of 150 MHz to 300 MHz can originate from personal or business computers. The TV set scan rate may cause a false alarm on some detectors. RF noise from industrial equipment, auto ignitions or high-tension wires may also cause false alarms. (See Table 1.)

Identifying over-the-air signal sources

While monitoring the drop, recognize that over-the-air signals can have enough strength to cause a false alarm. Near an aircraft control facility, any detector tuned to Ch. 14 (A), 15 (B) or 16 (C) may display or sound a false alarm from aircraft voice communication signals. FM, ham, mobile or government radio broadcasts also may cause false alarms if they are sufficiently strong and at the detector's tuned frequency. (See Table 2.) TB

Table 2: Over-the-air signal sources that cause false alarms

Detector		Cable signals			Over-the-air signal sources			
Sniffer Jr.	Searcher	Channel	Cable frequency (MHz)	Over-the-air band use	Over-the-air band frequency (MHz)	Image frequency (MHz)	Image band use	Closest over-the-air frequencies (MHz)
	✓	14 (A)	121.2625	Aircraft voice	121 and 121.75	99.8625	FM	99.7 and 99.9
	✓	15 (B)	127.2625	Aircraft voice	127 and 127.25	105.8625	FM	105.7 and 105.9
✓	✓	16 (C)	133.2625	Aircraft voice	132.25 and 133	111.8625	Aircraft navigation	111.7 and 111.9
✓	✓	17 (D)	139.25	Space research	138-144	117.85	Aircraft navigation	117.75 and 118
	✓	18 (E)	145.25	Ham	145-148	123.85	Aircraft	123.75 and 124 voice
✓		20 (G)	157.25	Mobile	156.25-162.0125	145.85	Ham	146.0

The Guardian RSVP™ Return Path Evaluator

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Working with a Guardian IsoMeter™ reverse leakage detector in the field and a standard Trilithic 9580™ reverse path analyzer in the headend, the Guardian RSVP analyzes the return path as well as the ingress potential and shielding integrity of subscribers' home wiring.

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Test Shielding Integrity: By simply connecting the Guardian RSVP to the subscriber's ground block, your technician can flood the home's cabling system with a calibrated return test frequency that makes all leaks immediately detectable to the Guardian IsoMeter.

The Guardian RSVP return path evaluator will help you protect the value of your return path because with the RSVP you'll home in on ingress before it enters your system.

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Reader Service Number 91

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The testing centers on meeting or exceeding Institute of Electrical and Electronics Engineers standards, scalability and whether the equipment will provide sufficient performance for high-speed networks.

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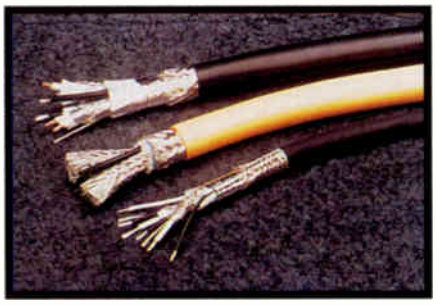

C&M Corp.'s Institute of Electrical and Electronics Engineers 1394 serial interface cable is designed to interconnect personal computers (PCs) to various peripherals and can be used for home entertainment systems, data services, workstations, video equipment and various other applications.

The cables are available in 10-meter lengths and beyond without repeaters and feature consistent isolation between overall and inner shield to meet S400 criteria. Various jacket colors are available to meet system requirements, and the cables are rated to 300 VDC.

For more information, contact C&M Corp. at (860) 774-4812 or on the Web at www.cm-corp.com.

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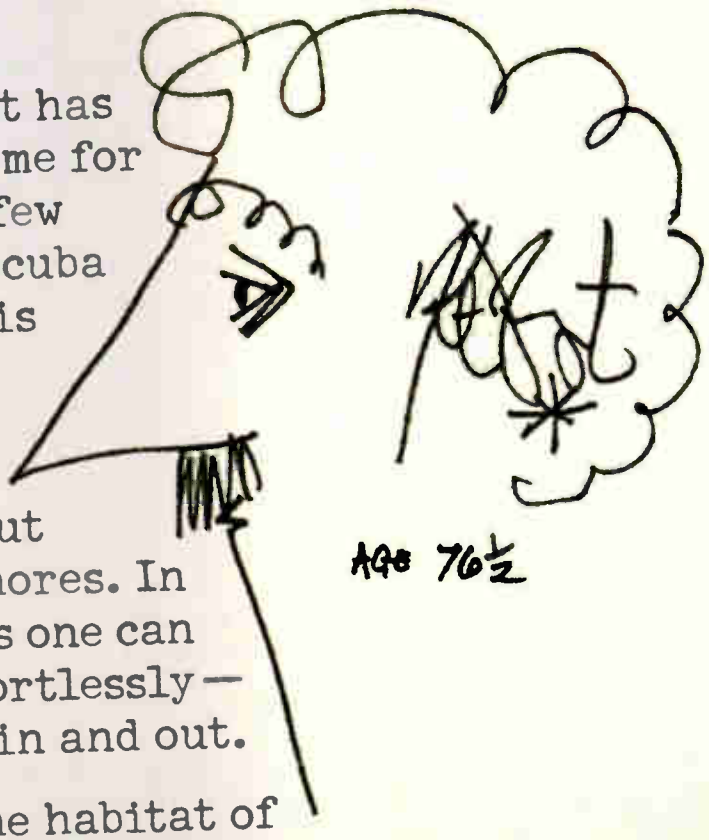

"The Internet has already become for a fortunate few ('spiritual scuba divers', one is tempted to call them) a limitless ocean without bottom or shores. In whose depths one can breathe effortlessly — in and out, in and out.

It is the habitat of the newest creatures to evolve in our part of the Milky Way — as enchanting and nobly bizarre as any giant manta or moray eel, say. They are recorded thoughts and feelings about what it is like to be a living thing."

-Kurt Vonnegut, A.K.A. Kilgore Trout

The New Internet

Well, Mr. Trout, you've said it all. At least we think you have. The potential of the Internet is limitless. But if these scuba divers – known as businesses and cable operators in our world – are to truly unlock its potential, it needs help. So we're building the new, high-performance Internet. Bolstering our HFC solutions with Optical Internet capabilities to make service faster and more reliable. And creating higher levels of quality and new economic opportunities through applications such as Internet Telephony. So come together, right now with Nortel Networks™. And make the Internet whatever you want it to be. **nortelnetworks.com**

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How the world shares ideas.

Lift Truck

Mobile Tool International's Telsta A37 offers up to 28 feet of side reach on a 60-inch chassis with a 15,000-pound gross vehicle weight rating.

The A37 gets its side reach via a telescoping upper boom and articulating lower boom, which can provide a working height of 42 feet when fully extended. Boom rotation is 360°, noncontinuous. The rig is intended for use in hard-to-reach areas, such as areas where poles are set back from the roadway.

For more information, contact MTI on the Web at www.mobiletool.com.

Fiber Light Sources

GN Nettest has introduced three new fiber-optic light sources for fiber testing: the GN-6150, GN-6250 and GN-6260.

The GN-6150 is a dual wavelength 850/1,300 nm multimode light emitting diode (LED) light source, while the GN-6250 and GN-6260 are dual wavelength single-mode laser light sources operating at 1,310/1,550 nm and 1,550/1,625 nm, respectively. Each is capable of continuous wave (CW) or 2 kHz modulation and comes with an AC charger and soft transit case. The units can be powered via AC power, rechargeable NiCd batteries or alkaline batteries.

For more information, contact GN Nettest at (315) 797-4449 or on the Web at www.gnlp.com.

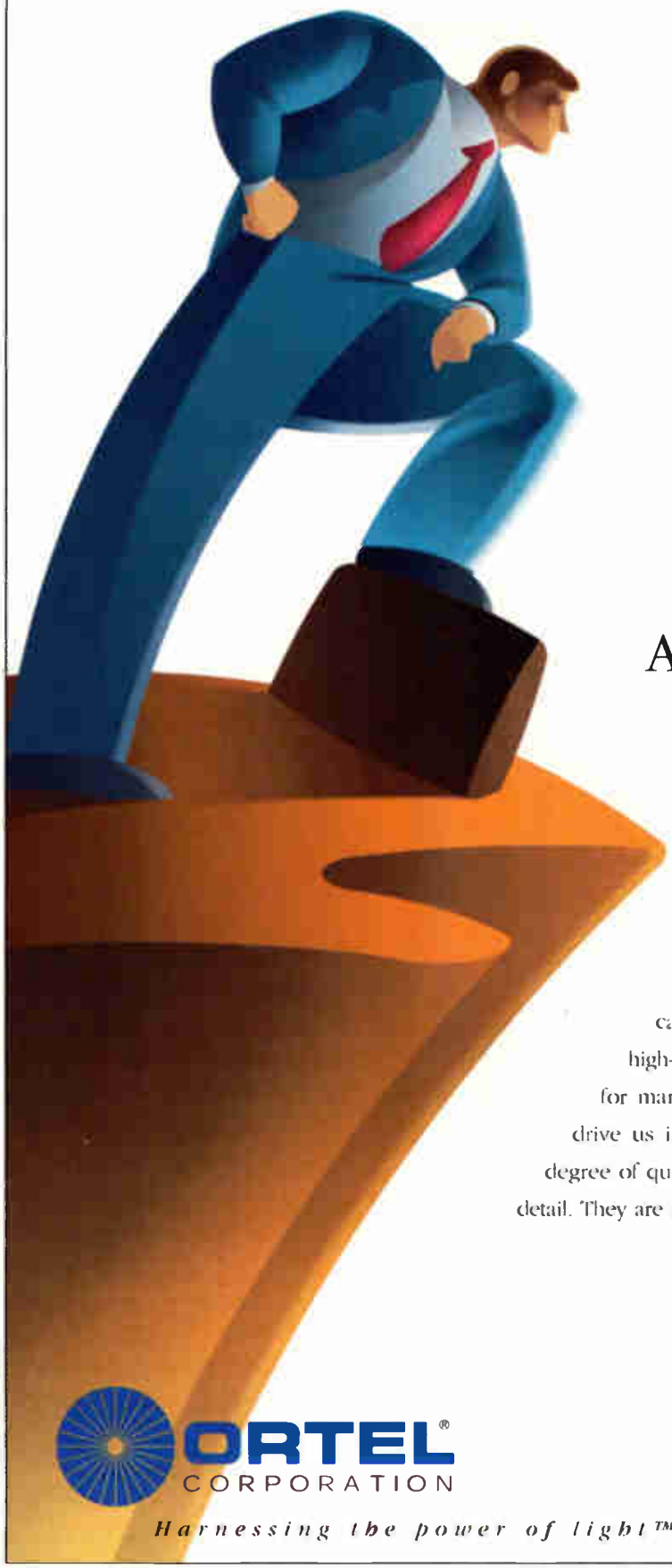
Tower Foundation Analysis

Lawrence Behr Associates' Foundation Wizard services use dispersive wave technology to determine the effective depth of tower concrete bases. The tests, leaning on research at North Carolina State University, are nondestructive and do not require disturbing the earth around poured bases.

The service allows testing of self-support, guyed and monopole tower bases either to the bottom of the concrete column or to a shallower point in the column that represents a structural flaw. It also can be used to evaluate the "deadmen" used with guy wires.

For more information, contact LBA at (800) 522-4464 or on the Web at www.lbagroup.com.

A proud history of firsts



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Reader Service Number 95

Gigabit Ethernet Diode

Anadigics' AMT128503 metal-semiconductor-metal diode and transimpedance amplifier (MSM-TIA) is intended for use in 850-nm Gigabit Ethernet (1.25 Gbps) and Fiber Channel (1.064 Gbps) telecommunications applications.

The unit's front-end receiver operates from a 3.3 V (+/- 5 percent) power supply and is designed to convert optical signals into electrical pulses. According to the company, it exhibits typical sensitivity of -22 dBm and minimum responsivity of 1,000 V/W with a total power dissipation around 120 mW. The device is rated from 0°-70°C and features an on-chip automatic gain control (AGC) circuit.

For more information, contact Anadigics at (908) 668-5000 or on the Web at www.anadigics.com.

Set-Top Connector

Bomar Interconnect Products' Eliminator is a male F-connector designed to allow set-top box tuner modules to connect directly to the personal computer (PC) board, thereby saving space and cabling.

The connector is intended for a wide array of set-tops, from analog or digital video to cable modem or voice over Internet protocol (VoIP) technologies. The Eliminator is machined brass with Teflon insulators and a gold-plated contact. It also can accommodate a range of centerline heights.

For more information, contact Bomar at (973) 347-4040 or on the Web at www.bomarinterconnect.com.

Custom Truck Body

Service Trucks International's custom-built one-ton service body features a crane tower built to accommodate a crane up to 50,000 foot-pounds, manual or hydraulic outrigger crankdown, 14-gauge steel cabinets, 11-gauge gavaneal doors, pressurized compartments, 250-pound toolbox rollout tray, and stainless steel pins and hinges.

For more information, contact STI at (800) 225-8789 or on the Web at www.servicetrucks.com.

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Reader Service Number 97

WDM Transceiver

Anacom Systems' AC 234 features an internal wavelength division multiplexer (WDM) that permits four-channel transmission over one fiber.

The unit accepts two independent RF signals via two 50-ohm SMA connectors and converts them to optical signals for transmission over 9/125 single-mode fiber. Connectors are FC/APC.

The transceiver operates on one 12 VDC power supply and offers remote monitoring and alarm features. It also incorporates laser on/off control and laser monitoring, along with a received optical power monitor.

For more information, contact Anacom at (732) 846-2680 or on the Web at www.anacomsystems.com.

"No New Wires" Cable Modem

Want the capability of cable modems, but not thrilled about the cost of adding new cabling?

The Zoom Telephonics Cable Modem is designed to provide Data Over Cable Service Interface Specification (DOCSIS) 1.0/1.1 compliant wide area network (WAN) service with "no new wires" connections to distributed personal computers (PCs) in a home or business.

Connection options for a local PC include universal serial bus (USB) and 10BaseT Ethernet. Remote PCs can be connected using Home Phone Line Networking or an optional 802.11 wireless network interface card (NIC).

Routing features include dynamic host control protocol (DHCP) and network address translation (NAT). The modem is expected to ship in December with wireless and Home PNA networking options.

For more information, contact Zoom Telephonics on the Web at www.zoom.com.

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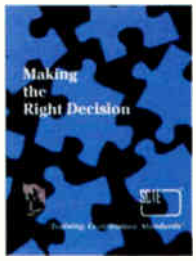
BOOKSHELF

The following is a listing of some of the resources currently available by mail order through the Society of Cable Telecommunications Engineers. The prices listed are for SCTE members only. Nonmembers can contact the Society for additional pricing information.

- *Effective Decision-Making and Problem Resolution*—Learn the art of problem-solving using decision-making and problem-resolution skills from real-life situations. *Effective Decision-Making* is structured in a self-teaching format, with six modules to increase management skill levels. Topics covered include establishing a baseline, foundations, the decision-making process, developing a decision summary and practice using the decision-making process. The package contains one book and one videotape. Order TM-16, $95.

- *Making the Right Decision*—Learn how to make, evaluate and present the rationale for your decisions. The book's six modules will guide technicians through the decision process. Topics include examining the steps involved in making a good decision, addressing the total picture when faced with conflicting priorities, basing decisions on a systematic application of appropriate business principles, getting to the facts and explaining the important aspects of analysis and the resulting decision, how to "write it down" effectively, and practicing scenarios that help make the decision and resolution process tools work. Gain confidence in analysis, decision and resolution skills, and transfer those skills to real-life situations. The package contains one book and one videotape. Order TM-17, $95. CT



Note: The videotapes are in color and available in the NTSC 1/2-inch VHS format only. They are available in stock and will be delivered approximately three weeks after receipt of order with full payment.

Shipping: Videotapes are shipped UPS. No P.O. boxes, please. SCTE pays surface shipping charges within the continental U.S. only. Orders to Canada or Mexico: Please add $5 (U.S.) for each videotape. Orders to Europe, Africa, Asia or South America: SCTE will invoice the recipient for additional air or surface shipping charges (please specify). "Rush" orders: a $15 surcharge will be collected on all such orders. The surcharge and air shipping cost can be charged to a Visa or MasterCard.

To order: All orders must be prepaid. Shipping and handling costs are included in the continental U.S. All prices are in U.S. dollars. SCTE accepts MasterCard and Visa. To qualify for SCTE member prices, a valid SCTE identification number is required, or a complete membership application with dues payment must accompany your order. Orders without full and proper payment will be returned. Send orders to: SCTE, 140 Philips Rd., Exton, PA 19341-1318 or fax with credit card information to (610) 363-5898.

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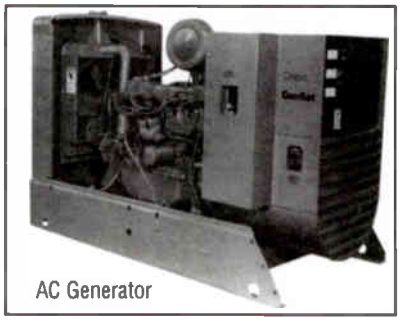

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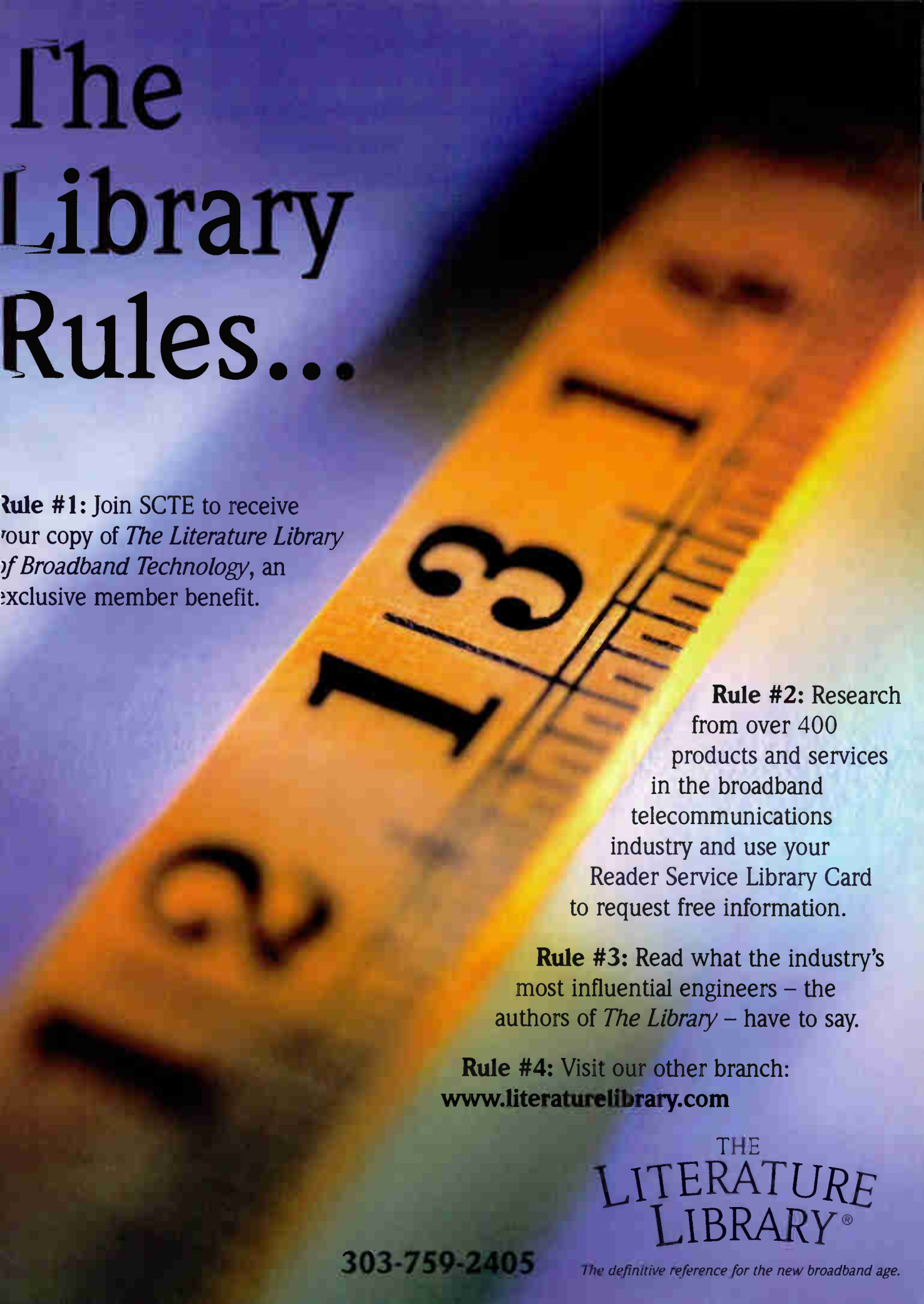
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CALENDAR

December

2: New England Society of Cable Telecommunications Engineers Chapter technical seminar and testing session, Holiday Inn, Boxborough, Mass. Topic: "Safety." Broadband Communications Technician/Engineer (BCT/E) and Telephony certification examinations to be administered. Contact Tom Garcia, (508) 562-1675 or tgarcia@cablevision.com.

6: Ark-La-Tex SCTE Chapter vendor show, Holidome, Shreveport, La. Contact Jim Bostic, (318) 213-3322.

6-7: Telcordia Telecommunications Overview seminar, Atlanta. Call (800) 832-2463.

Planning Ahead

Jan. 11-13: SCTE Conference on Emerging Technologies 2000, Anaheim, Calif. Call (610) 363-6888.

Feb. 23-25: 40th Anniversary Texas Show, San Antonio Convention Center, San Antonio. Call (512) 474-2082.

March 12-15: Eastern Cable Show, Atlanta. Call (404) 255-1608.

April 2-4: Canadian Cable Show, Toronto, Canada. Call (613) 232-2361.

May 7-10: C2K, NCTA Cable 2000, New Orleans. Call (202) 755-3669.

June 5-8: SCTE Cable-Tec Expo 2000, Las Vegas. Call (610) 363-6888 or go to www.scte.org.

7: Wavetek Wandel Goltermann's "Understanding Digital" course, Indianapolis. Call (800) 851-1202.

8: Badger State SCTE Chapter technical seminar, Holiday Inn, Fond du Lac, Wis. Topic: "Cable Modems and Internet Protocol 101." Contact Bob Shugarman, (608) 238-9690 or visit www.scte.org/badger/.

8: Snake River SCTE Chapter technical seminar, Ameritel Inn, Twin Falls, Idaho. 9 a.m. to 4 p.m. Contact Tim Alverson, (208) 377-2491.

14-17: Western Cable Show, Los Angeles. Call (510) 428-2225 or go to www.cct-assn.org.

16: Razorback SCTE Chapter technical session, Holiday Inn—Airport East, Little Rock, Ark. Contact Jack Trower, (501) 327-8320.

17: Oklahoma SCTE Chapter testing session, Multimedia Cablevision registration office, Edmond, Okla. BCT/E certification examinations to be administered. Contact Steve Johnson, (405) 422-2346, sjohnson@cvvt.org or visit www.scte.org/oklahoma/.

18: North East SCTE Meeting Group technical seminar. Contact Jim Kelly, (508) 222-6304.

21-22: Appalachian Mid-Atlantic SCTE Chapter testing session, TV Cable of Carlisle, Carlisle, Pa. Installer, BCT/E, Service Technician and Telephony examinations to be administered. Contact Loarn Arthur, (717) 263-5541. CT

VENDOR CONNECTION

Vendor Connection is *Communications Technology's* resource for up-to-date information on the industry's leading technology suppliers. These vendors have advertised in this issue. Check their ads for products and services that will improve your cable system's reliability, efficiency and capacity.

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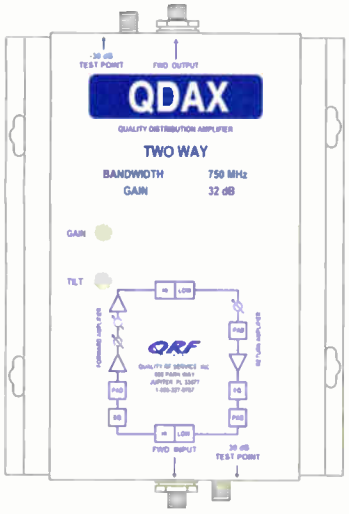

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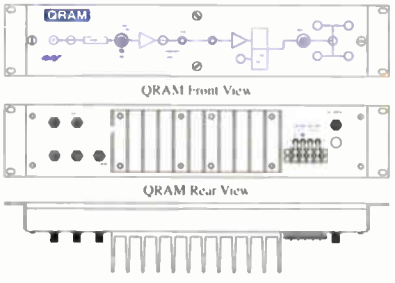

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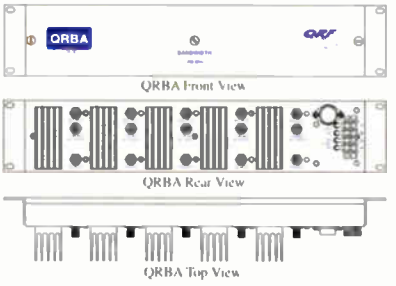

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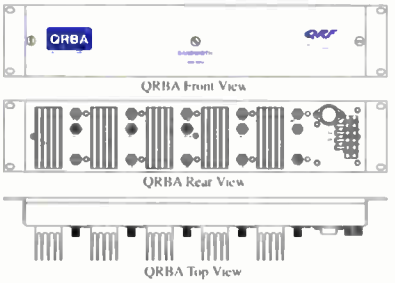

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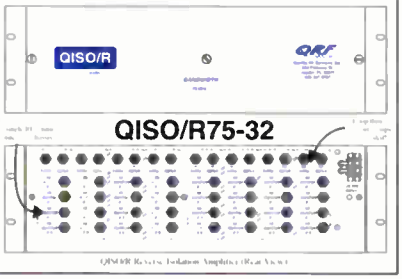

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AD INDEX

RR#	Advertiser	Page #
57	ADC Telecommunications	99
73	Agilent Technologies	123
3	Alpha Technologies	5
6	ANTEC TeleWire Supply	9
82	Aurora Instruments	132
110	Avcom of Virginia	164
72	Barco	119
23	Blonder Tongue	33
67	Budco	114
19	C-Cor.net	26-27
11	Cable AML	14
31	Cable Leakage	56
75	Cable Prep	125
34	Cable Resources Inc	63
60	CableServ	104
56	Cabletek	98
1	Cheetah Technologies	2
45	COM 21	77
24, 74	Commscope	35, 124
76, 97	Commscope	126, 151
-	Corning	45
14	Digitrans	17
87	Diva Systems	137
17	DX Communications	23
40, 42	Eagle Comtronics	69, 71
119	Electroline	179
7	Fiber Instrument Sales	10
54	FM Systems	97
-, 100	General Instrument Corp	43, 153
29	Harmonic	53
28	HSA	51
15	HUKK Engineering	19
-	ICS Network Solutions	Insert
35	ICS Network Solutions	64-65
66	ICTV	110-111
61	IMAKE	105
64	Lectro Products Inc	109
58	Lindsay Electronics	102
77	Line Ward	126
-	Literature Library	155
27	Lucent Technologies	38-39
39	Mainline Equipment	68
85	Marconi Communications Network Solutions Group	135
108	Mastec Broadband	162
13,21,38	Mega Hertz	16,30,67
50,53,55	Mega Hertz	82,96,97
69,71,92	Mega Hertz	116,118,146
99,101	Mega Hertz	152,154
118	Mindport	83-90
37	Monroe Electronics	67
26	Moore Diversified Products	37
120	Multilink	180

RR#	Advertiser	Page #
83	NCS Industries	133
96	NEPTCO	150
93	Nortel	147
95	Ortel	149
10	Passive Devices	13
30	PCI Technologies	54-55
78	Power & Telephone Supply	127
105	Quality RF Services	159
63	Quintech	108
89	Rifocs Corporation	142
86	Ripley Company	136
70	Riser Bond Instruments	117
32	R. L. Drake	57
25	Sadelco	36
18	Samsung	25
-	SCTE	91,156,169
68	Sencore	115
43, 44	Siecor Corporation	72, 73
62	Siemon Company, The	106-107
106	Signal Vision	161
52	Sprint North Supply	95
8	Standard Communications	11
107	STB Systems	162
49	Sumitomo	81
5, 9	Telecrafter Products	8, 12
98	Tempo Research	152
4	Terayon Communication Systems	7
104	Tollgrade	157
16	Toshiba	21
22, 91	Trilithic	31, 145
47	Trilogy	79
33	Tsi Technical Solutions	61
41,88,112	Tulsat	70,141,165
20,46,48	TVC	29,78,80
84	Unique Broadband	134
109	Videotek	163
51	Viewsonics	47
111	Wade Antenna	164
90	Watkins-Johnson	143
12,36,81	Wavetek Wandel Goltermann	15,66,131
-	Women in Cable	46
-	www.Bigpipe.com	167
-	www.CableToday.com	148
59	Zenith	103

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- 03. Independent System Operator
- 98. Telecom Network/Carrier (RBOC, LEC, CLEC, Long Distance Provider.)
- 19. Public/Private Utility
- 20. System Contractor
- 21. Hardware/Component Manufacturer/Dist.
- 18. Other (please specify)

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- 47. Regional Engineer
- 48. Divisional Engineer
- 49. Plant Manager
- 50. Installation Manager
- 51. Network Manager
- 52. Construction Manager
- 53. Field Services Manager
- 54. Technical Manager Engineering
- 55. Engineer
- 56. Headend Engineer
- 57. Const. Engineer
- 58. OSP Engineer Technical
- 59. Headend Technician
- 60. Line Technician
- 61. Bench Technician
- 62. Sweep Technician
- 63. Other Technical Title (Please specify)

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- 64. Installer
- 65. CSR
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E. In the next 12 months, what cable equipment do you plan to buy?
- 35. Amplifiers
- 36. Antennas
- 37. CATV Passive Equipment including Coaxial Cable
- 38. Cable Tools
- 39. CAD Software, Mapping
- 41. Compression/Digital Equip.
- 43. Connectors/Splitters
- 45. Headend Equipment
- 46. Transmission/Switching Equipment
- 47. Networking Equipment
- 48. Vaults/Pedestals
- 49. MMDS Transmission Equipment
- 51. Receivers and Modulators
- 52. Cable Modems
- 53. Subscriber/Addressable Security Equipment/ Converters/Remotes
- 54. Telephone/PCS Equipment
- 55. Power Supplies. (Batteries, etc.)
- 56. Video Servers

F. What is your annual cable equipment expenditure?
- 57. up to $50,000
- 58. $50,001 to $100,000
- 59. $100,001 to $250,000
- 60. over $250,000

G. In the next 12 months, what fiber-optic equipment do you plan to buy?
- 61. Fiber-Optic Amplifiers
- 62. Fiber-Optic Connectors
- 63. Fiber-Optic Couplers/Splitters
- 64. Fiber-Optic Splicers
- 66. Fiber-Optic Patchcords/Pigtails
- 68. Fiber-Optic Cable

H. What is your annual fiber-optic equipment expenditure?
- 70. up to $50,000
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- 72. $100,001 to $250,000
- 73. over $250,000

I. In the next 12 months, what cable test & measurement services do you plan to buy?
- 74. Audio Test Equipment
- 75. Cable Fault Locators
- 76. Fiber Optics Test Equipment
- 77. Leakage Detection
- 78. OTDRs
- 79. Power Meters
- 80. Signal Level Meters
- 81. Spectrum Analyzers
- 82. Status Monitoring
- 83. TDRs

J. What is your annual cable test and measurement expenditure?
- 84. up to $50,000
- 85. $50,001 to $100,000
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6	30	54	78	102	126	150	174	198	222	246	270	294
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17	41	65	89	113	137	161	185	209	233	257	281	305
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19	43	67	91	115	139	163	187	211	235	259	283	307
20	44	68	92	116	140	164	188	212	236	260	284	308
21	45	69	93	117	141	165	189	213	237	261	285	309
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M. Do you plan to rebuild/upgrade your system in:
- 95. 1 year
- 96. more than 2 years

N. How many miles of plant are you upgrading/rebuilding?
- 97. up to10 miles
- 98. 11-30 miles
- 99. 31 miles or more

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10	34	58	82	106	130	154	178	202	226	250	274	298
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12	36	60	84	108	132	156	180	204	228	252	276	300
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By John Clark

Charter Members Pass Baton To Circle of Eagles

As we've seen, Sally Kinsman has been awarded this year's Women in Technology Award. I applaud her for the leadership she has shown the cable telecommunications industry.

Recognizing leaders in our industry has always been a goal of the Society of Cable Telecommunications Engineers. SCTE's Charter Members are a fine example of this trait.

Getting some history

One of the highlights of my first Cable-Tec Expo in May in Orlando was breaking bread with our Charter Members at the annual Charter Member Dinner. I had met many of them at the General Session opening of Expo '99, where Charlie Tepfer, Bill Karnes, Ron Cotten, Austin Coryell, Jake Landrum, Wayne McKinney, Rex Porter, Herb Timberlake and Al Williams recreated the birth of SCTE 30 years ago in San Francisco. Seeing each recast their 'aye' votes for the Society's creation was an incredible moment. We have a great responsibility and opportunity to carry out their vision through the successful implementation of SCTE's mission—training, certification and standards.

History is important; learning and understanding the roots of SCTE is something on which I have spent much time focusing. The Charter Member Dinner was an excellent vehicle to accomplish this.

My then-fiancee (and now wife), Cynthia, and I arrived early to the cocktail reception; we wanted to be there to hear the best of the many "war stories." There were some doozies, many dealing with Roswell, N.M. The dinner itself was a classy and fun affair, which we were thrilled to be attending.

A new plan

Toward the end of the evening, the first SCTE President, Ron Cotten, brought forth a business issue to the group. Ron reviewed how, through the inevitability of the aging process, the Charter Member group was shrinking in number every year. Given this inevitability, Ron said he was not looking forward to "someday having dinner alone at some future Expo." We all understood his point.

Ron, Bill Karnes and others spoke about how the Charter Members have been a helpful advisory group to both the Board and SCTE staff alike, adding that losing this council of elders might create a void within the Society they had formed. They presented a solution to the group—replacing the Charter Members with a new group that would go on in perpetuity.

SCTE President John Clark and his wife (then fiancee), Cynthia, with SCTE Charter Members and their spouses at Cable-Tec Expo '99.

The new group would be the Circle of Eagles. As Bill Karnes put it, "Eagles don't flock; they fly alone. And eagles soar above the rest of their world. So, too, do people who start things, who lead groups or who otherwise set themselves apart from the crowd." At the end of the evening, each of the Charter Members present voiced support for the new group to replace their own. The Circle of Eagles was ready to fly.

The eagles' nest

Both the SCTE Board and staff have pledged our support for the new group. Circle of Eagles membership would qualify from any of four SCTE areas: Charter Members, Hall of Fame members, former board chairmen and former presidents.

As Bill Karnes stated: "The thought occurred to me that there might be a way to continue the spirit that was inherent in the Charter Members and that has also been a part of the leadership of SCTE through the years. That spirit is the willingness to step out and lead and to see the future as it can become with proper vision followed by action. Given that, it appears that a group made up of Charter Members, members of the Hall of Fame, former SCTE presidents and chairmen could continue this spirit."

Plans are being made for the first Circle of Eagles gathering at Expo 2000 in June in Las Vegas. I am excited about working with them and being able to draw upon their experience and wisdom. The Charter Members should be proud of taking their legacy of leadership and ensuring its continuation as part of our future. We all thank them for that. CT

John Clark is president of the Society of Cable Telecommunications Engineers.

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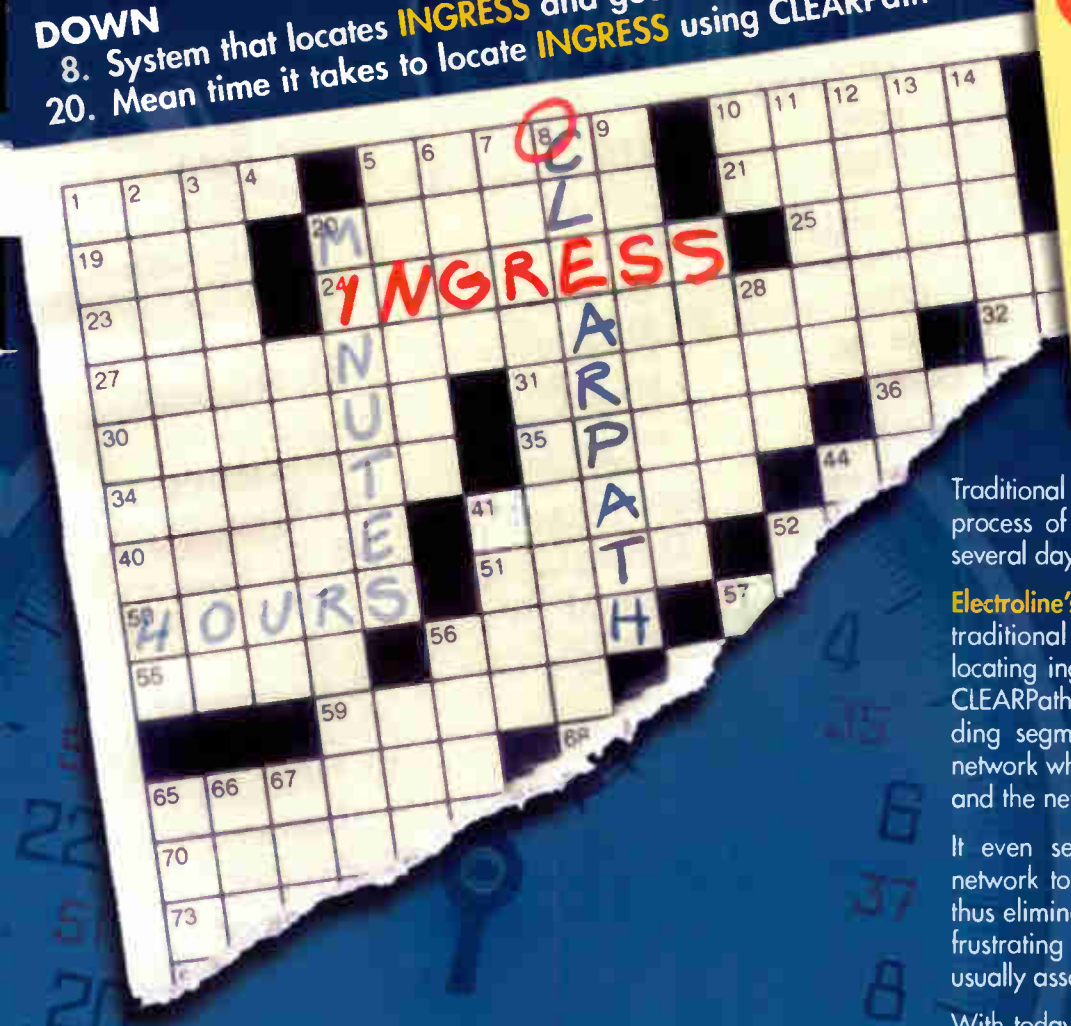

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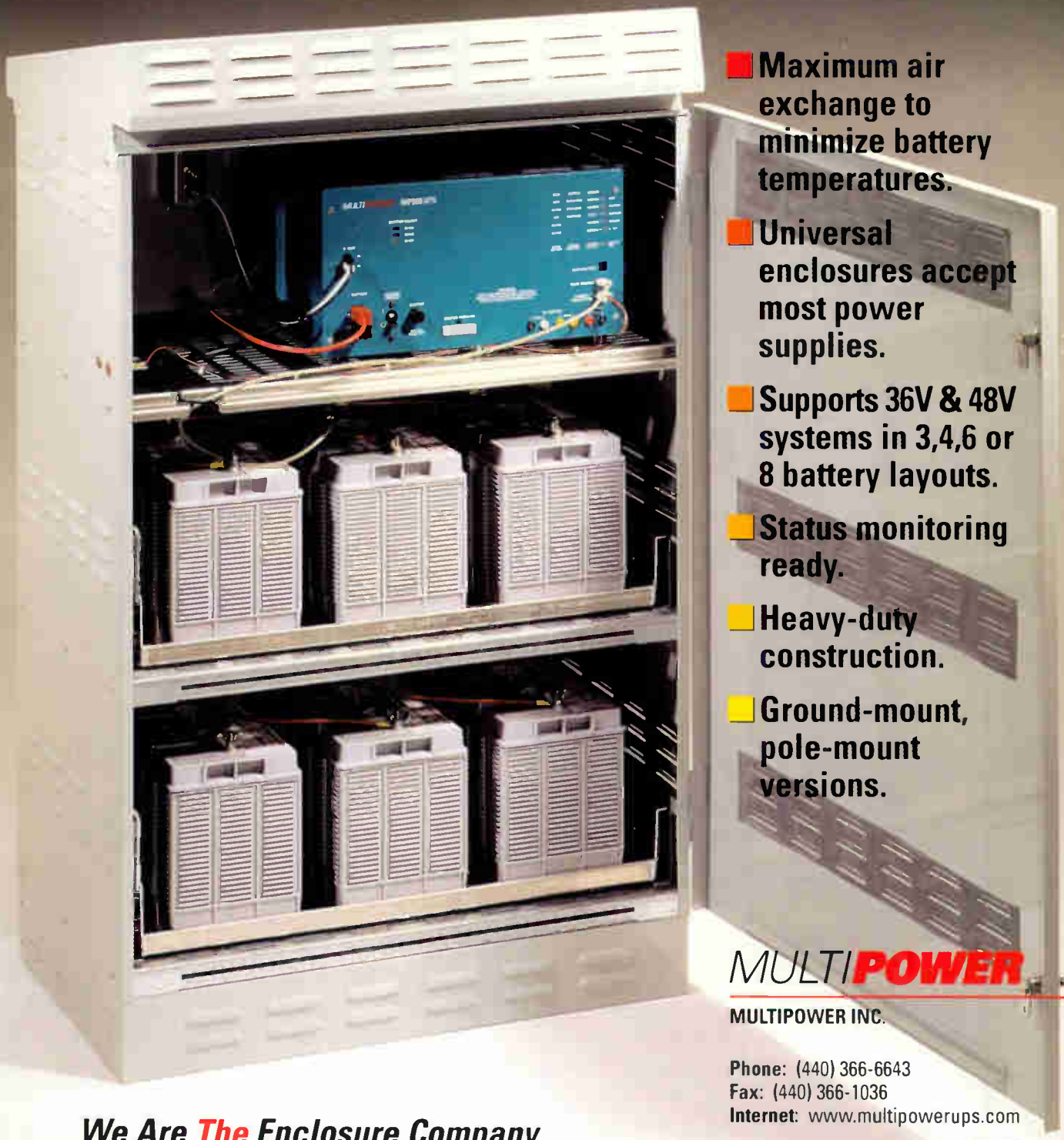

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