Communications Technology

Official Trade Journal of the Society of Cable Telecommunications Engineers

May 2000

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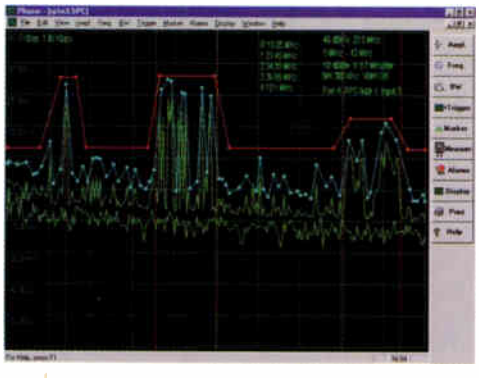

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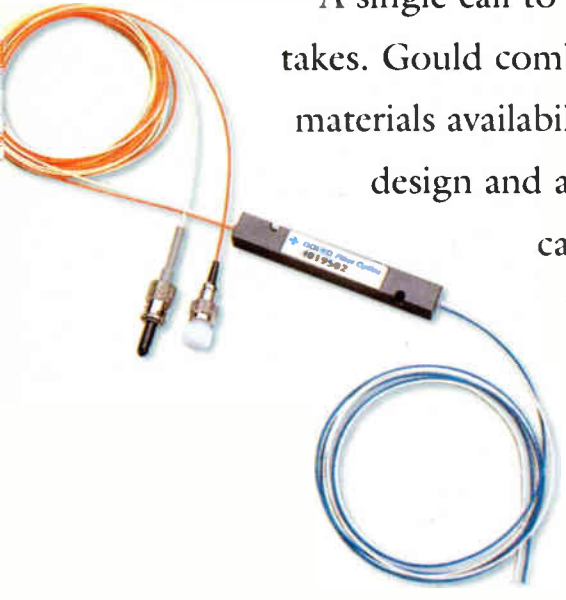

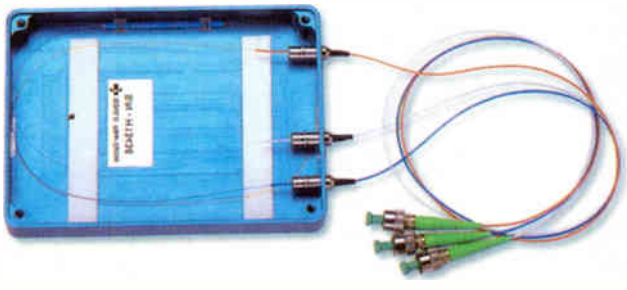

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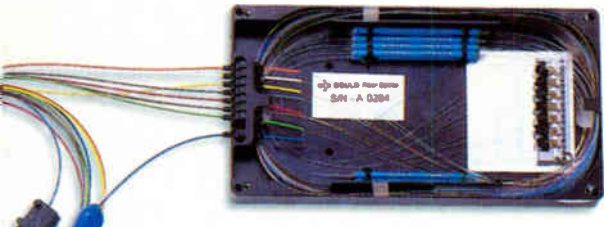

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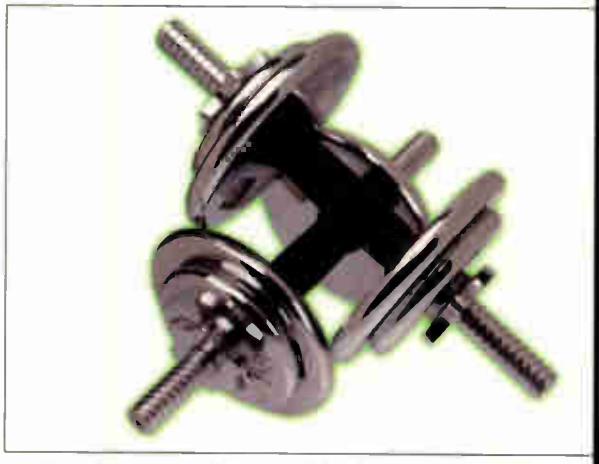
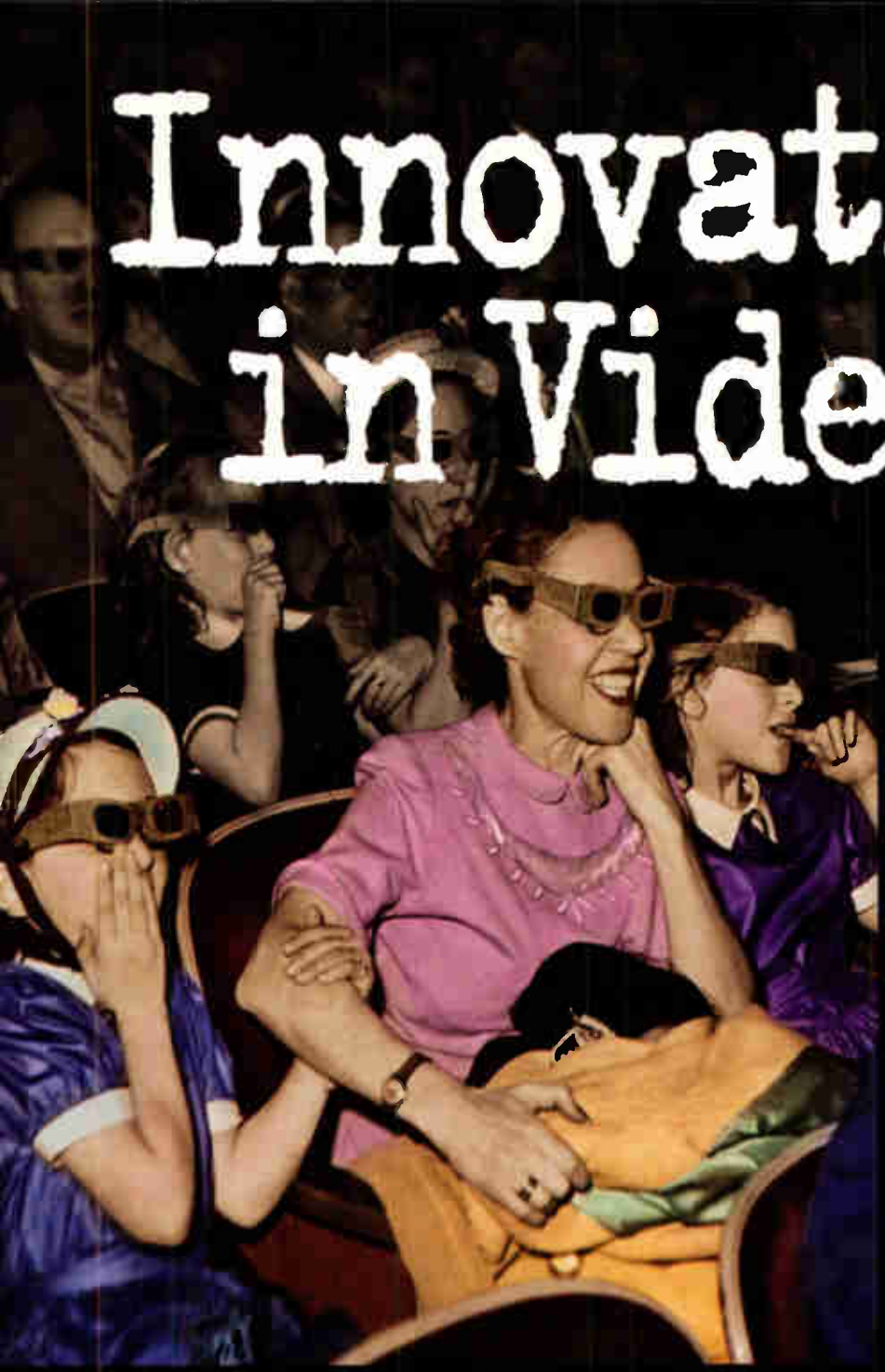


Innovation in Video?



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The History of Cable Engineering

This past week, I spent hours glued to a soon-to-be-released book by Archer Taylor. Engineers and technicians have always asked how some practice started or how one of the manufacturers came on the scene. Well, this book, "History Between Their Ears," will answer all of these questions.

Covering the period from 1948 through 1973, Archer tells the stories of cable engineering in such a way that the reader cannot lay the book aside. Beginning with Ed Parsons in Astoria, Ore., Archer moves on to the life of Jim Davidson in Arkansas, Bob Tarlton and Marty Malarkey, Jr., in Pennsylvania, and John Walson in Mahoney, Pa. Taylor covers the first cable convention in Pottsville, Pa., on Sept. 18, 1951, and the first National Cable Television Association convention in 1952.

This book is the best treatment of cable TV to date. Perhaps I am biased because it is written to, about and by one of our elite engineers. As he reviews Milt Shapp's life, Taylor writes about other partners and engineers who helped Jerrold Electronics grow from Shapp's initial $500 investment.

Readers will learn how a simple misinterpretation of the word "insulation" decided the outcome of a court case between Jerrold and Entron. The chapters cover how multichannel amplifiers were developed and the heartache involved. Chapter 7, "Ameco," introduces how cable was brought to the West. Engineers such as Earl Hickman and Millford Richey also are highlighted in this section, as is the introduction of transistors and chips. Taylor records both SKL's contributions to the cable industry and Argyle "Socks" Bridgett's efforts. The section about Alex Best is fascinating.

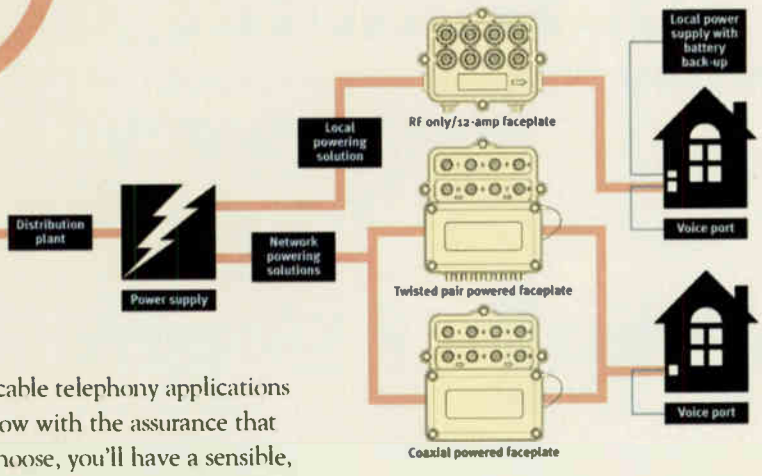
Proceeding, the book covers Jim Palmer's early days at C-COR, the Blonder-Tongue story, the Mezzalingua family's fantastic growth as a cable power, Kaiser, Theta-Com, GTE Sylvania, Texscan, Anaconda, Phasecom, Century III, Vikoe (Viking), EIE, RCA, CAS, Oak AEL, Holt, Cascade, Delta-Benco, Electroline, Lindsay, Triple Crown, and Rediffusion.

In short, it's all here.

Archer Taylor will be signing copies of his book at the 2000 NCTA Convention. I think everyone in cable TV will head their Christmas list with copies of this excellent history of early engineering.

Rex Porter
Editor-in-Chief

3 faces 1 body 0 worries



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Communications Technology

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A division of Phillips Business Information Inc.
CT Sales and Editorial Offices
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LETTERS

> A Network Management Idea

Jennifer:
I could not agree with you more about the increasing complexity of the networks being built today ("Return Path," March 2000, page 32).

In the column, you mentioned a gentleman from Tellabs by the name of Preston Gilmer and that he's interested in assembling five to seven key players in the industry "to build the legal agreements and get together to work on a common model."

Our company, C.I.S., is interested in joining Mr. Gilmer in this effort. If possible, would you please forward my name to Mr. Gilmer? I could then pursue this matter with him.

Thank you for your fine article and for passing on my name.

Thank you,

Jeffrey C. Eichler
President
C.I.S.

Editor's response: Thanks for your note—we always like hearing from readers. You can reach Preston Gilmer at Tellabs. His e-mail address is preston.gilmer@tellabs.com. You might also want to contact Ted Woo, director of standards at the Society of Cable Telecommunications Engineers. Ted oversees development of SCTE standards. The number at SCTE headquarters in Pennsylvania is (610) 363-6888. Let us know if we can be of any other assistance. —JW

Last Mile Question

Sir:

I am new in communications, but even with my brief exposure, it is so, so interesting. I finished reading your article on bandwidth in April's issue of *Communications Technology*. I find the magazine on the cutting edge of informing those in the field which wave they are riding at the moment and will be in the future. My question is about the "last mile." With all the advancements in bandwidth management, how does rural America fit into the increasing demand for bandwidth?

Edward von Tobel

Editor's response: Well, it depends. Some cable systems are trying out new services in rural markets first, as small-scale tests. Others are doing so in major markets. Generally, though, you can expect advanced services over cable to reach major metropolitan areas first, simply because return on investment (and the investment is huge) will be quicker there. With wireless broadband, terrestrial plant costs are less of an issue in areas with low population density. This is the same model as that for satellite TV services. —RH

Vertical or horizontal?

Jim:
Thanks for your article in the February issue of *Communications Technology* ("Digital Video Compression," page 66). I enjoy your style of writing, and it certainly does help make these new technologies much more clear and understandable.

One very minor point: Read the first full paragraph of your article on page 70. Correct me if I'm wrong, but it says "About 21 or 22 lines of each field are taken by the horizontal blanking interval (HBI), resulting ...." Shouldn't that be vertical blanking interval (VBI) instead? Seems to me that the vertical blanking blanks 21 or so horizontal lines. HBI shuts off the beam only during the horizontal retrace and doesn't cause the loss of any complete lines, only part of a horizontal line. Or am I putting the emphasis on the wrong syllable or mis-interpreting your explanation? It's been known to happen.

Keep the good stuff coming—it is indeed appreciated.

Par Peterson
Senior project engineer
ADC Telecommunications

Jim Farmer's response: Yep, you caught me. Numerous people have gotten after me for "H-ing" where I should have "V'ed." You are quite right, and I stand corrected. I wish I could say I put it in just to see who was paying attention, but you'd know better, wouldn't you? Anyway, thanks for your kind comments and for reading "Communications Technology." —JF

Battery Concerns

Rex:
The article "Power Corrupts," (March 2000, page 90) was really informative and accurate. I just had to put together something to give to AT&T corporate to give them an idea of the shelf life of batteries. This was covered on page 94 in the article. All the things covered in the article we harp about all the time.

The only thing I would like to add is this. When installing new batteries, make sure you install all the same batteries: same type, same size, same brand. Do not mix batteries. They might all be new and all the same type, but different manufactures' batteries charge at different rates.

Thanks for getting the information out to the industry.

Cheri Kettler
CATV sales manager
MK Battery

> Write to Us

What do you think of this month's issue? If you agree, disagree, or have comments on what you've read, please let us know. Simply e-mail *Communications Technology*'s editors at tvrex@earthlink.net or jwhalen@phillips.com. CT may edit letters for clarity and space.

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LaGrange, Ga., Funds Internet Access

By Jonathan Tombes,
Deployment Editor

Did someone say Digital Divide? The City of LaGrange, Ga., is trying to banish that notion by bringing Internet access to all cable households in its community.

Charter Communications will provide the service, using WorldGate's Internet on EVERY TV product and Motorola's set-top boxes. The city of LaGrange is funding the effort, which builds upon a relationship that arose from the city's interest in providing broadband services.

LaGrange Mayor Jeff Lukken has five goals for this initiative: 1)-Internet competency, 2)-educational enhancement, 3)-community networking, 4)-city government communication, and 5)-e-commerce support.

Instead of going head-to-head with Charter, which owned the local system, in 1998 LaGrange agreed to buy the system, rebuild it into a 750 MHz two-way plant, and lease back capacity to Charter.

Charter introduced LaGrange to WorldGate, a developer of interactive television services. As it happened, the missions of LaGrange and WorldGate dovetailed.

"We had initially deployed WorldGate in LaGrange through our Charter affiliation agreement, and the Mayor of the town happened to come across the service, and was moved by the possibilities of providing low-cost but highly functional Internet access on the TV set to all of his constituents," said Peter Mondics, vice president of sales and marketing for WorldGate.

The system is currently in a beta-test mode, with about a hundred customers using an advanced analog set top box. The technical challenges for rolling out the service appear modest.

"This is no different from deploying WorldGate anywhere, with the exception of its obviously going to be a large number of WorldGate customers," said Phil Skinner, Charter's general manager for Georgia.

Hall is budgeting about $300,000 for the first year's service and will split associated capital costs at the headend with Charter. The city is planning to purchase Charter's set-top boxes and sell or lease them back after a year, at which time customers may be charged for the set-top, but not the service. Hall anticipates 7,000 of the 9,100 homes that have basic cable taking this service.

The city, which also operates a separate fiber optic system for commercial and industrial applications, will install the WorldGate service with its own technicians. The service will come defaulted with SurfWatch, a product that filters adult-oriented material. Hall expects the rollout in early June.

NEWSBITES

> **MasTec Contracts**
> In the first quarter, MasTec won more than $450 million in new infrastructure contracts. The work comes from COLO.COM, IBM, Lawton Cablevision, Level 3, MCI Worldcom, Sprint PCS, US West, Williams Communications, WinStar, Worldwide Fiber USA, and others. The work on these contracts will be performed over 18 months.

> **nCube and Prasara Team**
> nCube's MediaCUBE 4 and Prasara's digital TV services will combine to manage digital cable, from content acquisition through customer billing. The combined interactive TV service will give cable subscribers access to movies on demand, fast-food delivery, TV banking, local even information, news, customer education and other e-commerce services.

> **RCN Bundles**
> RCN Corp. has expanded its ResiLink bundled phone, cable and high-speed Internet service to San Mateo, Calif. and Folcroft, Pa. With 205 homes per mile of plant, San Mateo has a density of nearly seven times the national average. Folcroft has a density of four times the national average. RCN offers subscribers four, all-in-one pricing options.

> **Adelphia Orders SciCare**
> Adelphia Communications signed a $4.8 million order with SciCare Broadband Services for digital installation and integration services in order to deploy turnkey digital subscriber networks. SciCare is a newly launched business unit of Scientific-Atlanta.

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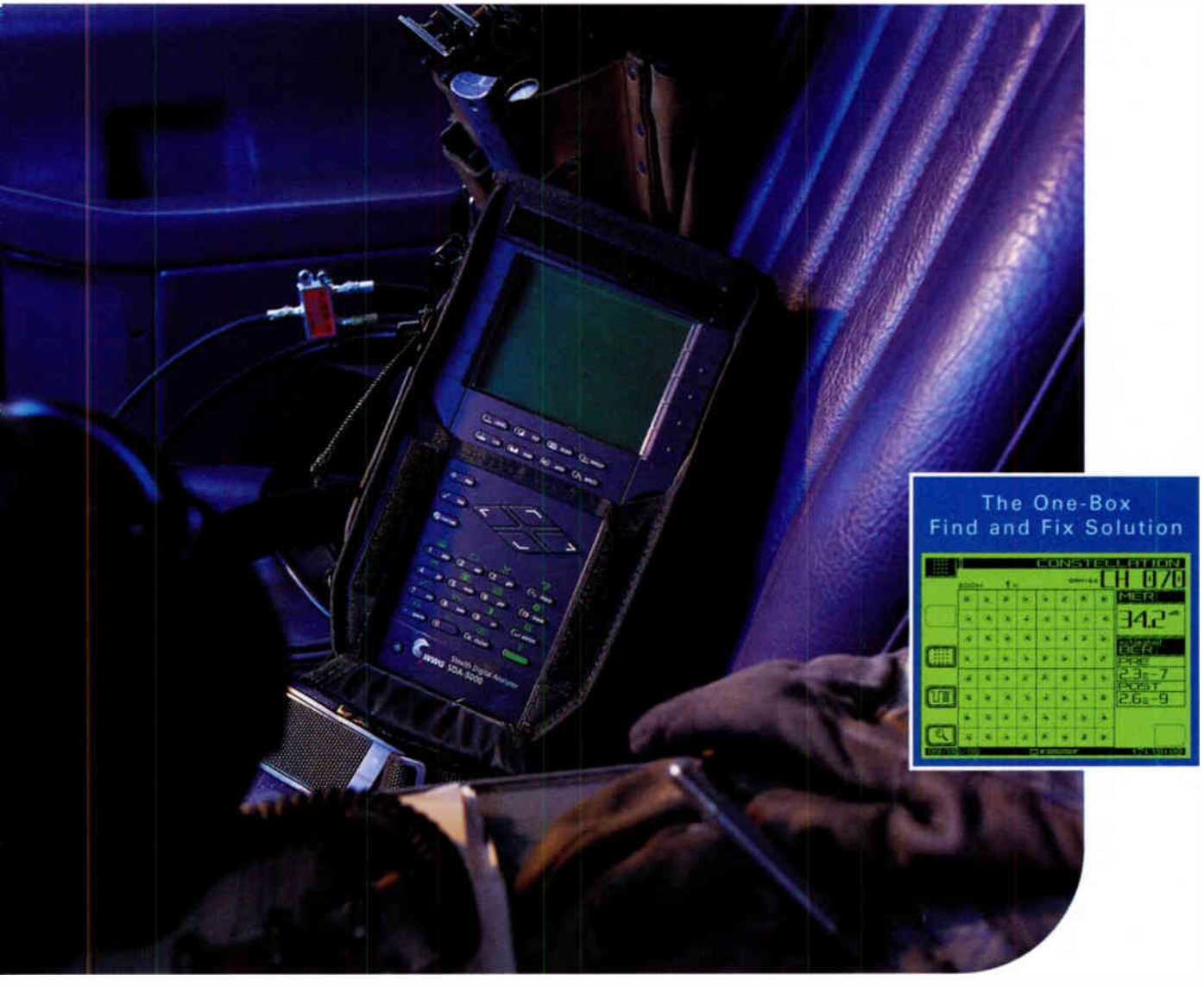

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RiverDelta Boxes QoS

By Jonathan Tombes,
Deployment Editor

Within only a year of its founding, RiverDelta Networks is poised to demonstrate and begin beta-testing its flagship product, the Broadband Services Router (BSR) 64000.

RiverDelta jump-started development by acquiring technical teams steeped in the domains that the BSR 64000 seeks to link: the regional wide area network/metropolitan area networks (WANs/MANs) and the Data Over Cable Service Interface Specification (DOCSIS) hybrid fiber/coax (HFC) networks.

"The technical opportunity is that mechanisms such as multiprotocol label switching (MPLS) and differentiated services have enabled quality of service (QoS) on Internet protocol (IP) backbones, and DOCSIS 1.1 has enabled QoS on HFC access networks," said RiverDelta Chief Technical Officer Gerry White.

The result of the technical opportunity, White said, is that "an end-to-end QoS capable infrastructure can be built enabling applications such as voice over Internet protocol (VoIP) and streaming multimedia."

The BSR 64000's key feature lies in its SmartFlow Virtual Router, which is designed to allow multiple system operators (MSOs) to offer independent virtual networks to multiple service providers, thus better harnessing traffic over increasingly crowded HFC architectures. The implications involved for VoIP telephony are especially striking.

"You could be running at maybe 10 percent of capacity of the bandwidth, but still have very poor quality service for your voice traffic, because you're not classifying it properly," said Jeffrey Walker, RiverDelta's vice president of marketing.

QoS concerns have kept many cable operators from plunging into telephony.

RiverDelta's BSR 64000 challenges Cisco's Universal Broadband Router (uBR) 7200 series, an integrated cable modem termination system (CMTS) and router.

"What RiverDelta does is take it to another level," said Ron Westfall, senior analyst at telecom research firm Current Analysis. "Not only are you integrating the sheer media aggregation component, the CMTS element, and integrating the routing capabilities, but also you're including the switching and also the upconverter/modulating functions onto a single platform."

Westfall said such integration can help operators to improve scaling. "The current Cisco routing capabilities run about 300,000 packets per second, whereas the BSR 64000 can scale to a couple of millions packets per second," he said.

With its claim to offer "four times the performance at one-fourth the cost in one-fourth the space," RiverDelta aims to make a big splash when it demonstrates the system at the National Cable Television Association's convention and show in New Orleans.

Another player to watch is Broadband Access Systems, which has a similar system. Speculation is already rising among industry analysts over what comes next.

"The technology is elegant; however, with both RiverDelta and BAS, what's going to be interesting is what kind of partnerships they can line up to get these deployed by the AT&T ventures, the Paul Allen ventures, the really big cable guys," added Westfall.

NEWSBITES

> **MediaOne Halfway Through Twin Cities**
>
> Construction has begun in Burnsville, Eagan and St. Paul, Minn., putting MediaOne halfway through its $220 million upgrade of the Twin Cities network. The upgrade should be done by the end of 2001.

> **Williams Deploys Fiber**
>
> Williams Communications is deploying additional dense fiber count cables in spare conduits from Houston to Atlanta to Washington, D.C. Williams will double its network fiber count through deployment of new high-density fiber cables on its longest network segment, an 1,800-mile route that runs alongside one of its interstate natural gas pipelines.

> **Cox Picks Marconi**
>
> Cox Business Services selected Marconi to enhance its fiber optic communication network in Santa Barbara, Calif. The upgrade will use Marconi's OSR with PacketPath, a multiservice platform that offers businesses differentiated broadband data services.

> **Lucent Goes Video**
>
> Lucent Technologies launched a video network designed solely for the Internet. Called GeoVideo Networks, the company will deliver high definition TV-quality, real-time bi-directional Internet Protocol (IP) video over an international fiber network for various business-to-business Internet video applications. Metromedia Fiber Network will supply the metropolitan and long-haul optical network infrastructure, and its AboveNet subsidiary will supply global IP services.

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USB Simplifies Modem Installs

By Arthur Cole,
Contributing Editor

CableLabs' recent certification of three new cable modems with universal serial bus (USB) technology marks the first significant step toward reducing the time and annoyance involved in physical set-up and activation of broadband data service for new cable modem users.

Because most new computers are coming out with standard USB ports, this new generation of modems will allow customers literally to plug and play their own off-the-shelf cable modems. Cable operators will no longer have to send out technicians to open up the customer's computer, install a network interface card (NIC) and configure the modem.

"Cable modems are already dropping in price and quickly becoming a commodity," said Michael Horton, director of marketing at Arris. "We expect a lot of manufacturers to follow the (USB) path."

For the CM-200 USB cable modem, Arris provides a self-provisioning software package that allows users to set up their own services from home.

For cable operators, the advantages of USB technology are threefold. First, it will likely spark consumer interest in the devices now that they don't have to worry about opening up their personal computers (PCs) to add a $20 to $65 Ethernet card. Second, installation costs drop because of fewer truck rolls. Finally, cable operators can now get out of the hardware leasing game, in which they retain ownership of ever-depreciating hardware.

"(USB modems) will definitely move the industry toward more retail deployment."
—Bon Lam, Motorola

"This reduces one of the more significant installation barriers to cable modem deployment," said Dave Bukovinsky, vice president of broadband services at CableLabs.

The certified USB modems come from Arris Interactive, Motorola and Thomson Consumer Electronics. Executives at Arris and Motorola say they are prepared to start shipping their modems immediately, either through retail outlets or through traditional lease arrangements with cable operators. Thomson officials could not be reached for comment.

Few industry observers express any doubt that USB modems will become the wave of cable's high-speed data future.

"This will definitely move the industry toward more retail deployment," said Bon Lam, cable modem product manager at Motorola. "There will be a lot of movement this year and more so in 2001."

Lam said Motorola's current DM-100 USB modem is likely to be available only to cable operators for lease to customers. The follow-up product, the SB-4100, ought to hit retail shelves later this year.

Now that cable modems have entered the realm of plug-and-play, many players are looking ahead. Next stop: an internal cable modem card that is factory installed before the computer even leaves the manufacturer's shop.

PEOPLE

> **Hranac Goes to Cisco**
CT's own Senior Technical Editor Ron Hranac has gone to work for Cisco Systems as a consulting systems engineer in the company's Service Provider Engineering group. His previous "day job" was as vice president of RF engineering for High Speed Access Corp.

> **Johnson Becomes FCC Advisor**
The National Advisory Committee for the Emergency Alert System (EAS) has voted Steve Johnson, who currently chairs the Society of Cable Telecommunications Engineers' EAS Subcommittee, to be NAC's second vice chairman. The Committee advises the Federal Communications Commission on EAS and its implementation.

> **Pace Names VP of Engineering**
Pace Micro Technology has appointed Graham Williams vice president of engineering. Williams is an 11-year Pace veteran, with nine years of design engineering with emphasis on analog and digital satellite, and broadband network technologies.

> **VP-Hardware at Integral Access**
Integral Access has appointed Marc Parent vice president of hardware. Parent brings more than 13 years of product development and engineering management experience to the job.

> **C-COR.NET CEO Honored**
David Woodle, president and CEO of C-Cor.net received the Year 2000 Penn State Outstanding Engineering Alumni Award from the university's College of Engineering. C-Cor.net also won Pennsylvania's Growth Company of the year for 1999.

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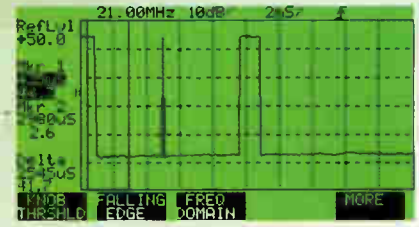

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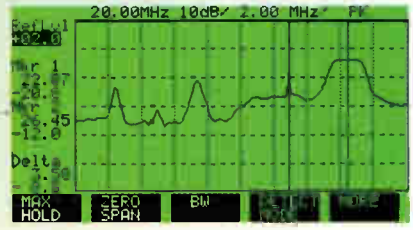

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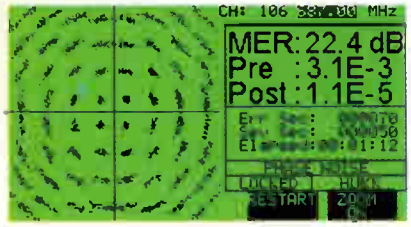

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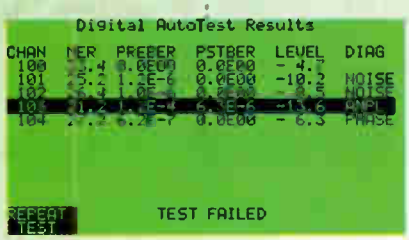

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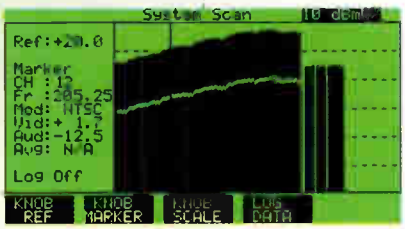

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Exam Proctoring Key Concern of SCTE Chapter Leaders

By Jonathan Tombes,
Deployment Editor

Chapter leaders of the Society of Cable Telecommunications Engineers (SCTE) and SCTE staff fast-tracked normal communications during their first-ever gathering in Exton, Pa. Proctoring certification exams was a top concern of many attendees.

"I don't want our certification to become a piece of paper on a wall," said SCTE president Jim Kuhns, who supported the current policy, which limits proctors to SCTE chapter presidents (numbering about 70), SCTE staff and SCTE board members. However, that policy appears to pose hardships, in some cases.

"Instead of saying here's the test date, come to us, we try to go out to them," said Randy Parker president of the Great Plains (Nebraska) chapter. "So you might have a two or three or four hour drive just to go out and test people, and when you're the only person to do that, very often it's difficult."

Attendees proposed extending proctoring privileges to past presidents and senior members to address this concern. Changing the rules on proctoring would require action by the SCTE training committee, which is slated to meet at the Cable-Tec Expo in June, and then approval by the board of directors.

Chapter leaders also expressed concern over administering the exam, particularly laying the ground-rules and handling latecomers. Some proposed providing proctors with an official SCTE checklist of current rules covering the exam, which proctors could in turn distribute to examinees.

"Indeed, we are working on this," said SCTE Director of Certification Gary Selwitz, after the meeting. "And it doesn't require a vote by anybody."

Highlights from SCTE's first-ever Chapter Leadership Conference included meeting with the Society's Board of Directors and round-table discussions on problem-solving at the chapter level.

Photos courtesy of SCTE

At the meeting Selwitz announced changes to rules covering installer certification, as well. Most significantly, candidates are required to have six months of experience as an installer before taking the exam. And, candidates must complete an installation during the exam.

Chapter leaders also heard from SCTE Coordinator for Accounting and Personnel Jill Patterson, who explained how maintaining the SCTE's tax-exempt, 501-C (6) status required filing accurate chapter reports. "You'd be surprised at how many didn't understand why this was so important—including board members," she said.

Chapter leaders spent several hours brainstorming ideas for successful chapter topics, recruiting, managerial involvement and vendor shows. Some of their proposals included:

- Offer scholarships at tech schools or colleges
- Expand chapter libraries
- Coordinate with vendors' regional sales schedule
- Alternate meeting days to facilitate permission for attendance
- Limit seminar times at vendor days
- Coordinate schedules with other chapters and vendor shows

Communications Technology, *The Literature Library*, ADC, Harmonic, C-COR.net and Alpha Technologies sponsored the meeting, which is expected to become an annual event.

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Terayon to Embed Firewall

By Jonathan Tombes,
Deployment Editor

SofaWare Technologies, a Check Point Software spin-off, is working with Terayon Communications Systems to give firewall protection to residential broadband Internet users.

Terayon plans to embed SofaWare's HomeSecure! firewall security in both its TeraPro and its Data Over Cable System Interface Specification (DOCSIS)-certified TeraJet cable modems. SofaWare based its product on Check Point's core Stateful Inspection technology, which uses packet-filtering algorithms on the network and application level.

TERAYON COMMUNICATION SYSTEMS

The vulnerability of "always on" high-speed Internet access is not news. [See Ron Hranac's column in February, CT.] But confusion lingers, in part because of protection that already exists within cable networks.

"There's privacy of information, and the DOCSIS specifications do an excellent job of ensuring that the privacy over the shared network exists via the encryption technologies," said Dennis Ricker, chief operating officer of Terayon.

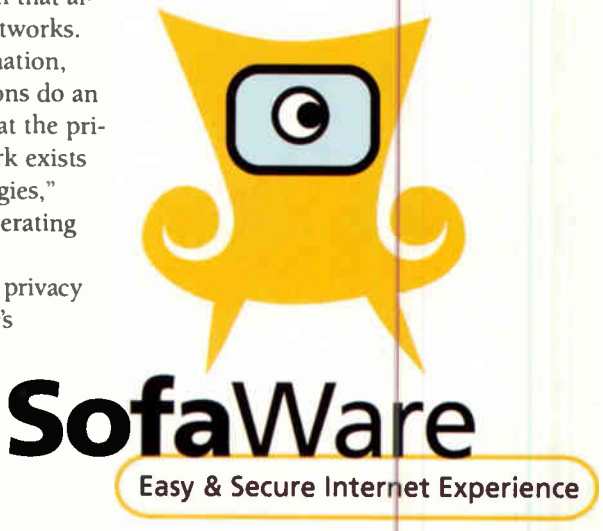
"There are also features in privacy intended to protect the MSO's network from damage or malfunction as a result of a malicious user," he added. Broadband Internet connections, however, raise additional concerns over who can penetrate the home.

"Right now, with a broadband connection, the fact that there's a permanent IP address, that it's an always-on connection, actually gives someone an opening to sneak in and look at your computer and look at all of your files and steal information or deface things," Steve Schick, a marketing manager with Check Point.

Personal firewalls are one answer to this problem. Hranac listed three in his column: Back Orifice, Norton Internet Security 2000 and ConSeal Private Desktop for Windows.

"The concern I have about personal firewall software for users is that if they don't configure it correctly, they may have a false sense of security," said Ricker. "And then the other thing is the updates; I mean, new security attacks happen all the time."

The Terayon-SofaWare collaboration not only embeds the firewall in the cable modem, but it also provides remote management and configuration. The end user can get involved through a web-based graphical user interface (GUI), or else relax—say, on the sofa—leaving it to the service provider to create and manage security policies.



Just don't fall asleep as far as computer viruses go. While it is possible to perform virus checking at the residential gateway, or cable modem, the initial SofaWare-embedded Terayon modem due out in the second quarter, will not include that feature.

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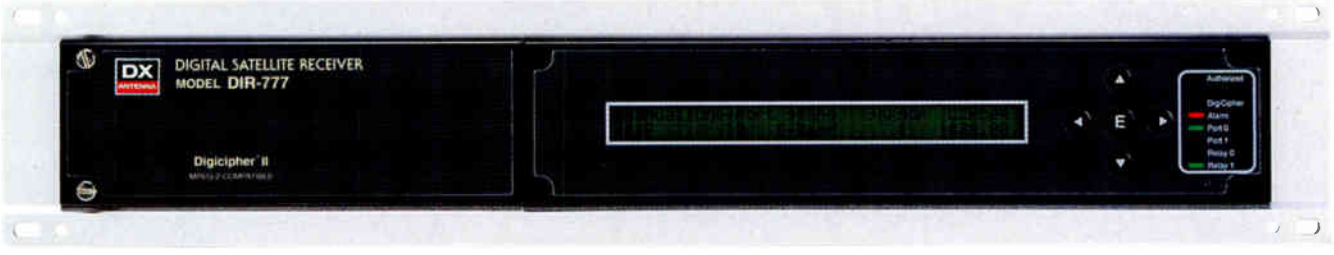

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SCTE Board Gets Four New Faces

By Marci Dodd, SCTE

The results are in for the Society of Cable Telecommunications Engineers Board of Directors election to fill seats for the 2000-2002 term. New board members include:

- Region 3 Director Eric Brownell of AT&T BIS, representing Alaska, Idaho, Montana, Oregon and Washington
- Region 4 Director M.J. Jackson of Fujikura Ltd., representing Oklahoma and Texas


Brownell


Jackson

- Region 5 Director Percy Kirk of Multimedia Cablevision, representing Illinois, Iowa, Kansas, Missouri and Nebraska


Kirk

- Region 12 Director Bob Foote of Antec/Telewire Supply, representing Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island and Vermont.


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Re-elected were:

- At-Large Director Ron Hranac of Cisco Systems, representing the entire membership
- Region 7 Director Jim Kuhns (current SCTE Board chairman) of Terayon Communications Systems, representing Indiana, Michigan and Ohio
- Region 8 Director Don Shackelford of Time Warner Cable, representing Alabama, Arkansas, Louisiana, Mississippi and Tennessee
- Region 10 Director Wes Burton of MediaOne, representing Kentucky, North Carolina, Virginia and West Virginia and District of Columbia

SCTE President John Clark said the election's outcome bodes well for the Society, showing great promise for the years to come.

"The election results give testimony to the diversity that makes SCTE the great organization that it is," he said. "I look forward to working with the leaders that the members have chosen."

The newly elected and re-elected members will join the seven SCTE board members currently serving their 1999-2001 terms:

- At-Large Director Christopher Bowick of Cox Communications, representing the entire membership
- At-Large Director Tom Elliot of CableLabs, representing the entire membership
- Region 1 Director Steve Allen of TVC Communications, representing California, Hawaii and Nevada
- Region 2 Director Steven Johnson of Time Warner Cable, representing Arizona, Colorado, New Mexico, Utah and Wyoming
- Region 6 Director William Davis of Communications Supply Group, representing Minnesota, North Dakota, South Dakota and Wisconsin
- Region 9 Director Keith Hayes of MediaOne, representing Florida, Georgia, South Carolina and the Caribbean
- Region 11 Director Marianne McClain of Baker Installations, representing Delaware, Maryland, New Jersey and Pennsylvania

The general vote and Article 10 regarding changes to the SCTE Bylaws also were balloted and passed in the election.

The newly elected and re-elected directors will officially begin their two-year terms at the next SCTE board meeting, scheduled for June 4, just prior to Cable-Tec Expo 2000 in Las Vegas.

DEPLOYMENT WATCH MONTHLY UPDATE

Provider/Operator	Service/Feature	Communities	Vendor/Partner
Time Warner Cable	Interactive advertising	Manhattan	Wink Communications (software), Motorola (set-tops)
Time Warner Cable	Interactive television	Myrtle Beach, S.C. (four hotels)	SeaChange International
MediaOne and Adlink	digital-into-digital ad insertion	Los Angeles	nCube and Terayon
Cox Business Services	enhanced fiber optic network	Santa Barbara, Calif.	Marconi (OSR with PacketPath)
RCN	phone, cable, high-speed Internet services	Folcroft, Pa., San Mateo, Calif.	multiple vendors
Shaw Communications	digital cable	Portage La Prairie, Manitoba	Motorola (set-tops)
Charter	Enhanced Broadcasting	Los Angeles, Glendale, Calif.	Wink (software), Scientific-Atlanta (set tops)
Classic Communications	digital cable	Breckenridge Colo., Weatherford, Okla., Burkburnett, Texas, Tenton, Mo.	Motorola (set-tops)
Time Warner Road Runner	PC games	Houston	NetActive
Cable & Wireless	private Internet network upgrade	14 U.S. cities	Savvis Communications
Telocity	high-speed Internet access	northern and southern California	NBC Internet

AT&T Crosses Fixed-Wireless Gauntlet

By Malcolm Spicer,
Editor, Wireless Today

AT&T is pulling the wraps off its Project Angel wireless broadband effort to determine whether it will fly in Fort Worth, Texas, giving cable operators yet another competitive product to track.

The telecom giant recently began offering Internet access and voice services through its wireless broadband technology operating at 1900 MHz in the Fort Worth area. However, AT&T execs are not saying what markets it will launch in next or when that might happen.

Expectations for AT&T's fixed wireless launch grew last year when MCI WorldCom and Sprint announced their planned merger. The union of those two carriers, both leading wireless broadband players, would hinder AT&T's fixed-wireless chances if it failed to move its Project Angel from development to launch.

In addition, AT&T's pending initial public offering of shares for its Wireless Group tracking stock is expected to make more money available to pay for Project Angel's commercial launch.

"Will (the tracking stock IPO) bring Project Angel back up?" asked David Goldsmith, executive vice president of Buckingham Research Group, a New York-based investment firm. "I think it has."

The new service's key attraction will be the high-speed Internet element, said David Berndt, wireless market analyst for Boston-based telecom research consultancy the Yankee Group.

"People get great Internet access in their offices and they want to get it at home," Berndt said.

The first commercial launch of AT&T's broadband fixed wireless service isn't far from where the carrier tested a fixed-wireless offering as an alternative to wireline service in 1998 and 1999: Plano, Texas. However, that test showed insufficient consumer interest to continue developing wireless local loop to compete with local exchange carriers.

Wireless services are beginning to emerge as the telecom service of choice for consumers who have more mobile telecom than fixed telecom needs, Berndt said. However, wireless isn't threatening wireline to be the service American consumers prefer in their kitchens or on their desks.

"In the United States, we're not going to see that, because we have such a high penetration of wireline service," said Berndt. "Basically, everyone is covered."

But AT&T's likely failure to gain much local-service market share through this broadband offering would be a win for the company anyway, he added. AT&T could tell Federal Communications Commission officials and state telecom regulators that local exchange carriers continue to put up obstacles to allowing competition and, therefore, should not be allowed in the long-distance market, said Berndt.

AT&T is offering voice service for one phone via wireless broadband with caller ID, call waiting and three-way calling services. The service costs $25.95 a month. The rate includes unlimited local calling and long-distance rates of 7 cents a minute for intrastate as well as interstate calls. Additional phone lines cost $7 a

month. For the service's high-speed data feature, including AT&T's WorldNet Internet service, customers will pay $34.95 a month.

AT&T began testing Project Angel in 1997 using the 10MHz slices of D- and E-block spectrum for PCS operations it acquired in FCC auctions. The carrier's mobile telecom network operates on A- and B-block spectrum designated for commercial cellular networks.

Nor-Cal Vendor Show a Big Hit

By Rex Porter, Editor-in-Chief

Steve Allen had the idea for the very first Vendor Appreciation Days several years ago, and there's been no looking back. This year's Northern California event, held in Concord, was a huge success.

If you wanted to exhibit products, you had to have acted fast, as floor space sold out early. Throughout registration, lines stretched two deep across the hotel lobby, and vendors lined the halls off the main floor and out into the hotel's parking lots. And they were glad to settle into any available spot, once an unprecedented number of installers, technicians and engineers began flooding the exhibit areas. Cable Games, a sell-out (rained-out) golf tournament and raffle of prizes were some of the many features of this high-profile gathering.

Winners at Cable Games were: MTDR testing (host Riser Bond), Rick Ortiz; Meter Reading (host Wavetek), Rick Ortiz; Splicing (hosts Gilbert and Thomas & Betts), Ron Poole; "Go Fetch" (host: Power & Telephone Supply), Will Chandler; Cable Jeopardy (host NCTI), San Ramone; and Overall Gold winner was AT&T Monterey Bay's Rick Ortiz. CT

SCTE Region 4 Director **Jim Wood**

By Rex Porter

Society of Cable Telecommunications Engineers Region 4 Director Jim Wood entered the cable industry nearly 20 years ago, and he's been going great guns ever since.

The native Texan was born in El Paso, but has lived in the Dallas area most of his life. He served four years in the Air Force and then completed his degree in business at North Texas State University. After graduating, he took a job as cost accountant for about six years and entered the cable industry in 1980.

Since then, he's helped form two SCTE chapters and one meeting group, and he's championed the Society's Broadband Communications Technician/Engineer (BCT/E) certification program.

But it hasn't been all work and no play—he also helped found SCTE's Cable-Tec Expo golf tournament and has great fun with his three granddaughters. Let's get to know him a little better.

"(Involvement on SCTE's board) brings home how much volunteer work is done to make things such as Cable-Tec Expo successful."

Communications Technology: How did a career in cable TV first catch your interest?

Jim Wood: My first job was with Cable TV Services, which later evolved into Sawtre Electronics during the early 1980s. How I got the job has an interesting twist.

I played a lot of softball in highly competitive leagues. Cable TV Services had a softball team, and they asked me to play on weekends. They had a job opening for an outside sales position, and even though I didn't know what cable TV was, they offered me the job. Sawtre later separated from repair into a repair/sales/rep organization.

From there, I joined Al Laughlin at the Cable Equipment Corp. and worked for him about six years. In the early 1990s, I worked for MicroSat, Steve Miller's company in Atlanta. I worked with Steve for about four years. I then joined Productions Products Co., my employer for the past four years.

CT: What prompted you to run for a spot on the SCTE board?

JW: Prior to last year's SCTE board election, Dan Pike from Prime Cable asked if I would run for the position of regional director. I agreed to become a candidate and am very pleased with the opportunity to serve the SCTE as director of Region 4. I am especially happy to see the direction of the Society under John Clark as president. I am very positive about way we will be moving.

CT: You have contributed to the SCTE growth by helping found meeting groups and chapters. Tell us a little about that.

JW: I originally joined the SCTE in mid-1980. As one of the founding fathers of the Oklahoma Chapter in Oklahoma City, I served on that board for about six years. I also cofounded the Ark-La-Tex Chapter based in Shreveport, La., which covers an area in northeast Texas and the states of Arkansas and Louisiana.

I also cofounded the SCTE golf tournament, which seems to be a very successful event at Expo each year. I have been able to be active on that board through the life of the Expo Golf Tournament.

Since I was elected director of Region 4, we have formed a new meeting group in San Antonio, the Hill Country Meeting Group. I have also been very active with the Sam

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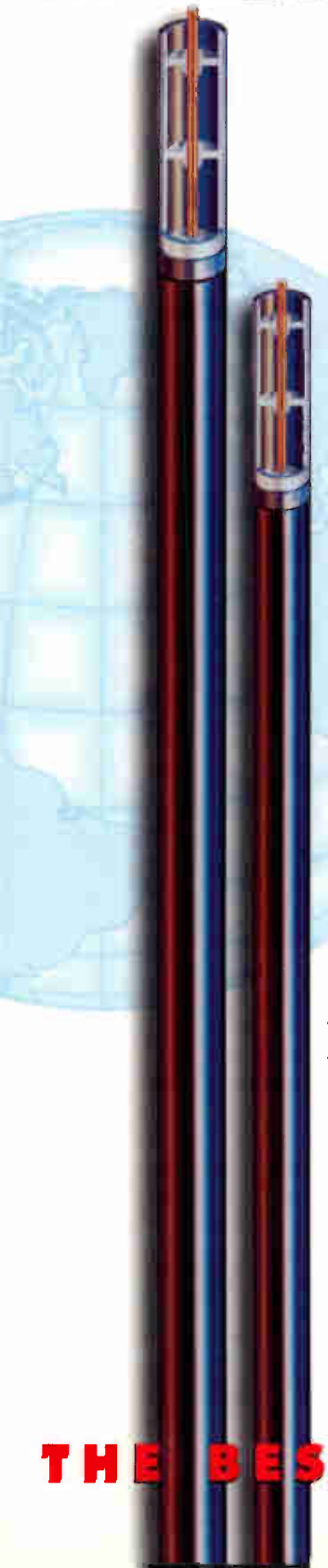

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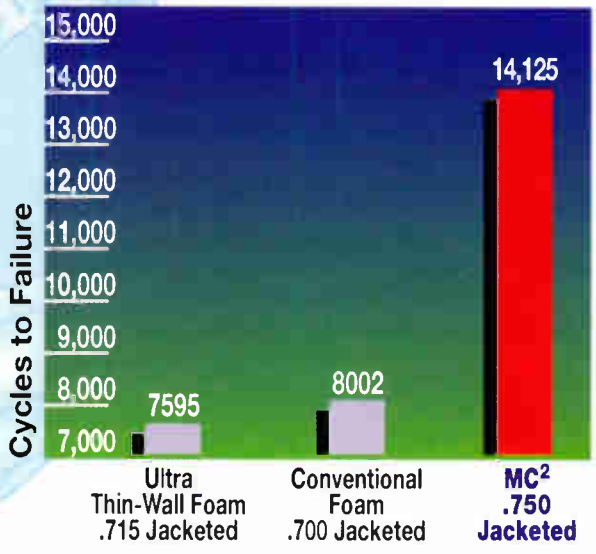

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Houston Meeting Group.

Additionally, we have the Lubbock SCTE Meeting Group, which has a unique situation in that we meet on Saturdays. We seem to get better participation on weekends because there are so many miles between so many small systems. We get a group of guys who are dedicated to the SCTE. These guys are giving up their own weekend time to attend meetings for a specific reason—to learn about new technologies and how to perform their jobs better.

CT: *Why are you so vocal about the value of BCT/E certification programs?*

JW: I continue to stress, at our meeting groups and chapters, the importance of BCT/E testing and certification. We recently performed our first testing at the Hill Country Meeting Group in San Antonio. Houston is beginning to test, as well. Dallas has always had a steady group of guys. They are small in number but are getting some of their people certified. Les Read, one of the very first BCE graduates and former Region Four director, emphasizes training also.

With our changing technology, we have to get our people trained and certified. And the technicians I speak with want a badge, patch or something for their uniforms that would identify their certification. They feel this would show added value to their company. Showing such qualifications would also influence others in the technical community to test and get their own patches. We need to do our part in making top management aware of the value of training, testing and certification.

CT: *Training paid off for some of the systems in your regions, didn't it?*

JW: One thing I am really proud of about the Oklahoma Chapter is they do a lot of testing. They strive hard to get guys certified at the BCT/E levels and, at the 1999 Cable-Tec Expo, they succeeded.

One of our technicians from the Multi-Media system in Edmond, Okla., won the Gold Medal as National Cable-Tec Games "overall" winner. I think he finished first place in connecterization, and, unless I am mistaken, he placed in every event—either first, second or third. Of course, he was excited about winning the competition, and I was proud to witness his success.

CT: *And how about future growth in your Region?*

JW: Activity at the North Central Texas Chapter (Dallas) seems be increasing. We are trying to increase our attendance by getting the AT&T/TCI folks in Dallas to support SCTE, and our attendance is picking up there as well.

We have a couple areas that we've really got to investigate in order to have better coverage in our state. In west Texas, perhaps in the El Paso area, we may start a meeting group. I know those guys are starving for some type of SCTE participation. In far southeast Texas, along the Louisiana/Texas border, there have been a lot of requests about starting a meeting group in that area. We've been working with several people there.

The location is a little funny—it's right in between a number of other groups. They are about an hour and a half in each direction, between the Gulf Coast Chapter in Louisiana and the Beaumont area. Also, the Houston Chapter is about an hour and a half to two hours away. So we have to look at the total situation before starting a new meeting group for them. >

Jim Wood, center, poses on the links with the original MicroSat team in the early '90s.

Jim Wood and his granddaughters, whom he describes as the joy of his life, mug for the camera at Easter.

CT: *The board has elections each year, offering opportunities to new candidates. What does it mean to serve on the board.*

JW: This is my second year as an SCTE regional director, and it's been a very eye-opening experience. I am certainly glad to be involved at this level of the SCTE. It brings home how much work, especially volunteer work, is done to make things such as the Cable-Tec Expo so successful.

It takes so many people who are totally dedicated to the Society to make sure that events like the Expo, ET, BCT/E testing and Cable Games run so smoothly. They don't happen by accident. At the BCT/E testing, the guys show up at the meetings ready to test after preparing for long hours.

It is great that the Society is providing a route for these technicians to increase their knowledge about their jobs. As for the whole communications industry, we certainly look like we are merging together. Before too much longer, there will be a smaller number of operators than in past years with MSOs combining and merging together through acquisitions or clustering of systems.

CT: *So how do these fast changes to our old traditional industry really affect the SCTE and the engineering community as a whole?*

JW: As we move forward with data, digital and telephony, systems and MSOs are going to need more qualified installers, technicians, and engineers. And someone, whether it will be the SCTE or some other organization, will have to be responsible for training and qualifying these people.

When we go into a customer's home and we interface with their computer for the data services, we will be required to show some type of qualification or certification before we open that customer's computer or provide online, telephony, or other services.

John Clark's new emphasis is aimed at getting better MSO recognition and support. That will open a lot more doors than in the past. The direction he would like to see us go is toward more certification testing and standard-setting. Then we will be able to involve all MSO levels into our certification programs. CT

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

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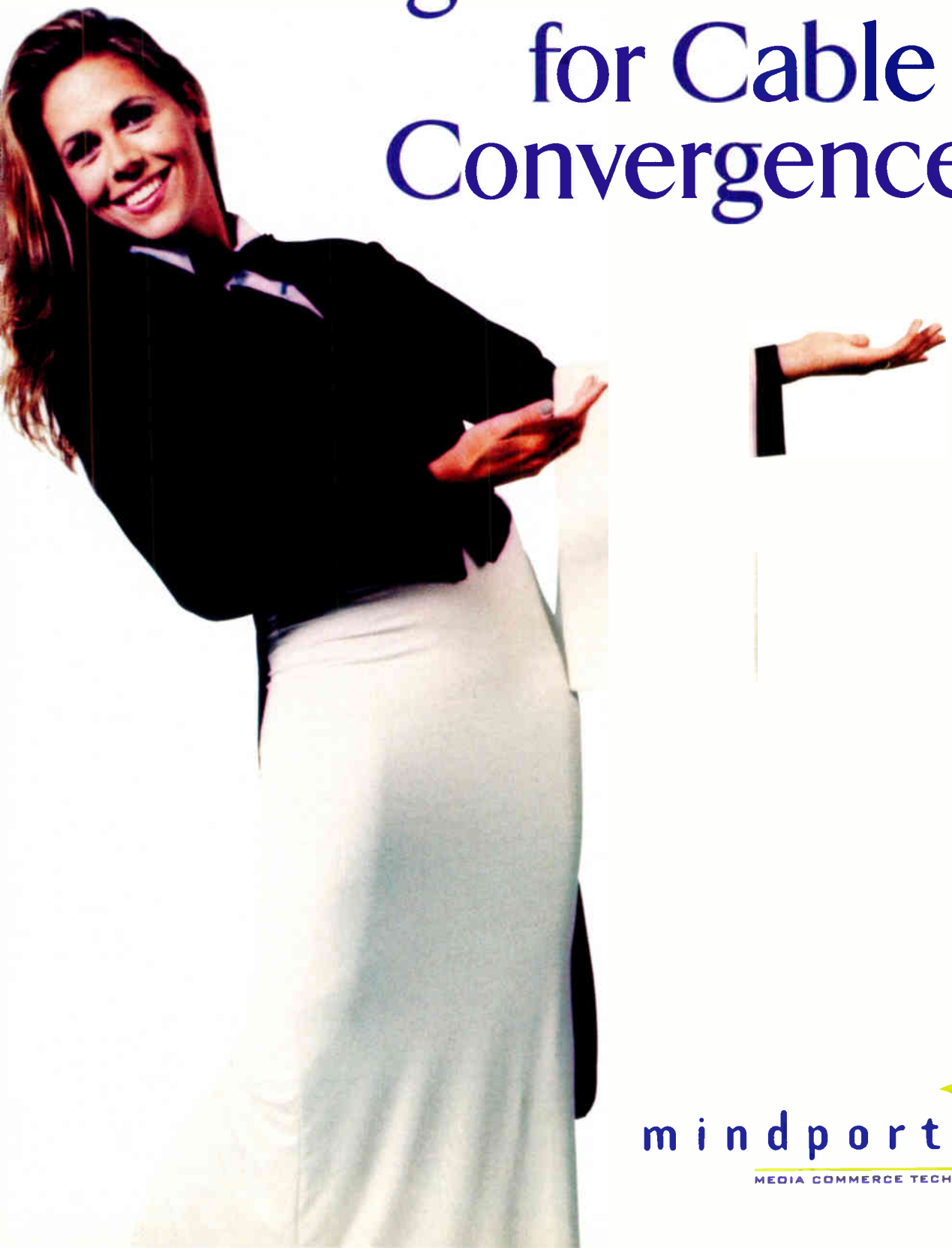

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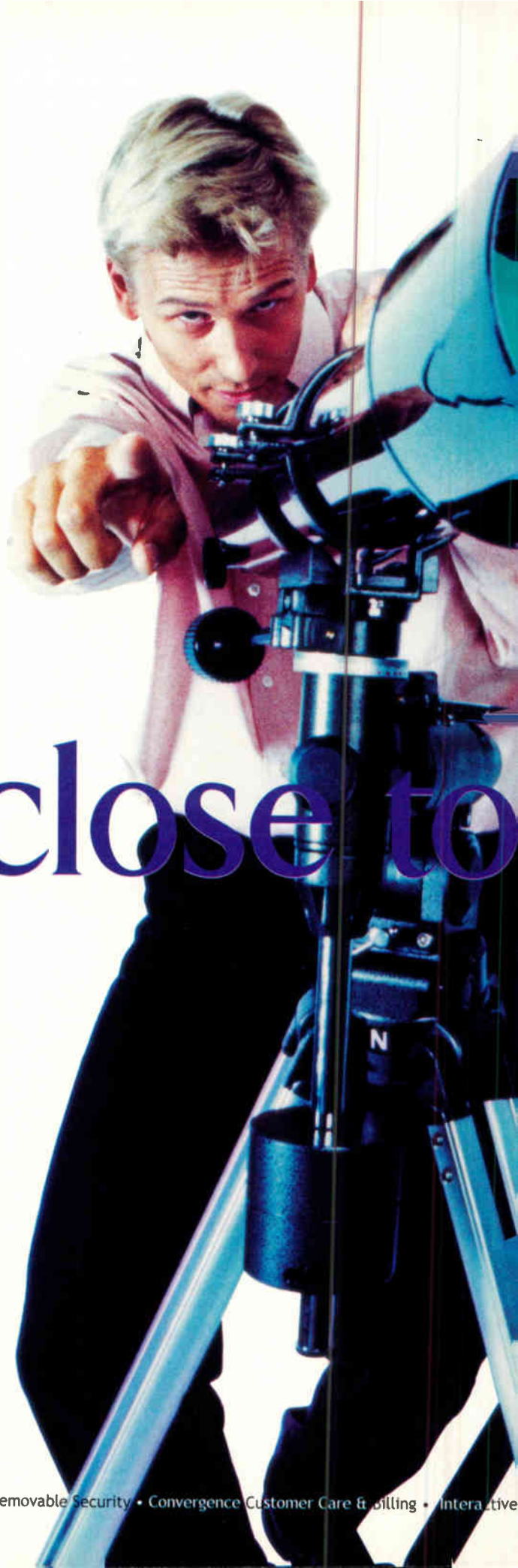

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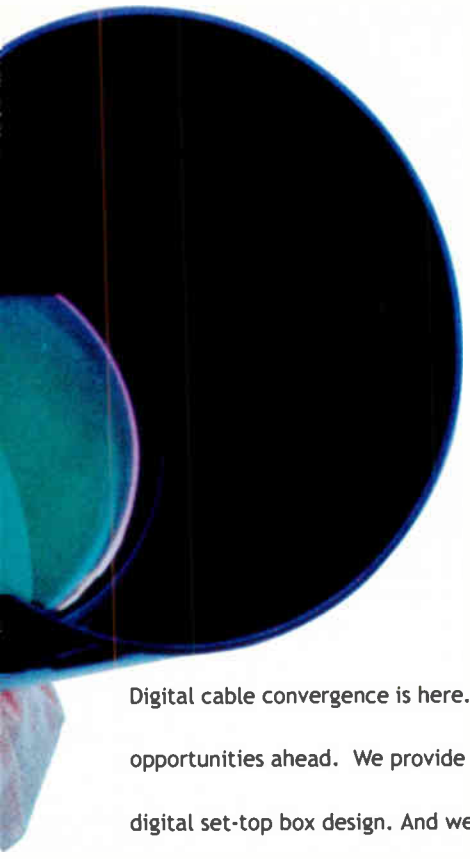

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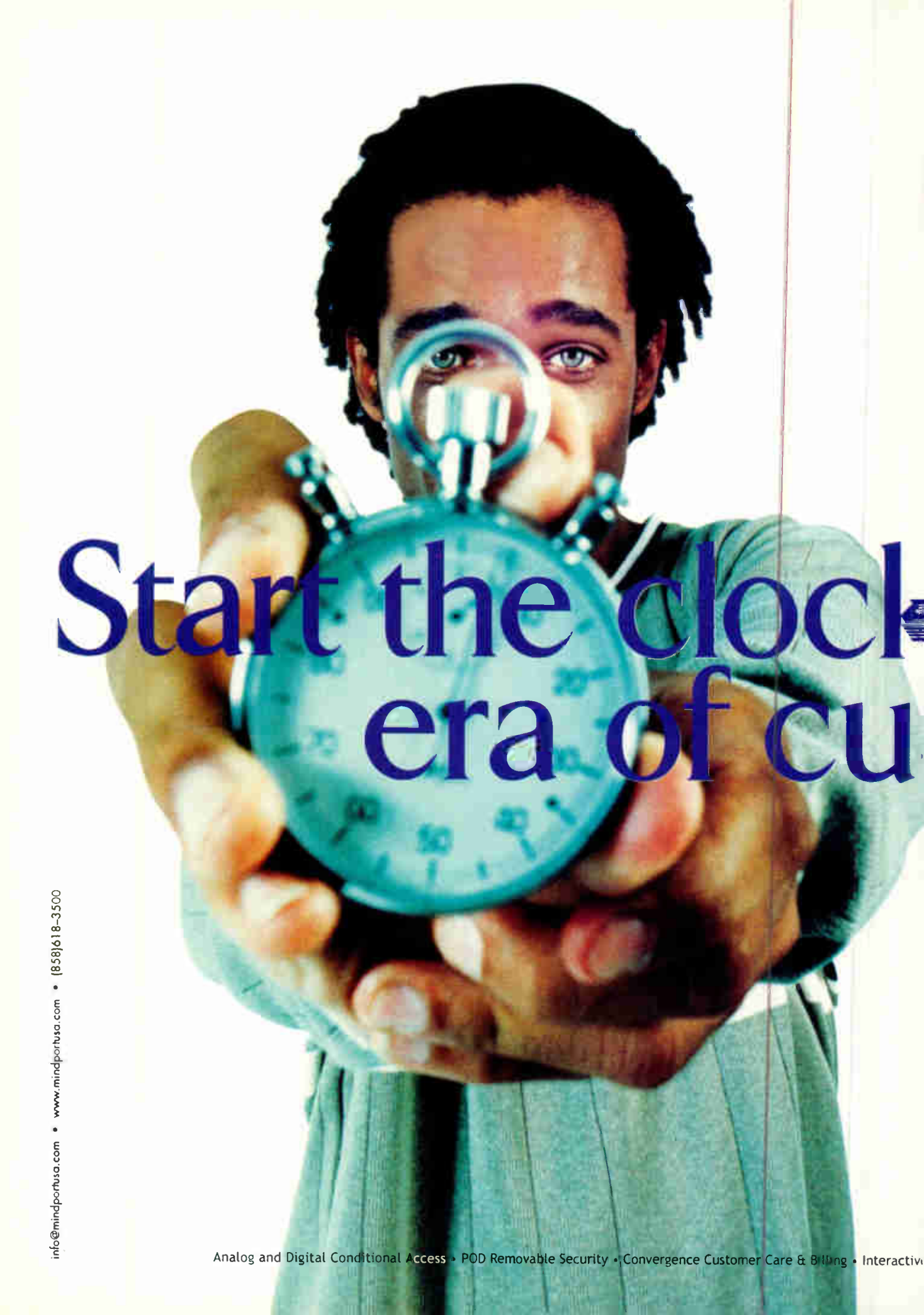

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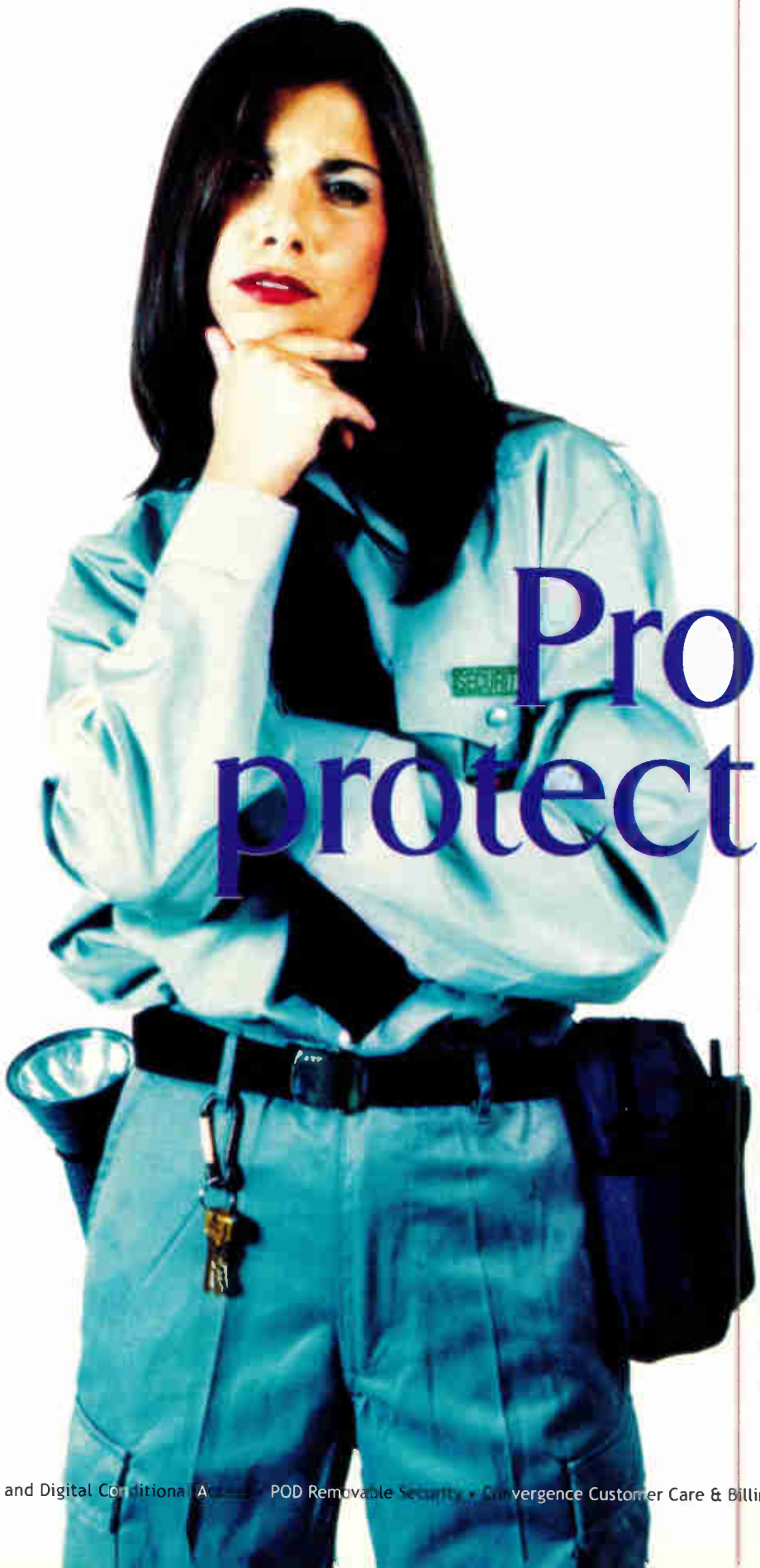

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The Numbers Behind Thermal Noise

Every now and then during discussions about particularly high carrier-to-noise (C/N) ratios—for instance, 60 dB to 70 dB or greater ratios common in some headend equipment—I hear the comment, "I thought the highest possible C/N was 59 dB."

Nope. C/N numbers much higher than 59 dB are indeed possible. Confused? Read on.

The number 59 (actually -59) as it applies to C/N measurements refers to the approximate level in dBmV of the room temperature thermal noise in a 75-ohm impedance. This is just one part of the noise when dealing with the concept of C/N, where it's possible for ratios to far exceed 59 dB.

"OK," you say, "so where does the number -59 come from?"

I'm glad you asked. Grab your trusty scientific calculator and a cup of coffee, and follow along.

Origins and other physics

Consider a plain old resistor sitting on your test bench at room temperature. That resistor, without being connected to anything, is a dandy little noise generator. This is because of random motion at the atomic level within the resistor. That is, at any temperature above absolute zero, the atoms and molecules are jiggling around and generating energy.

(A brief side note here: Absolute zero is an interesting concept, but in practice it's impossible to reach it. Oh, sure, it's possible to get within a fraction of a gnat's eyelash of a degree of absolute zero, but reaching *the* absolute zero, where all atomic motion comes to a complete standstill, isn't possible because it would violate Heisenberg's uncertainty principle. This little physics rule states that one cannot know both the precise position of an object—such as an electron, proton or neutron—and its momentum at the same time. But I digress....)

"At any temperature above absolute zero, the molecules and atoms are jiggling and generating energy."

Anyway, the energy can be expressed in terms of thermal noise power, as defined by the following equation:

$$P_{TN} = kTB$$

where
P_{TN} = thermal noise power in watts (technically the noise power that can be delivered from a noise source to a matched load)
k = Boltzmann's Constant (1.38×10^{-23})
T = temperature in Kelvin
B = bandwidth in Hertz (Hz)

This equation can be modified a bit to express thermal noise power as an open circuit voltage:

$$E = \sqrt{4kTBR}$$

where
E = open circuit voltage
R = resistance (or impedance)
and the other terms are as in the first equation

Let's plug in some numbers. For temperature, we'll use a comfortable 68° F, which in Kelvin is 293.15 K. (Note that there is no degree sign when expressing temperature in Kelvin.) Bandwidth will be 4,000,000 Hz (4 MHz, or 4×10^6 Hz), the common noise power measurement bandwidth used in NTSC visual carrier C/N measurements. R will be 75 ohms, the nominal impedance of our cable TV networks.

$E = \sqrt{4(1.38 \times 10^{-23})(293.15)(4 \times 10^6)(75)}$

$E = 2.2 \times 10^{-6}$ volt, or, for the purists in the crowd, 0.00000220339751372 volt

Because the answer is an open circuit voltage, we have to divide by two to get the voltage across a 75-ohm load. This gives us 0.00000110165375686 volt, or about 1.1 microvolt (μV). This voltage can be converted to dBmV with the formula:
dBmV = 20log(mV/1 mV) >

Of course, to use this particular formula, we have to convert the calculated voltage from volts to millivolts (mV), which is done by multiplying the voltage by 1,000. So, 0.00000110165375686 volt becomes 0.00110165375686 mV. Plugging this latter number into the dBmV formula gives us:

dBmV = 20log(0.00110165375686 mV/1 mV)
dbmV = 20log(0.00110165375686)
dBmV = 20(-2.95795488018)
dBmV = -59.1590976036

The analysis we just completed says a 75-ohm resistor at room temperature generates a measurable quantity of thermal noise power, which works out to -59.16 dBmV. Now you see where the -59 comes from.

"Imagine the noise that transistors and other components in an operating active device will generate."

After all of this, we have only reached the starting point for figuring out C/N.

There are at least two more factors to consider when describing the C/N ratio for an individual active device such as an amplifier. The first is the active device's noise figure, and second is the active device's RF input level.

One commonly used formula for the C/N ratio of an individual amplifier carrying NTSC signals is:

C/N = 59.16 - NF + I

where
NF = the amplifier's noise figure
I = amplifier RF input level

Noise figure and RF input

Let's look at noise figure first. Considering that an ordinary 75-ohm resistor (or 75-ohm impedance) at room temperature generates a thermal noise power over a 4 MHz bandwidth of -59.16 dBmV, imagine the noise that transistors and other components in an operating active device will generate. If you were to measure the C/N ratio at an amplifier's input and then make the same measurement at the amplifier's output, you'd find the two C/N ratios to be different. This is because of the added thermal noise power generated by the amp circuits.

If you had a stand-alone noiseless amplifier, the C/N ratio at the input and output would be the same (assuming, of course, the amplifier is a 75-ohm impedance device, its input impedance is 75 ohms, and its output is terminated in a 75-ohm impedance).

For example, a 20 dB gain noiseless amplifier with an RF input of +10 dBmV would have an RF output of +30 dBmV. That part is straightforward enough. Likewise, the thermal noise power at the input, -59.16 dBmV, also would be amplified by 20 dB, so the output thermal noise power would be -39.16 dBmV. Both the input and output C/N ratios would thus be 69.16 dB.

In real life, the input C/N under the previously described conditions still would be 69.16 dB, but when you measured the output C/N, you'd probably find it was something like 62.16 dB. Uh, what's wrong here? Is the amplifier amplifying RF by 20 dB but amplifying thermal noise by 27 dB? Not a chance. That "additional" 7 dB of noise is because of the amplifier's noise figure. There's a whole bunch of math that describes noise factor and noise figure, but I'll save you and my editors the grief this time around.

So, for this example, we say the amplifier has a noise figure of 7 dB. Plug this and the +10 dBmV RF input level into the previous equation, and you get:

C/N = 59.16 - 7 + 10
C/N = 62.16 dB

Given that there's not much you can do about changing an amplifier's noise figure spec, the only practical way you can improve the C/N ratio is to increase the RF input level. Raise it to, say, +15 dBmV, and the amp's C/N becomes:
C/N = 59.16 - 7 + 15
C/N = 67.16 dB

"Gee," you think, "I can improve my system C/N by raising the input levels to all of my amplifiers."

Yes, you could, but I'd advise you not to be too hasty about doing so. The tradeoff is distortions. Remember, when you raise RF input levels, the RF output levels go up by the same amount. Higher RF output levels mean the distortions get worse. So, you can certainly get better C/N, but your composite triple beat (CTB), composite second order (CSO), and other distortions will promptly go the other direction.

Seek balance in all things

This is the very foundation of cable TV network design engineering. You have to balance the tradeoff between good C/N and unacceptable CTB and CSO. Low levels result in a low C/N ratio and good distortion performance, while high levels give you a high C/N ratio but degraded distortion performance. CT

Ron Hranac is consulting systems engineer for Cisco Systems. He also is senior technical editor for "Communications Technology." He can be reached via e-mail at rhranac@aol.com.

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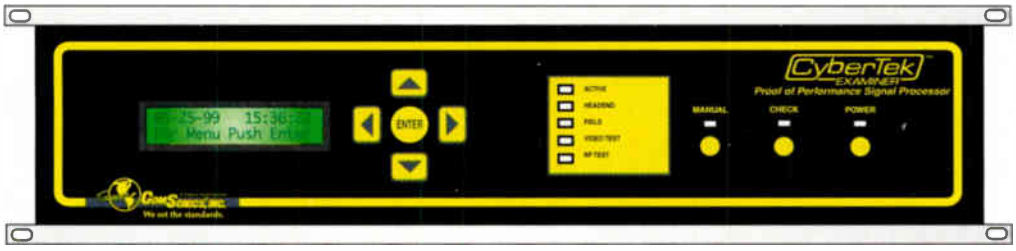

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Adapt or Die: Telephony's Metamorphosis

Telephony technology isn't what it used to be. No surprise in that statement, except that the "used to be" is beginning to refer to each month. That's how rapidly change is occurring. As a consequence, the participants in this industry have to change the way they operate, just to survive. Telephony vendor companies provide a good model for technical people who want to continue to be participants in a telephony industry where accelerating change has become the norm.

"It's impossible to isolate any given telephony function to just one part of the system."

First, let's define "participate." To me, that implies a commitment to continue doing whatever you are doing for the long haul. By this definition, a lot of folks can be "in" the industry, but not participating. That doesn't make them bad or good, it just means they have another objective—perhaps just to earn a living at something that's easier or more interesting than what they did before. Nonparticipants tend to move on to another opportunity when things change.

Participation, on the other hand, implies that you are part of the industry. You are defining how it operates, and where it will be in the next decade, because you'll be there, too. If change occurs, participants don't leave—they make it happen.

Now, let's think about how vendor companies have changed the way they participate in the telephony industry. For years, vendors succeeded in the telephony business by excelling in one or more technology niches and then applying good marketing skills to make potential customers aware of their expertise. Usually, the industry had room for three or four major vendors for each niche.

For example, AT&T Network Systems (now Lucent Technologies) and Northern Telecom (now Nortel) became the dominant telephony switch vendors, typically sharing 80 percent of the potential market. The remaining 20 percent went to one or two other players, such as Ericsson or Siemens, for switching. Transmission equipment sales were split in a similar manner.

Vendors embrace internet

Enter the Internet and packet technology. The vendor world changed rapidly because telephony became a hybrid technology. Market niches can no longer be defined by equipment function because technology blurs the lines between the functions. For example, switches are now data devices that don't connect calls, but instead route data units during a session that forms a call. Features don't live in switch hardware anymore, but are resident in server software.

Vendors committed to continued industry participation responded to the changes in technology by changing the way they viewed themselves. They became system suppliers and integrators, rather than technology niche vendors. For example, both Lucent and Nortel built upon their own technologies by acquiring companies that had expertise with new data devices. With this expanded self-image, they began to answer customer bids with end-to-end solutions that included not only the traditional niche functions, but also the new data functions.

Some vendors outside the traditional telephony business also decided to become participants in telephony, and adapted in a similar manner to gain new market share. Cisco is a good example of such a company. It grew up in the data world, but learned how to integrate telephony functions into its product mix. (By the way, Cisco didn't "move on" to another opportunity when it got into the telephony business. It "participated" in a new definition of its traditional industry that includes telephony.)

Improvise, adapt, overcome

Technical people need to adapt in a similar manner to remain as participants in the industry. When vendors operated in niches, you could become a valued resource to your company just by understanding terminology, such as the meaning of tip and ring, and the purpose of network elements,

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such as switches or multiplexers. Then, you were in a position to evaluate various vendor components and optimize or troubleshoot your part of the system. Only a few systems engineers needed to know how to hook everything together.

Today, with vendors becoming system integrators, it is impossible to isolate any given telephony function to just one part of the system. If you need an example, think about how IP telephony is delivering subscriber features via call agents. These entities can be part of software or hardware and can reside anywhere in the network, including at the customer premises. Obviously, just knowing terminology and components isn't enough.

Today, almost every vendor's telephony proposal is for a system. Vendors aren't the only cause of this system perspective. I've seen more than one operator request for proposal (RFP) that asks who will fulfill the system integrator role in the vendor's response.

Engineers and technicians therefore need to understand flows and interactions between numerous components, as well as terminology and the components themselves. That's the only way that today's valued, participating, telephony engineers and technicians can continually evaluate alternatives that accomplish the same thing with very different components.

The practical implication is that to participate fully in what has become a dynamic telephony industry, you need to learn data and transport, as well as telephony. Armed with that type of knowledge, you can support the integrated systems that vendors are supplying to our industry. Technology changes won't make you obsolete because you will be able to analyze differences and relate them to both new and existing equipment. In short, when you participate, you no longer work in the world of "things." You are in the world of concepts and systems that can be related to whatever implementation is current.

Down the road

What about those who are "in" but not participating? Let's just say that in the future, both financial and professional rewards will be commensurate with effort. The choice is yours. As telephony continues its metamorphosis, look for this column to help you become full participants. CT

Justin Junkus is president of KnowledgeLink and applications engineering director for Antec. He can be reached via e-mail at jjunkus@knowledgelinkinc.com.

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TIPS FOR ONE NETWORK DESIGN

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FUNCTIONALITY

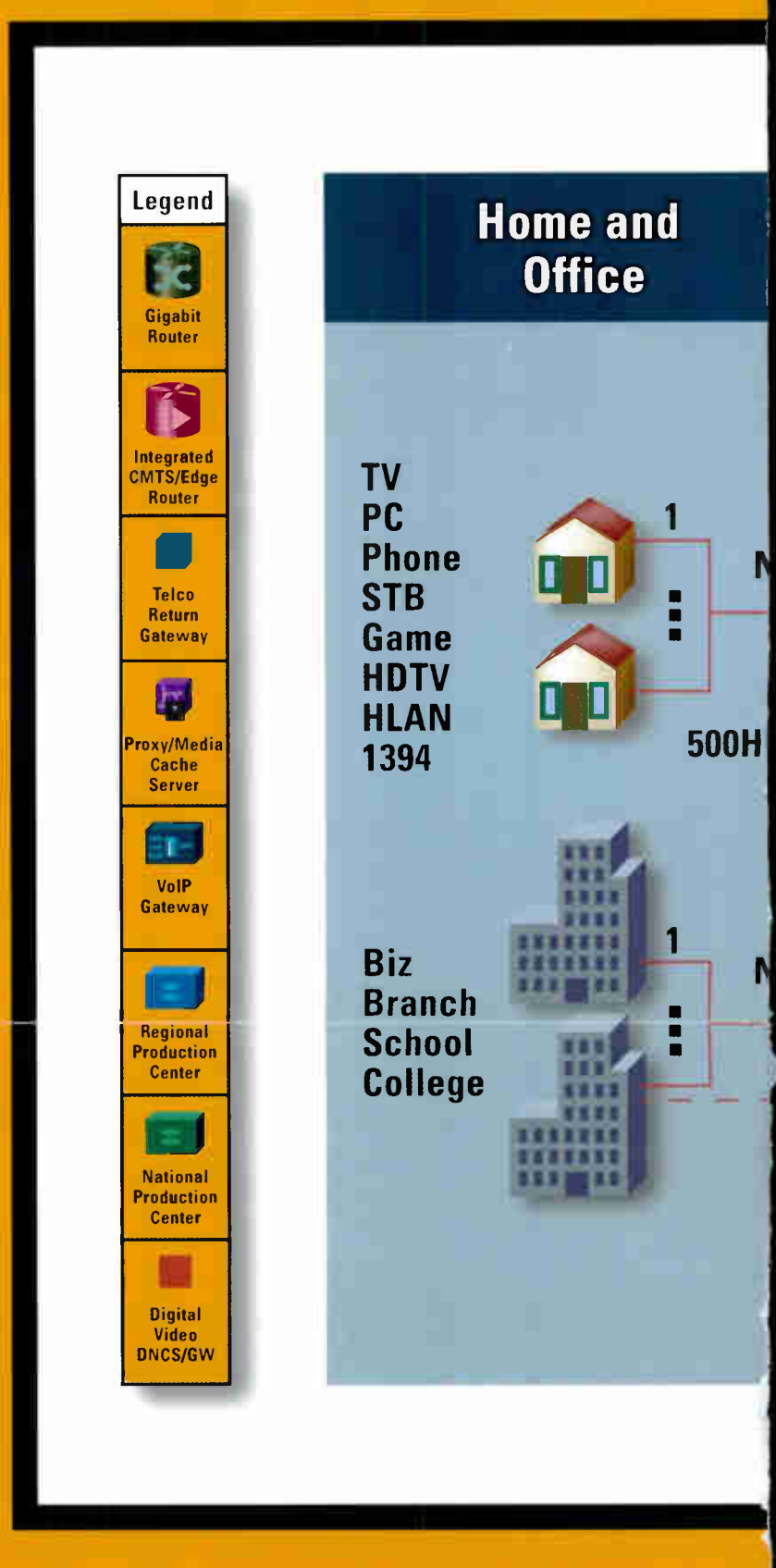
Today you may be deploying a single digital service, but tomorrow your network will need to support value-add applications like multicast and telephony. Consider delivering varied classes of service, allowing you to customize QoS metrics. Talk with your vendor about how the equipment you are purchasing today will meet your network needs tomorrow.

SCALABILITY

Look to combining fiber nodes for higher density at lower equipment costs for more bandwidth. Infra-structures like SONET will provide for hot-swappability on the fiber ring to scale from OC-12 to OC-48 to OC-192 as your plant requirements change. Look for equipment that scales at all points in the network.

ADAPTABILITY

Design your plant for maximum density. Look for ways to split combined nodes tomorrow when your subscriber base and service demands expand. Plan for the insertion of additional equipment to ease the transition without network reconfiguration.



MANAGEABILITY

Being able to see and manage each device on a single multi-service network is critical and can be managed more effectively with tools like SNMP and layer QoS. Consider common platform software, like Cisco IOS® software to enable ease of configuration and management.

COST EFFECTIVENESS

- Implement SCTE Return Path characterization process and use tools that create an HFC network performance baseline. Use Cisco software tools to identify issues before they become network problems.
- Design network architectures to maximize technologies, such as DPT, that use fiber optic bandwidth efficiently and have self-healing capabilities.
- Plan redundancy into the multi-service network to improve service availability and reliability. Design redundant architecture with a mesh or a ring using either lower layer protocols like ATM or DPT or higher layers with routing protocols like OSF or BGP.

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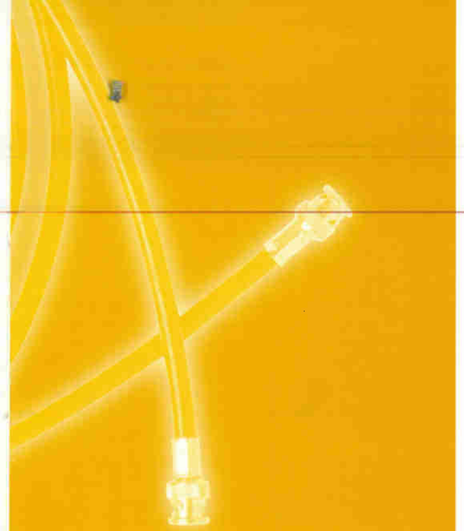

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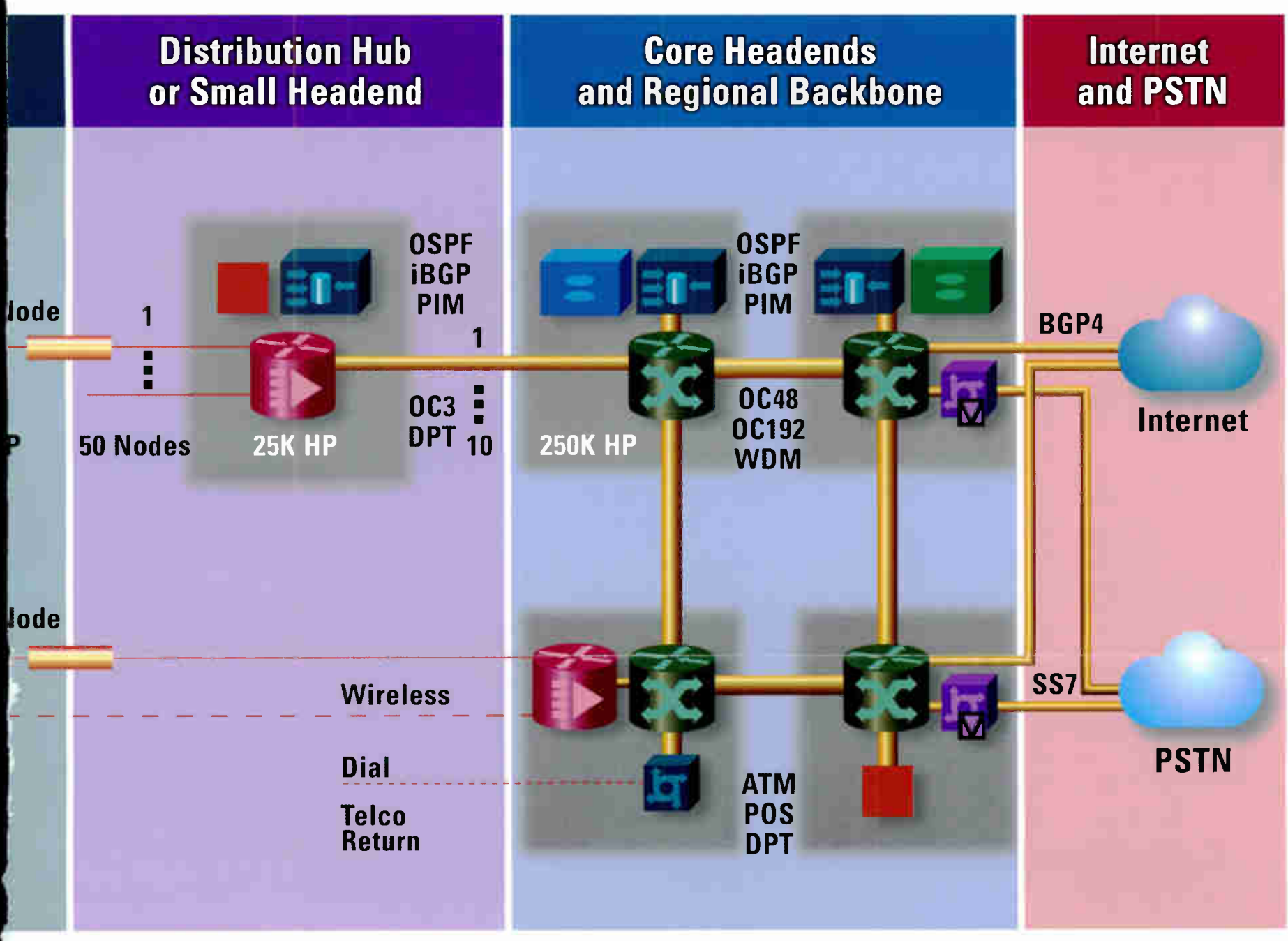

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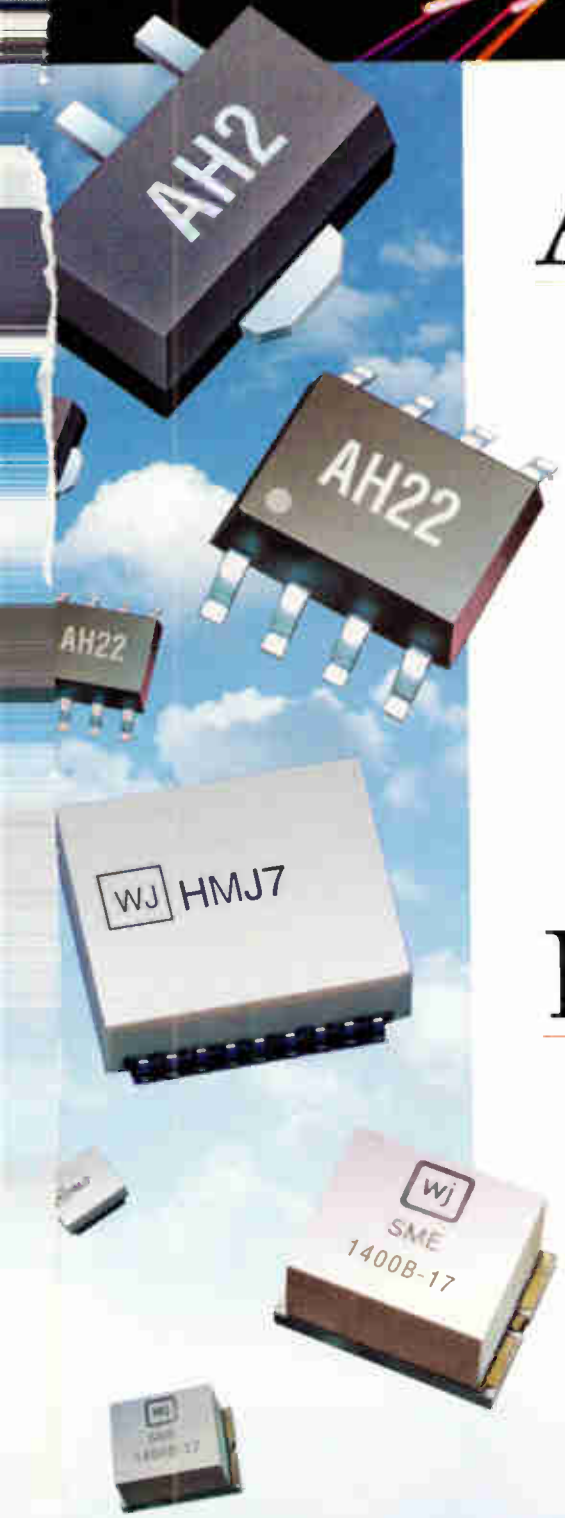

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CTB	-75*	-61**	dBc
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IP3	38	41	dBm
Gain	16.5	11.7	dB
NF	3.0	4.5	dB
DC voltage	5	5	volts
Package	SOT89	SOIC8 (Thermally enhanced)	

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**Measured at 40 dBmV output/channel, 110 channels.

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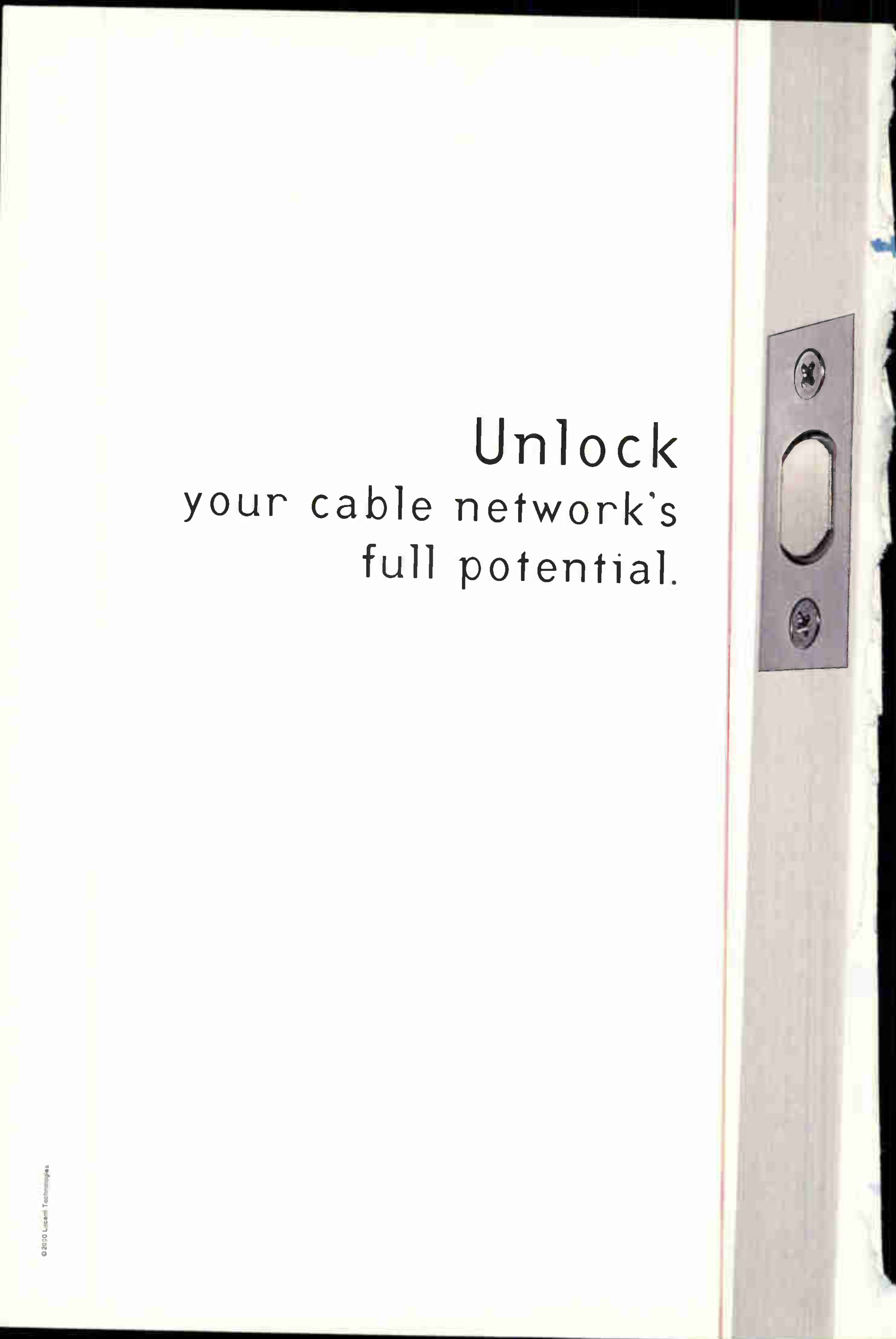
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DSL Providers Hot on Cable's Heels

When it comes to attracting Internet customers, it's true, the early bird really does get the worm. Unfortunately for cable operators, new birds have caught on, necessitating that cable reset its alarm clock.

Providers of digital subscriber line (DSL) services are in a veritable feeding frenzy. In recent months, they've swamped the market with new service rollouts and marketing strategies. In addition to the lure of new revenue streams, they recognize that once a company captures the customer—be it cable or DSL—that customer will be less likely to change providers.

Grab early and keep

In fact, new research into the home Internet market bears this out. In the findings of its recent report, "Internet User Trends," The Strategis Group notes that although monthly residential churn is running about 3.7 percent, 75 percent of users are happy with their Internet service provider (ISP). Customers also are becoming less sensitive to price. About 64 percent of the users surveyed said they would pay an average of $8.41 more a month, before switching ISPs—up from $6.76 just six months ago. What's more, they say the hassle of changing ISPs and giving up their e-mail address is a substantial barrier to switching. One can assume that this factor is even greater for business users.

DSL providers are getting in front of this increasing loyal customer base. They are aggressively launching services (see Sidebar DSL Watch). What's more, today's DSL providers are not only targeting cable's bread-and-butter residential subscribers, but they're aggressively courting the lucrative business market. Cable operators are well advised to develop packages, pricing, and premiums to attract business users.

Benefits of business sales

Why? Well, first off, business users pay more for even the simplest of services. For example, Bell Atlantic charges consumers $49.95 a month for its entry-level Personal Infospeed package. For that, consumers receive a 640 kbps connection with unlimited access to the Internet. However, businesses buying 640 kbps package—Infospeed DSL Personal Plus—pay $64.95 a month, which includes other benefits as well. And prices for both business and consumer services increase from there. A business connection at 1.6 Mbps runs $114.94, at 7.1 Mbps $204.95 a month.

In addition to high-speed Internet access, DSL providers are targeting small- to medium-sized businesses with the hopes of selling Voice over DSL (VoDSL) services to them later (see related story Voice-Over-DSL Upstarts Seek Place in Exploding Market, pg. 138). The Yankee Group estimates that the VoDSL market will generate $3.2 billion in revenues by 2004, with nearly all of that money coming from the business sector.

These services will be most attractive to small businesses with 8-24 voice lines, says Mathew Davis, senior analyst with the Yankee Group's Data Communications Planning. Integrating up to 24 voice, fax, and data lines over VoDSL offers a cost advantage to small businesses. "One DSL line provisioned for VoDSL might cost $500 per month, while 16 separate phone/fax lines, plus a high-speed pipe would potentially cost twice as much," writes Davis.

> DSL Watch: Recent Launches

ACS Internet: Anchorage, Juneau, Ala.
Bell Atlantic: Richmond, Va.; Ashton, Centerdale, Cranston, East Providence, East Greenwich, Narragansett, Newport, North Kingstown, Pawtucket, Portsmouth, Providence, Tiverton, Warren, Warwick, West Warwick, and Woonsocket, R.I.
Concentric Network: Albany, N.Y.; Albuquerque, N.M.; Austin, Texas; Buffalo, N.Y.; Colorado Springs, Colo.; Milwaukee; Minneapolis; Norfolk, Va.; Phoenix; Pittsburgh; Providence, R.I.; Richmond, Va.; Salt Lake City; San Antonio; Tucson, Ariz.
EarthLink: Atlanta, Dallas, Los Angeles, San Francisco
Excite@Home/Rhythms NetConnections: Major markets without cable (starting late summer)
Jato Communications: El Paso, Texas
New Edge Networks: Boise, Caldwell, Eagle, Meridian, Nampa, Idaho Falls, Lewiston, Rexburg, and Twin Falls, Idaho

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The 9580-SSR™. Up to six SSR field units can communicate with one SST simultaneously. The SSR displays ingress and reverse sweep information. The 9580 and GUARDIAN products are a complete return path maintenance system designed to test and service the entire return path.

The IsoMeter™. Now there is a fast and easy way to test the home cabling for resistance to signal ingress. The RSVP generates a special 28 MHz test signal. The installer uses the IsoMeter to track down leaks in the cabling. Moving in the direction of the leak causes a rise in pitch, quickly pinpointing its location.

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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Creative packaging

So how do DSL providers hope to catch small business users? In addition to the cost advantages of an integrated connection, they provide extra features. Bell Atlantic offers its Infospeed business users up to six mailboxes, sized at 20 MB each, and five MB of Web page space. Concentric bundles CPE, installation management, 24/7 technical support, five e-mail boxes, and Web hosting into its turnkey package. Last month, the company also began offering its business customers a free dial-up DSL connection until the installation process is complete. Jato Communications offers business users symmetric service—they can send and receive data at the same speed.

Free equipment and installation are also tried-and-true methods for attracting business users. Jato offered such a deal to its customers last month in El Paso. And during a promotion that ended April 30, SBC Communications offered free installation, DSL modem, network interface card and splitter to all customers of its Premium DSL service. The equipment package alone generally costs about $200, said the company.

Easing the install

Just as cable operators are seeking ways eliminate truck rolls for high-speed data installs, DSL providers close behind. Bell Atlantic offers what it dubs the Quick Start Installation Kit. After a customer places an order, the carrier will remotely equip his or her telephone line for DSL. At the same time, Bell Atlantic ships the modem and kit directly to the customer. The kit includes the DSL modem, 6 desk and 2 wall micro-filters, 2-line adapter, cable for the modem, Bell Atlantic.net software, user guide, and installation instructions.

Such-self installation procedures are sure to increase, as DSL providers hope to move to a retail environment just as cable operators do. In fact, as in cable, retail partnerships are on the increase in the DSL arena as are efforts to integrate the DSL modem into personal computers.

It's critical that cable operators and engineers keep aggressively deploying cable modem services to new markets and look for opportunities in the business market if they are to keep far enough ahead of these hungry competitors. CT

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

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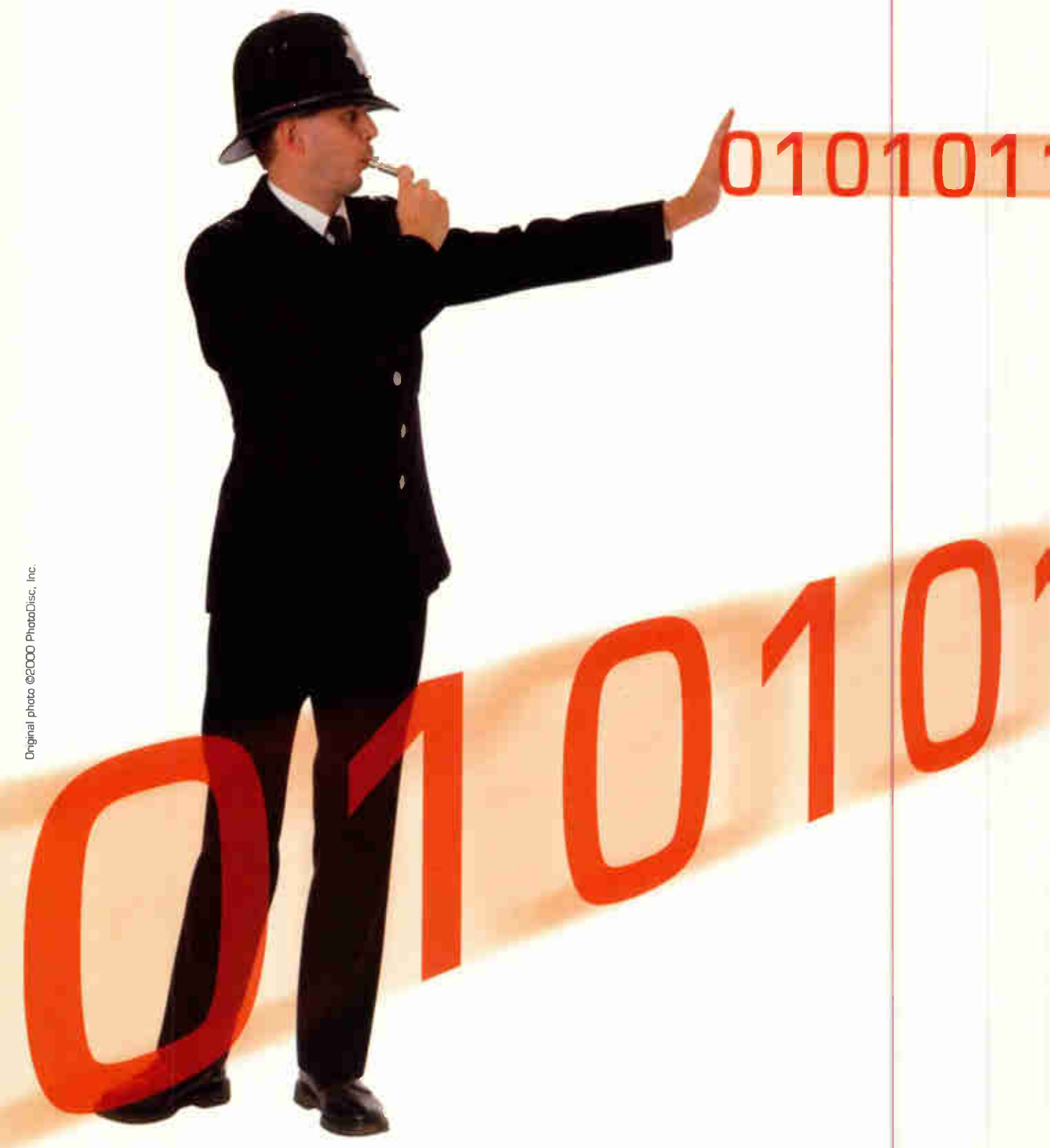
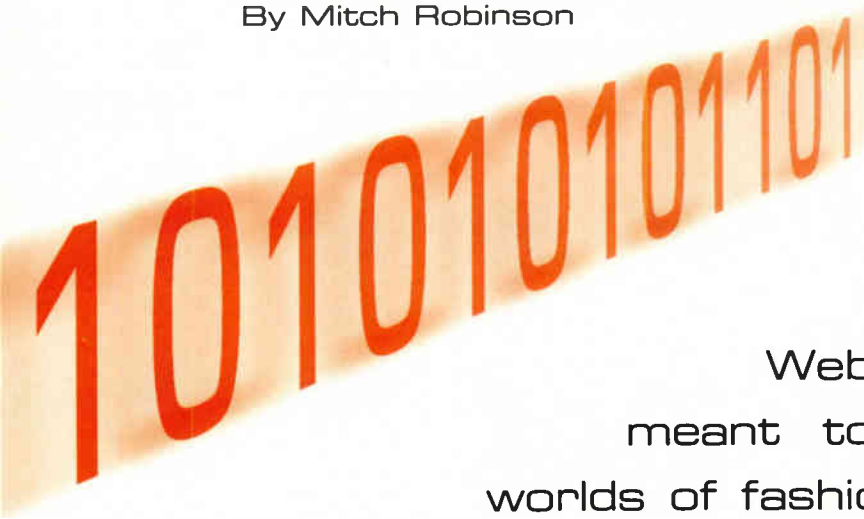
IP MULTICASTING:
DELIVERING BROADBAND



TO THE MASSES

Skirt the Internet's Speed Traps

By Mitch Robinson



The Victoria's Secret Webcast last year was meant to bring together the worlds of fashion and emerging technology. The 1.5 million people who logged on to broadcast.com to witness this first-ever event were sorely disappointed.

Many of them had difficulty logging on to the site, and those who did saw a video screen so small that the figures were hardly recognizable. The explanation, shared by an analyst as well as Victoria's Secret and broadcast.com representatives, was that the technology needed to support such an idea was not yet available.

Interestingly, during the months prior to and following this broadcast, two companies playing in the cable and broadcast industries, TVGuide and Williams-Vyvx, both signed agreements to work with technology that could have done the job. They were preparing to implement a broadband networking technology that most people did not know existed.

The solution is Internet protocol (IP) encapsulation and multicasting of broadband content. In cable, TVGuide uses this technology to deliver its electronic program guides (EPGs) to cable headends around the country. Williams-Vyvx uses IP multicasting for digital ad insertion for its clients—broadcasters, many of whom are carried on cable networks.

Using IP technology, content providers can multicast broadband content more effectively. For a cable operator looking for additional revenue opportunities by adding Internet services, the technology can be added to front and back ends of the network,

creating the "fat pipe" that all Internet service providers (ISPs) require.

To understand IP multicasting, let's look again at the failure of the Victoria's Secret Webcast.

How IP multicasting works

The Webcast failed for several reasons. The poor quality of the images was a result of the currently overburdened terrestrially-based Internet backbones. The difficulties experienced by visitors trying to reach the site stemmed from overtaxed servers and Internet connections, as ISPs were constantly resending the IP video content to every user requesting it. In this scenario, each individual personal computer (PC) was receiving a unicast, point-to-point transmission.

The site used to host the event was incapable of accommodating such high volumes of traffic. In an attempt to correct the problems indicated by the broadcast failure, Victoria's Secret switched from a shared network infrastructure to a dedicated one. This was an improvement, but not a solution. If Victoria's Secret were to attempt another broadcast, the results probably still would be unsatisfactory because the data continues to be transmitted from a single point to another single point.

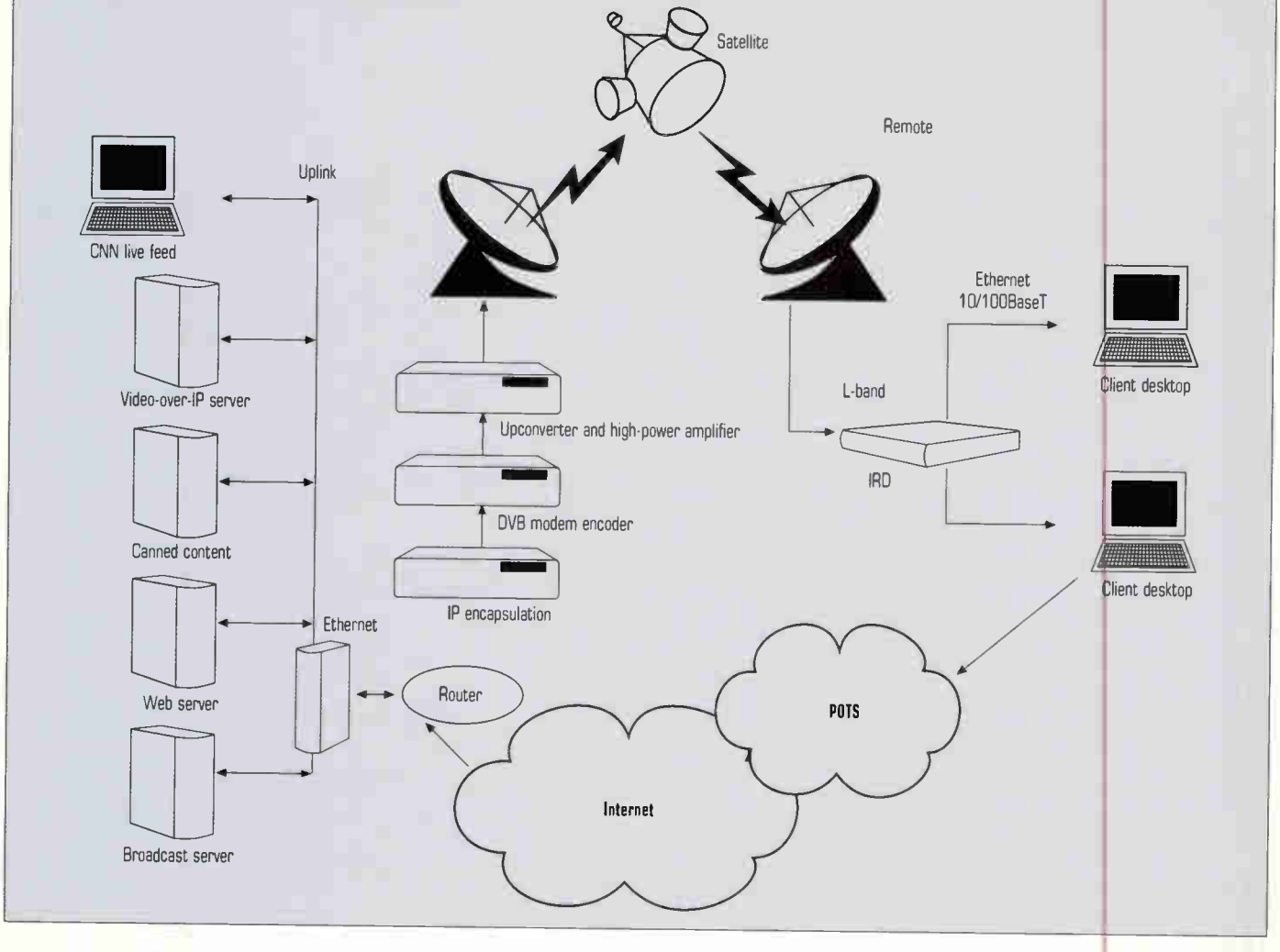
The appropriate solution for this kind of broadband data transmission is IP multicasting. Multicasting allows companies such as Victoria's Secret to continue using the same amount of network space to deliver content, extending the capabilities of their existing infrastructure, regardless of whether that infrastructure is terrestrial, such as cable, or satellite-based.

Regardless of the underlying infrastructure, IP multicasting works by sending data from one point to multiple points. Data can be transmitted via satellite, cable, terrestrial wireless or other land-based networks.

Keep in mind that IP technology is packet-based: The video or data components are packaged or encapsulated, creating a vehicle in which the data travels. Compressing and containing the data reduces its overall size, and therefore the amount of bandwidth needed, for that package of data to be transmitted. In addition, that one packet can be sent from one location to a thousand different locations simultaneously. The result: cost-effective and efficient delivery of data.

One specific solution that could have eliminated many of the problems experienced in the Victoria's Secret broadcast is the use of a digital video broadcasting (DVB)-based IP multicast via satellite. (See Figure 1.) With such an approach, the multimedia IP

FIGURE 1 DVB-BASED IP MULTICAST VIA SATELLITE



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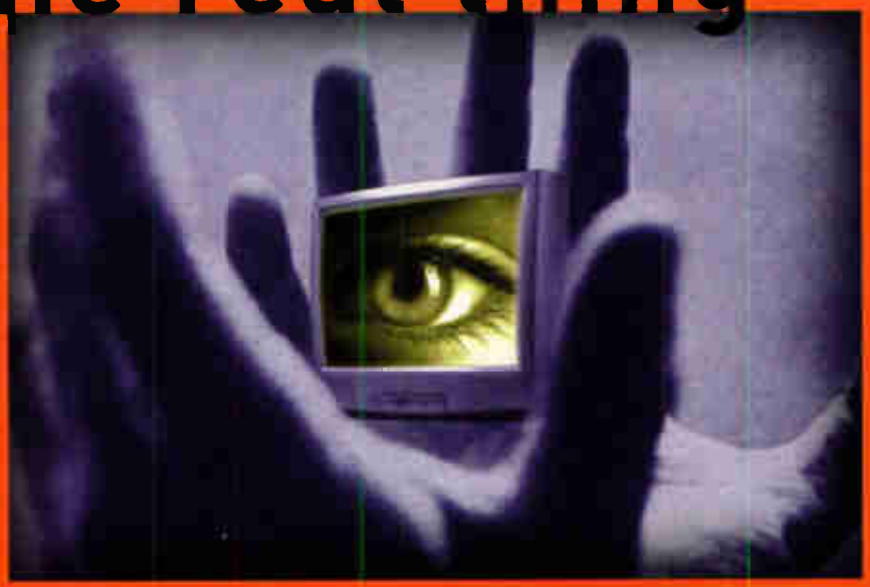

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broadcast bypasses terrestrial Internet backbones and is brought to the edge of the network or the ISP's point-of-presence (POP).

Through powerful media streaming servers colocated with a broadband satellite receiver, for example, the content is brought closer to the end user so that the Web experience is dramatically improved. In deploying such a system, the multimedia broadcast eliminates the bandwidth-eating unicast sessions and folds them into one multicast session to the edge of the network, which can then be rebroadcast down a cable infrastructure, for example. (See Figure 2.)

By embracing the IP and DVB standards, content providers, ISPs and other groups working with broadband content can efficiently illuminate a whole satellite transponder to deliver media-rich data streams to their customers at speeds of 45 Mbps or more. This allows for the delivery of bandwidth-intensive broadband content such as EPG material and broadcast-quality audio and video.

The technology—IP multicasting—that makes such delivery possible is being used by ISPs, emerging service providers and corporate networks alike. In the cable realm, broadband IP multicasting is gaining recognition.

TVGuide transmits The nightly lineups

Anyone who subscribes to cable service at home has at some point flipped to the EPG and watched the data scroll along the screen at a painfully slow speed. Recently, however, with the adoption of DVB IP multicast satellite technology by TVGuide, the viewer experience has improved.

TVGuide originally purchased non-DVB compliant components for its network. Now, after moving from analog to digital data transmission, TVGuide makes better use of its bandwidth, while improving the overall quality and appearance of the data being transmitted.

By using IP technology, TVGuide continued to use a satellite transponder to transmit and receive data, but no longer did the entire transponder have to be illuminated. TVGuide was able to improve the quality of its content, but it also wanted to increase the speed at which it was delivered.

Building a new platform with an underlying DVB structure, TVGuide

BOTTOM LINE

> IP Multicasting: The Broadband Answer

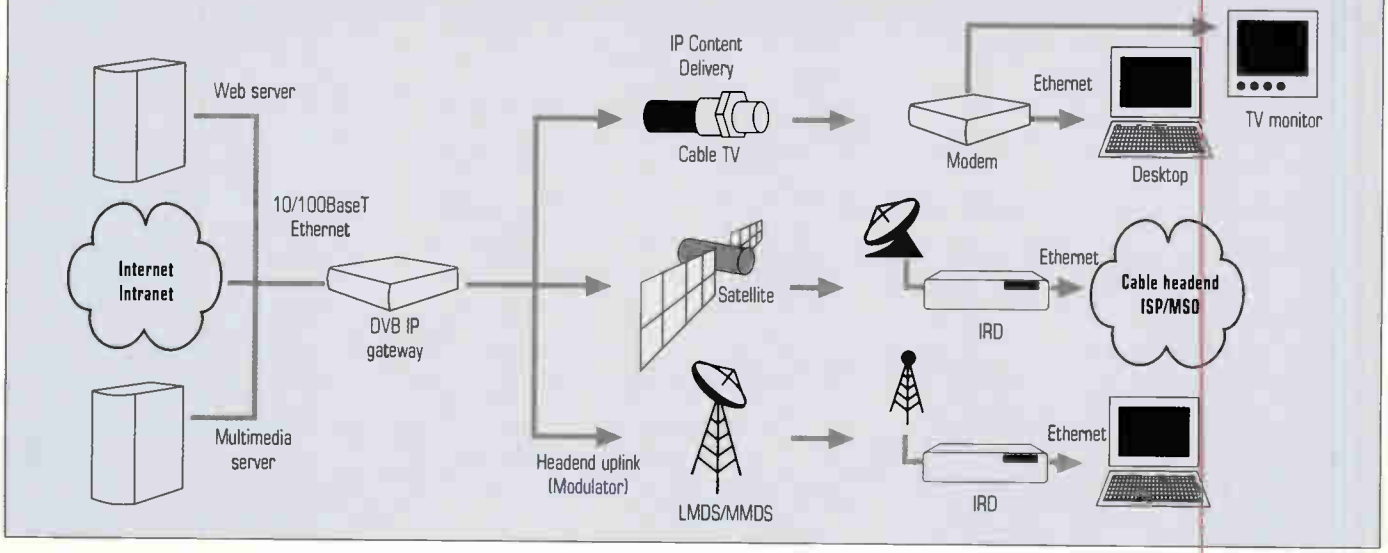
Internet protocol (IP) encapsulation and multicasting of broadband content can be used by the cable industry in a range of applications. Distribution of electronic program guides (EPGs) and digital ad insertion are among the most useful applications.

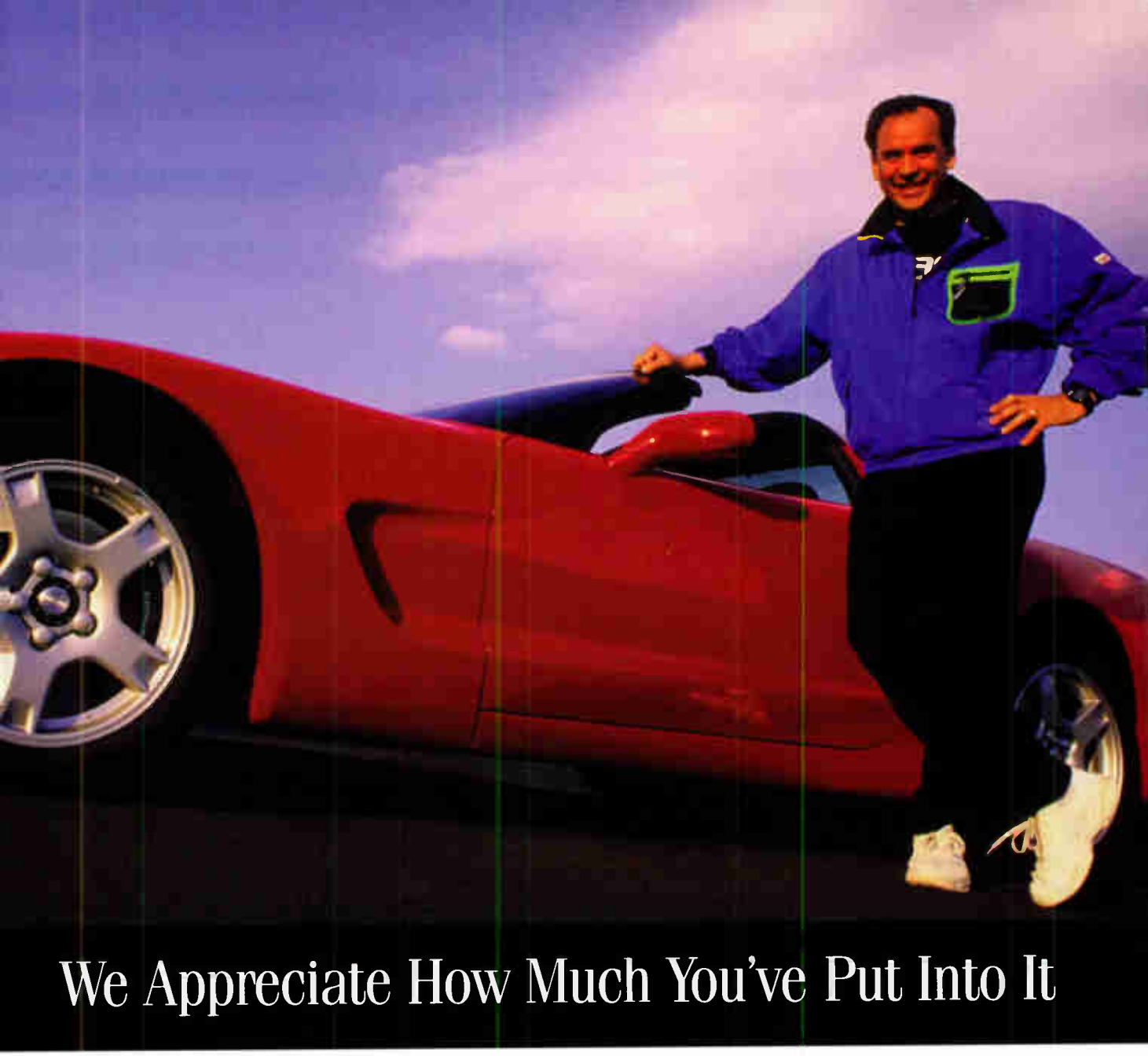
For a cable operator looking to add Internet services, the technology can be added to front and back ends of the network.

IP multicasting sends data from one point to multiple points. Data can be transmitted via satellite, cable, terrestrial wireless, or other land-based networks. IP technology is packet-based: The video or data components are packaged or encapsulated, creating a vehicle in which the data travels. A data packet can be sent from one location to a thousand different locations simultaneously.

Embracing IP and digital video broadcast (DVB) standards, broadband content providers can efficiently illuminate a whole satellite transponder for data rates of up to 45 Mbps or more. This high-speed technology is being used by Internet service providers, emerging service providers and corporate networks alike. In the cable realm, broadband IP multicasting is gaining attention.

FIGURE 2 MULTIMEDIA BROADCAST





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merged its existing technology with newer components, resulting in a faster and more robust solution. That was a year ago. TVGuide had a good idea of the service it wanted to provide to its customers, the cable providers. The infrastructure was complete, but the planning and implementation of the solution still were in the conceptual stage.

TVGuide previously used set-top box solutions, independent of the PC. This time they wanted a solution contained within a PC. The answer: a "box" within the computer that would not disrupt the motherboard. The solution married an IP core processor, a router and a "personality module" or plug-in network interface card (NIC).

This solution would allow the digital data to be encapsulated and compressed within the physical structure of the PC. It still would require transmission via satellite, but the enhancement enabled reutilizing the bandwidth and refining the delivery of data associated with the electronic program guide.

Delivery was now a signal empowered by the box across a satellite to the cable headend. A modem termination system at the headend then received and deciphered the data. What resulted was no longer jerky or fuzzy content on the TVGuide channel, but clear, digitally developed and delivered content that rolled at a good rate.

"Regardless of the underlying infrastructure, IP multicasting works by sending data from one point to multiple points."

700 tapes too many

Like TVGuide, Williams-Vyvx also benefited from IP multicasting for its broadband delivery needs. Williams-Vyvx provides digital ad insertion to more than 700 TV stations in almost every market in the United States. The company's customers are advertising agencies that need to send digitized commercials to the stations.

Prior to IP multicasting, Williams-Vyvx received advertisements from its customers and manually cut tapes from a master tape, which were then distributed to the individual TV stations. Although the initial quality of the videos was excellent, the survivability of these tapes was very short-term. The boxing and shipping of the tapes also was very expensive. It was not long before the company realized it would need a more efficient and cost-effective way to work.

The answer for Williams-Vyvx required changing the format of the video advertisements, in addition to a

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better method of transmission. The video content had to be digital and meet DVB standards. Next, Williams-Vyvx needed to install a receiver and satellite uplink device at its headquarters in Oklahoma, as well as a receiver and downlink at each of the numerous TV stations receiving the content.

L-band receivers, digital tuners and a 45-Mb satellite router with an internal power supply were used to create the solution, which was elegant in its simplicity, and yet acquired signals almost immediately. With this improved IP format of transmitting and receiving the video advertisements, TV stations could store the content digitally, significantly improving its shelf life.

Multi-protocol encapsulation (MPE), the DVB standard for data broadcast, allows high-quality, digital ad insertion to take place in real time with a better image. Williams-Vyvx uses MPE technology for both the compression and transmission of the video, and the TV stations use it to receive and decompress the videos.

Using the system on both encoding and receiving ends let Williams-Vyvx leverage its full bandwidth. Because the company had use of a full satellite transponder, the transmission could reach speeds up to 50 Mbps.

Future of IP multicasting—Internet and interactivity

Beyond these applications, cable operators acting as ISPs can benefit from IP multicasting. Broadband content can be encapsulated as IP at the origination end and transmitted via satellite to cable headends or ISPs domestically and internationally. At the headend, the content can be stored on caching servers.

By replicating Web sites and bringing content closer to users, foregoing terrestrial hops that delay access, surfers get a faster Internet, with easier access to broadband content.

This revolution is underway now. Industry analysts expect the content distribution and caching industry to reach $2.2 billion by 2002.

Although both TVGuide and Williams-Vyvx are satisfied with the solutions to their broadband content delivery problems, the technology is improving every day. Neither company currently uses all of its bandwidth capabilities.

Just as a number of solutions are available to prevent another broadband failure such as the Victoria's Secret Webcast, both TVGuide and Williams-Vyvx (not to mention other companies serving the cable industry) could improve their offerings as greater speeds and new technologies continue to become available. At its heart, however, the solution for high-speed broadband content delivery is IP multicasting. CT

Mitch Robinson is president and chief executive officer of ViaCast Networks. He can be reached via e-mail at mrobinson@viacasting.com.

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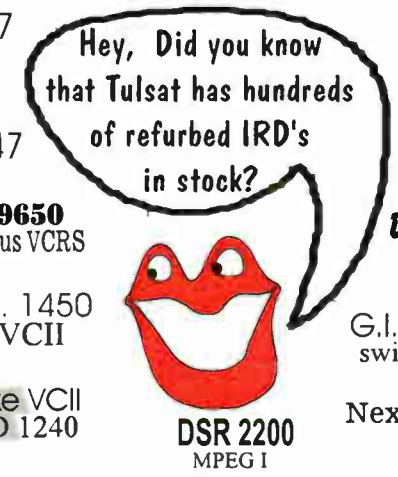

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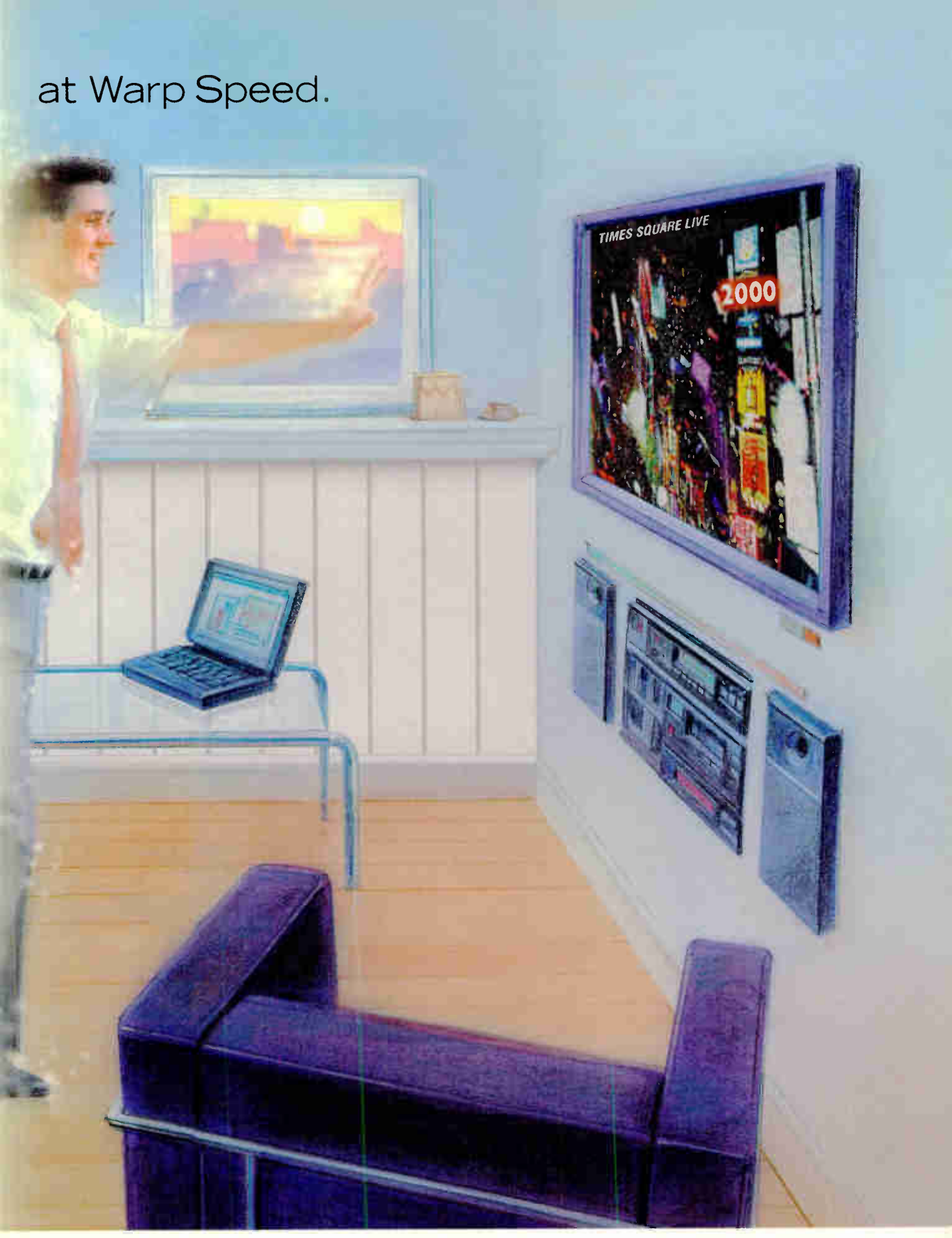

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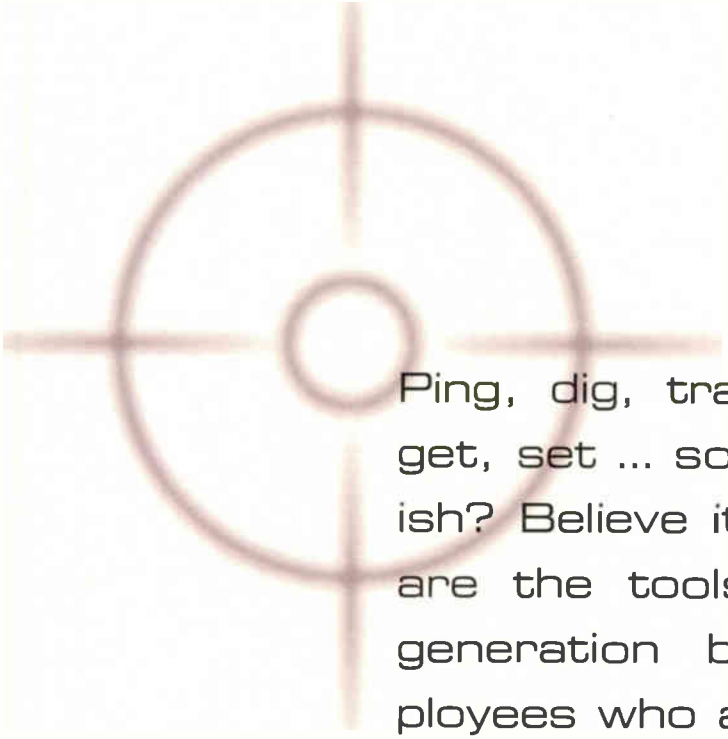


Ping, dig, trace, arp, scan, get, set ... sound like gibberish? Believe it or not, these are the tools of the next-generation broadband employees who are tasked with resolving customer problems as well as building and maintaining the delivery medium.

Speed shooting for High-Speed Data

Fixing PC Modem Problems, Part 2

By Bruce Bahlmann

In 1996, MediaOne (then Continental Cablevision) began a high-speed data alpha field trial. Back then, we could count our high-speed data customers on a couple pairs of hands, operated in makeshift facilities (known as the Bat Cave) and had customers who were so pleased to be selected for this early trial phase that they were extremely understanding when technical problems arose.

Back then, we used static Internet protocol (IP) addressing, and each customer's personal computer (PC) and cable modem IP address was written down for easy reference. We used this information along with one of the simplest network troubleshooting tools, called ping, to check if the customer was connected to our growing broadband network. Beyond that, we either corrected the problem over the phone or resorted to rolling a truck to resolve the problem on-site.

Because we hadn't built up sufficient experience with cable modems, networking PCs or hybrid fiber/coax (HFC) return path issues, we rolled a lot of trucks. Through the alpha and follow-on beta field trials, we acquired a wealth of information about what it takes to run a successful high-speed data service. This information directly led to several infrastructure and process improvements across all high-speed data-affiliated groups. However, these improvement efforts failed to address one important question: How are we going to diagnose customer problems?

Tools of the trade

Today, we no longer count customers on pairs of hands, but rather by the hundreds of thousands, and those same customers who were so understanding in the past light up our phones at the slightest degradation in service quality. We also no longer use static IP addressing for PCs and cable modems, but rather maintain the largest dynamically addressed (via dynamic host configuration protocol, or DHCP) networks in the world.

Troubleshooting devices on this cutting-edge DHCP network is a major challenge. However, since our early trials with DHCP during alpha and beta phases, we began asking the following questions:

- How can we ping a customer's cable

modem and PC when we don't know their "current" IP address?
- How can technicians determine whether the customer's cable modem and PC are reaching the DHCP server?

To address these questions, I began developing a troubleshooting tool that would enable technicians to look up any device's current IP address and ping it. This troubleshooting tool began merely as a way for a small group of individuals to confirm the provisioning process. Through the years, I continued to add to this tool using information I learned from watching various groups use the tool and implementing every one of their requests.

New releases of this tool came out in Internet-time (often the very same day), and the tool gained popularity because of its timely response to the needs of its user community. Eventually, I began deploying the tool in other MediaOne locations, adding their feature suggestions as well and making it scalable and customizable to the point where today it is known across all of MediaOne as simply the "Bruce Tools" or the "Bahlmann Tools" (patent pending).

This troubleshooting tool gathers and consolidates information belonging to a number of different sources and shortens the time required to troubleshoot problems while eliminating the need for multiple individuals to have access (shell accounts) to mission-critical servers.

Through consolidation of this information, the troubleshooting tool provides the essence of what every installer, plant operations technician, broadband service representative (BSR), network operations center (NOC) staff and network engineer needs to diagnose most customer and network prob-

FIGURE 1 INFORMATION SOURCES REQUIRED FOR TROUBLESHOOTING

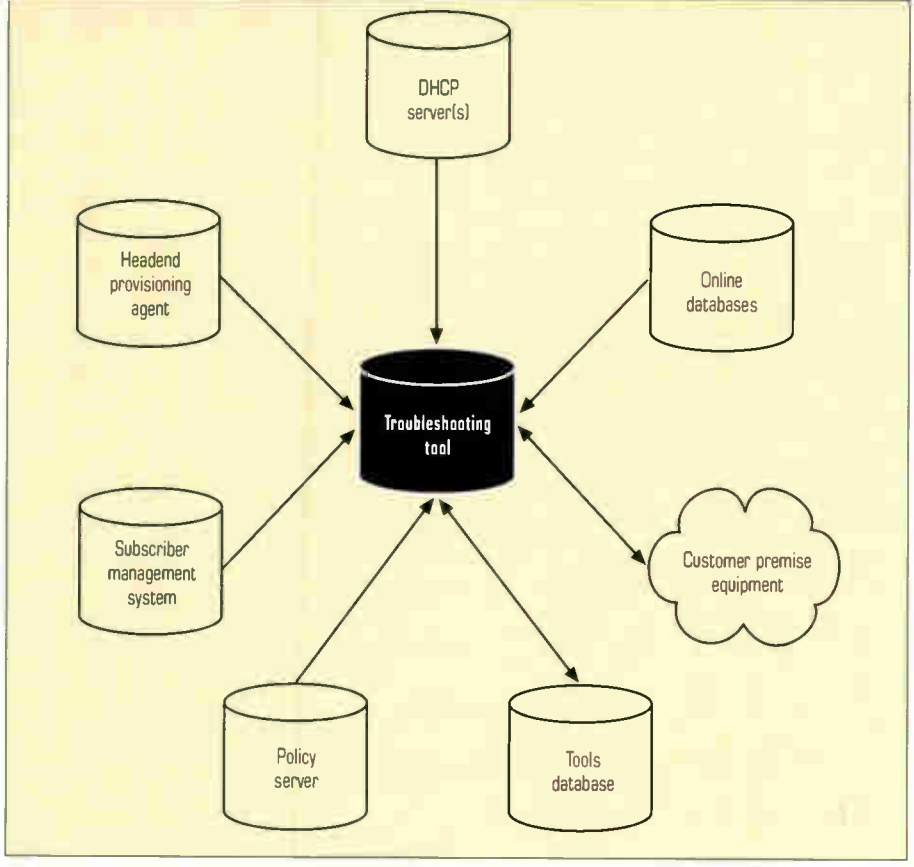
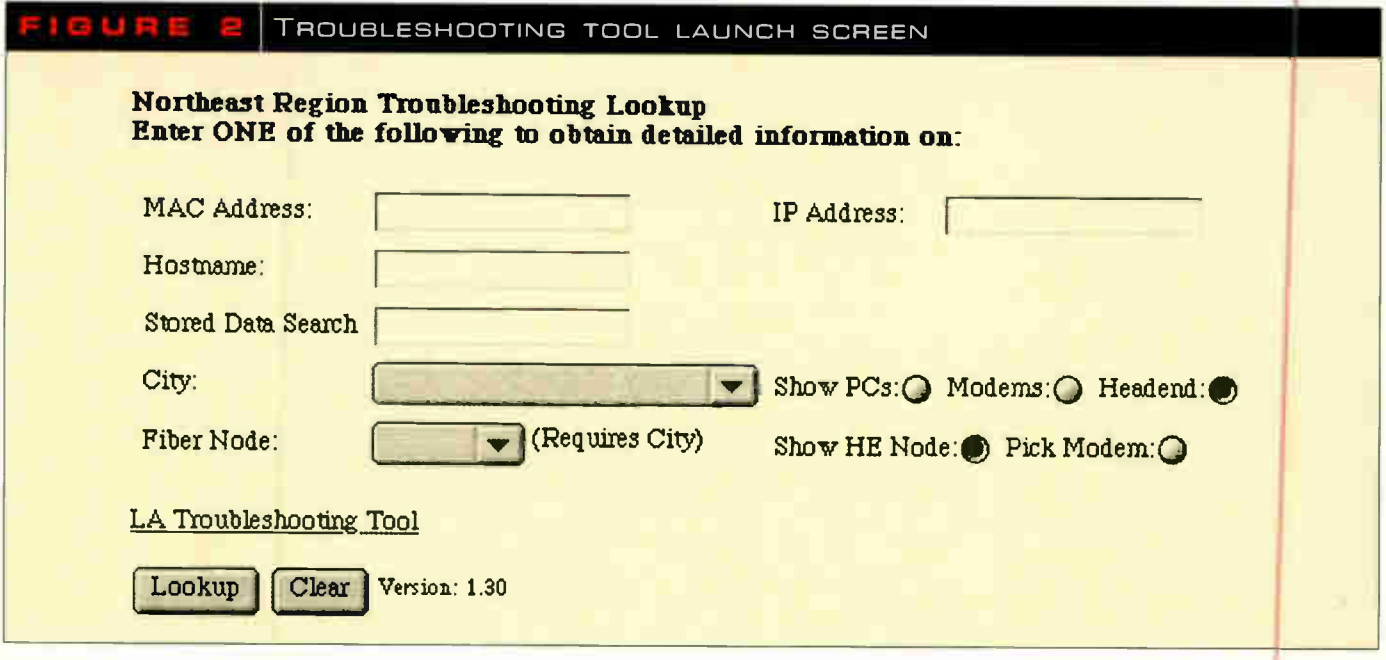


FIGURE 2 TROUBLESHOOTING TOOL LAUNCH SCREEN



lems associated with high-speed data. In fact, every one of these groups requires access to this troubleshooting tool to perform their jobs.

Let's look at the design and function of this troubleshooting tool in resolving customer, network and configuration problems.

Troubleshooting challenges

The troubleshooting tool requires information and connectivity to a number of various high-speed data and subscriber management resources as pictured in Figure 1. Further complicating matters is that several different organizations are responsible for this data, including your Internet service provider (ISP), information technology (IT) folks and network operations group. Each of these groups has its own rules about privacy, security, availability and so on.

In addition, there is another problem regarding the placement of this tool with respect to the networks it must access to perform its designed task. Subscriber management system (SMS) information resides within your company's internal network, but this tool is most likely to be on the customer network. For information to flow from these various sources to the tool requires access to data from your SMS as well as various online (or out on the Internet) databases. Orchestrating the proper flow of this information into the tool requires significant coordination, and it is best to design this system from the ground up.

Click and go

The troubleshooting tool is a software application consisting of a collection of screens that allow you to look up, troubleshoot, correct and maintain customer premise equipment (CPE) such as cable modems, PCs, set-top boxes and so on. Basically, the troubleshooting tool can be used for anything that has a media access control (MAC) address or an IP address, including the cable modem termination system (CMTS). >

FIGURE 3 TROUBLESHOOTING TOOL PICK LIST SCREEN

There were **4594** mac address matches to the pattern " **00:00:ca** ".
Select one of the following to retrieve information.

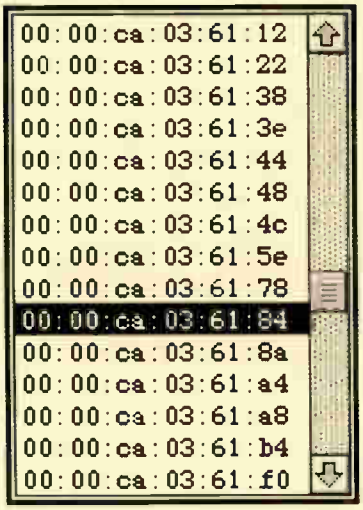


FIGURE 4 TROUBLESHOOTING TOOL MAIN DISPLAY SCREEN

Server Data:	0.00 hrs old	**Owner Data:**	10 days old	**Health Data:**	9 days old
Add. Type	dynamic	Firstname	BRUCE	Tx Freq.	26.75 MHz
Mac Add.	00:00:ca:03:61:84	Lastname	BAHLMANN	Rx Freq.	543 MHz
IP Add.	10.128.44.51	Address	243 SouthStreet	Tx Powr.	48.56 dB
Start Lease	Mon Jun 16 17:37:24 1997	City	READINGMA	Rx Level	Calibrated
Lease Exp.	Mon Jan 18 22:14:07 2038	Fiber Node	6	Min Rx since bs	+07.52 dB
Lease Ext.	Mon Jun 16 17:37:24 1997	Phone	781-9444329	Ave Rx since bs	+10.98 dB
Last Trans.	Fri Feb 27 09:14:29 1998	PC Mac	00:a0:24:90:cf:22	Uptime	2:45:09
		Modem Mac	00:00:ca:03:61:84	HE Node	MA-reading-6
Device Spec.		Email	bahlmann	HE Node IP	10.128.44.30
Registered	**Yes (BOOTP)**			Rx/Ex Fig.	7\7
Version	4.00_LCp			Serial Num.	62704760
Alive?	Yes			Headend	zionhill
				Tot. UL Pkts	90
				Pkts/error	0

Reg | DeReg | Update Server | Update Owner | Update Health
Bridging Table | Clear Errors | Reset | History | IP Filter | Port Filter | Ping | Listen
New Search

BOTTOMLINE

> High-Speed Troubleshooting

Today's high-speed data customers demand an unprecedented level of service from broadband operators. From installation, phone support and service, each broadband operator must seek means of fast and efficient problem resolution. Implementing a consolidated troubleshooting tool can:

- Reduce install times by up to 5 minutes by localizing the problem to the customers' home
- Reduce the length of support calls by 2-3 minutes by consolidating all information and toolkits to a single interface
- Reduce the number of unnecessary truck rolls
- Increase the efficiency of network engineering in resolving configuration problems.

The troubleshooting tool starts by generating a lookup screen that provides many different ways to search for the device in question. (See Figure 2 on page 72.) Through this screen, you can find any and all CPE associated with one or more of these fields. For example, you could enter the MAC address or the city and fiber node for the search criteria and click "Lookup."

Depending on the scope of the search, the tool will either display all known information about the device (see Figure 4 on page 73) or display a pick list (see Figure 3 on page 73) of matches associated with the search criteria. Note that the pick list has some interesting functionality that is less obvious than selecting an exact match.

For example, let's say you just renumbered a network and are waiting to see if CPE is coming up on the new network. Rather than just looking up a CPE that you know will be coming up on the new network, you can search for CPE with the new network's address (search by IP "24.128.44."). By leaving the last octet off, the tool will look for CPE on the subnet 24.128.44.x and display them in the pick list. If CPE is not coming up on the new network, something could be wrong with the network configuration or routing. This is just one of many ways that network engineers use the troubleshooting tool.

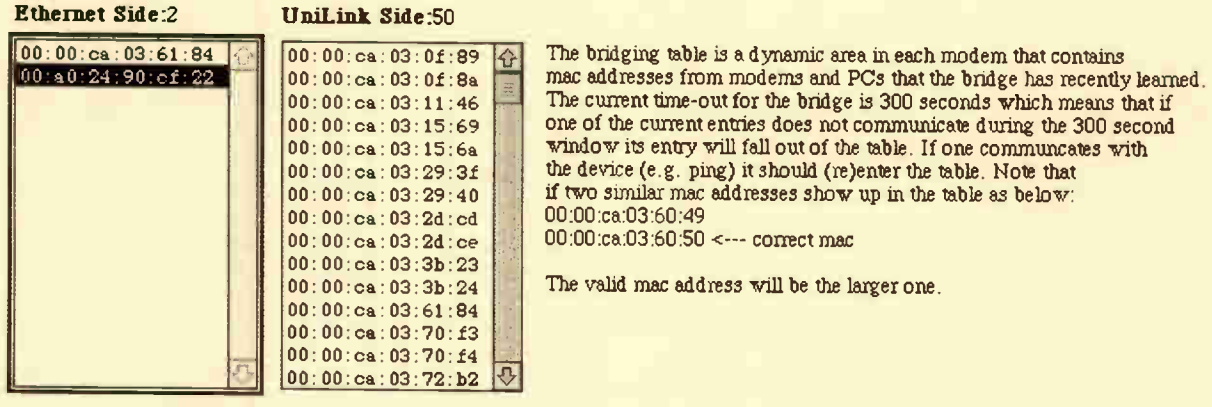
Once an exact match is found for the search criteria, the troubleshooting tool goes out and collects all the information it can about the device in question. The information gathered is organized and displayed to the user in various forms depending on the user's access rights. Figure 4 shows one such variation. Other variations may include more or less information.

Here, the information is broken down in terms of Server, Device, Owner and Health. Server information comes from the DHCP server, Device information comes from the tools database and DHCP registry, Owner information comes from the billing system, and Health information comes from the device itself as well as the DHCP manager application. From this screen, all troubleshooting, corrective measures and maintenance are performed via a tool kit (which represents functions that are available to the user depending on his or her access rights and the device in question).

Figure 4 represents a portion of the overall toolkit that addresses cable modem functions. This screen also represents a launch point for the user to access additional equipment related to the CPE displayed. For example, the information below provides a link to the customer's PC and their headend node as well as a way to e-mail this customer.

All the information in Figure 4 has persistence (is stored in a database for later use). The troubleshooting tool uses persistence to enable a "before" vs. "after" function, which allows users to go back and view parameters (for example, Health data). By being able to view former transmission

FIGURE 5 TROUBLESHOOTING TOOL BRIDGE-FORWARDING TABLE FUNCTION



Now your Stealth field unit can "view" headend data from the PathTrak Return Path Monitoring System. Simply put, you can be two places at once to quickly find and fix the source of ingress while cutting down on drive time, manpower and work-related frustration.

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power levels as well as obtain current health data (via Update Health function), a technician can determine what has changed since the last Health update or since initial installation.

"One of the most obvious ways noise affects cable modems is by generating error packets."

Building bridges

The rest of this article will highlight some unique functions available for troubleshooting high-speed data. Although these functions will be explained in the context of the Bahlmann Tools, the underlying application responsible for providing each function will be identified. Simple network management protocol (SNMP) is used in most cases unless otherwise specified. Note that although a legacy cable modem (LANCity) is used as the example, all these same functions apply to Data Over Cable Service Interface Specification (DOCSIS) modems.

The bridging table represents one of the most useful functions in the toolkit. (See Figure 5 on page 74.) This function reads the bridge-forwarding table on the cable modem that is a dynamic holding place of MAC addresses that have been "learned" by a modem. This table works similarly to a router's bridging table by learning the MAC addresses of devices that have talked recently. The default time-to-live for bridging table entries is 300 seconds, so only devices that have recently talked will be located in the table.

Because every modem has two ports, Ethernet and cable TV (LANCity calls this Unilink), two groups of devices are contained in the bridge forwarding table. These two different ports are displayed in two different tables on the application's screen. You can use this function as a way to find devices on the network. For example, you can verify the actual MAC address used by a customer's PC (especially useful if you believe the customer is not using DHCP and has a different machine connected to the modem). This information would be found on the Ethernet side of the modem.

The Unilink side of customer modems would enable you to locate other devices on a particular fiber node. This functionality exists for headend modems (or CMTS in DOCSIS) as well; however, in this case the Unilink side represents devices on the fiber node, and the Ethernet side represents servers, switches and routers on that network segment. >

FIGURE 6 TROUBLESHOOTING TOOL LISTEN FUNCTION

The bottom of this page has Instructions on the use of LISTEN:

Listening to Device at:
ip address = 10.128.44.51

mac address = 00:00:ca:03:61:84

DHCP Server Traffic = 1 packet(s)

871663282.529886 Packet arrived on Friday August 15 12:41:22

received on address 24.128.1.34
xid=0x846103ce secs=17 flags=0x2c06
chaddr: 00:00:ca:03:61:84
unpacked payload:
ht=1:ha=00.00.ca.03.61.84:ci=0.0.0.0:gi=24.128.44.1:sa=0.0.0.0:yi=0.0.0.0:flags=513,514,515,523,524,525:vm=rfc1048:

unregistered host=<00:00:ca:03:61:84> sending Dynamic BOOTP -- ignored

BOOTP Server Traffic = 1 packet(s)

871663323.249390 Packet arrived on Friday August 15 12:42:03

received on address 24.128.1.92
xid=0x846103ce secs=17 flags=0x2c06
chaddr: 00:00:ca:03:61:84
unpacked payload:
ht=1:ha=00.00.ca.03.61.84:ci=0.0.0.0:gi=24.128.44.1:sa=0.0.0.0:yi=0.0.0.0:flags=513,514,515,523,524,525:vm=rfc1048:

seeking BOOTP client (1,6,00:00:ca:03:61:84) on subnet 24.128.44.0
BOOTP packet from <00:00:ca:03:61:84> configured with <0.0.0.0>

Reply Host structure:
ht=1:ha=00.00.ca.03.61.84:ci=0.0.0.0:gi=24.128.44.1:sa=24.128.1.92:yi=10.128.44.51:flags=1,3,6,7,13,15,66,67,513,514,515,5:
24.128.52.6 24.128.1.80:lg=0.0.0.0:bs=1:dn=ne.mediaone.net:sn=chdhcp02:bf=/usr/tftp/zionhill/24.128.44.0/basic:

Back to Display | New Search | Listen Again

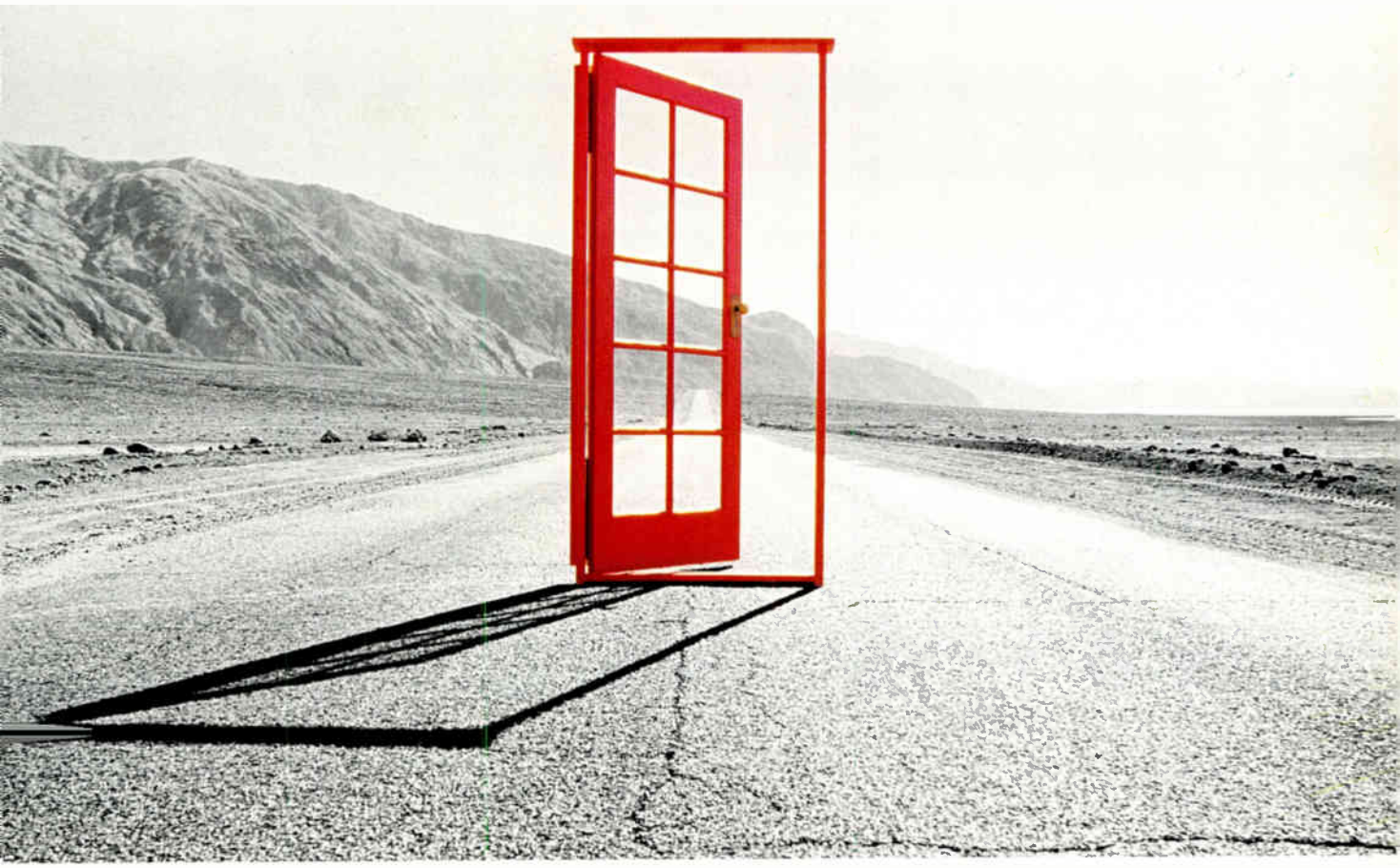

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FIGURE 7 TROUBLESHOOTING TOOL PING FUNCTION

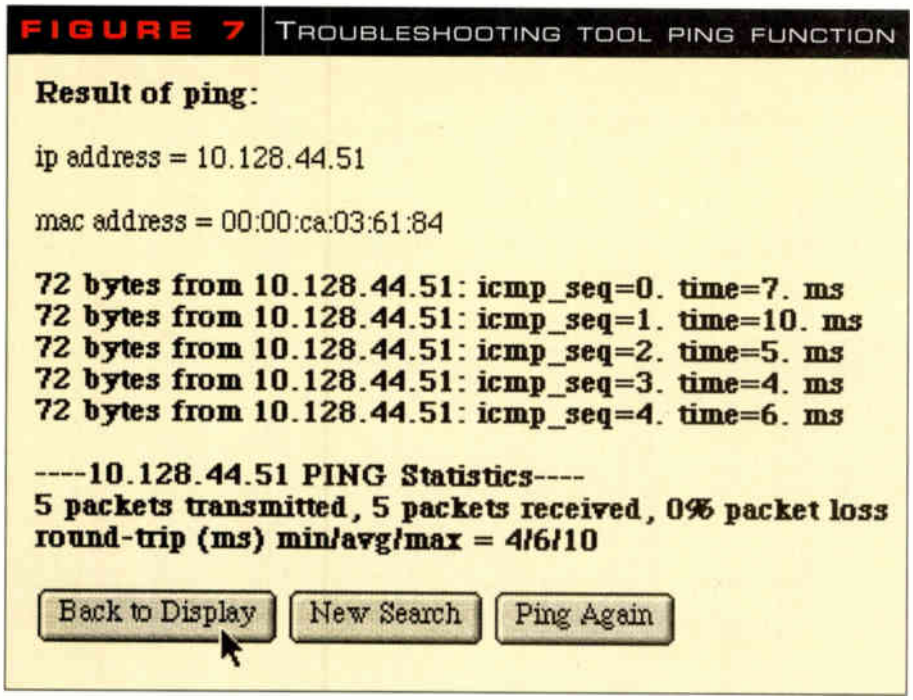
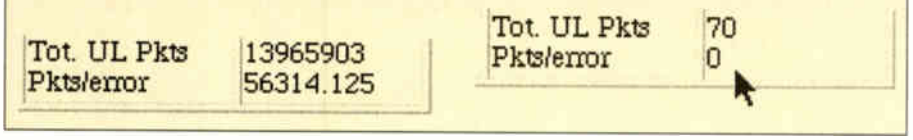


FIGURE 8 TROUBLESHOOTING TOOL CLEAR ERRORS FUNCTION



Listen to your system

The listen function shown in Figure 6 (on page 76) allows the log file of the DHCP/BOOTP (boot protocol) servers to be viewed for a specific device. The log file contains important information regarding the transaction between the DHCP/BOOTP servers and clients (PCs and modems). The troubleshooting tool has the ability to parse this file, extracting any transactions from specific devices. From these log entries, you can determine what (if any) response is destined for specific clients. You also can determine which clients are requesting, who is getting answered, and what configurations (or DHCP options) are being sent to the clients from the servers.

The ping function shown in Figure 7 remains a useful tool in troubleshooting cable modem and PC problems. The troubleshooting tool uses a particular version of ping that provides statistics on packet loss and round-trip times. These statistics are helpful in summarizing the results.

Fairly regularly, the broadband delivery medium becomes noisy. While noise can show up in many different ways in broadband, one of the most obvious ways it affects the modems is generating error packets. When customers complain about slow speed or intermittent connections, there is a good chance that the broadband delivery medium is noisy.

Your plant operations group can use the Clear Errors function shown in Figure 8 to check the progress of cleaning and tuning the broadband delivery medium or verifying the modem operations.

Additional functions

Some other functions worth noting include Reset (enables a cable modem or CMTS to be reset remotely), IP and Port Filter (enables a cable modem or CMTS port or IP filters to be read/set remotely), port scan (enables a computer's transmission control protocol, or TCP, application ports to be scanned, thus identifying which applications are running, such as Web, FTP, TELNET, SMTP and so on remotely) and history (enables a cable modem or CMTS status log to be read remotely).

Being able to perform these functions on any given device enables more sophisticated troubleshooting earlier in the problem resolution phase. Before the troubleshooting tool existed, many more problems required sending technicians to repair minor configuration settings. Today, armed with an ever more sophisticated toolkit, BSRs are able to localize and correct an increasing number of problems over the phone—keeping trucks rolling to more installs rather than routine service calls. CT

Bruce Bahlmann is senior systems engineer for MediaOne's Internet Services Group. He can be reached at bahlmann@bigfoot.com.

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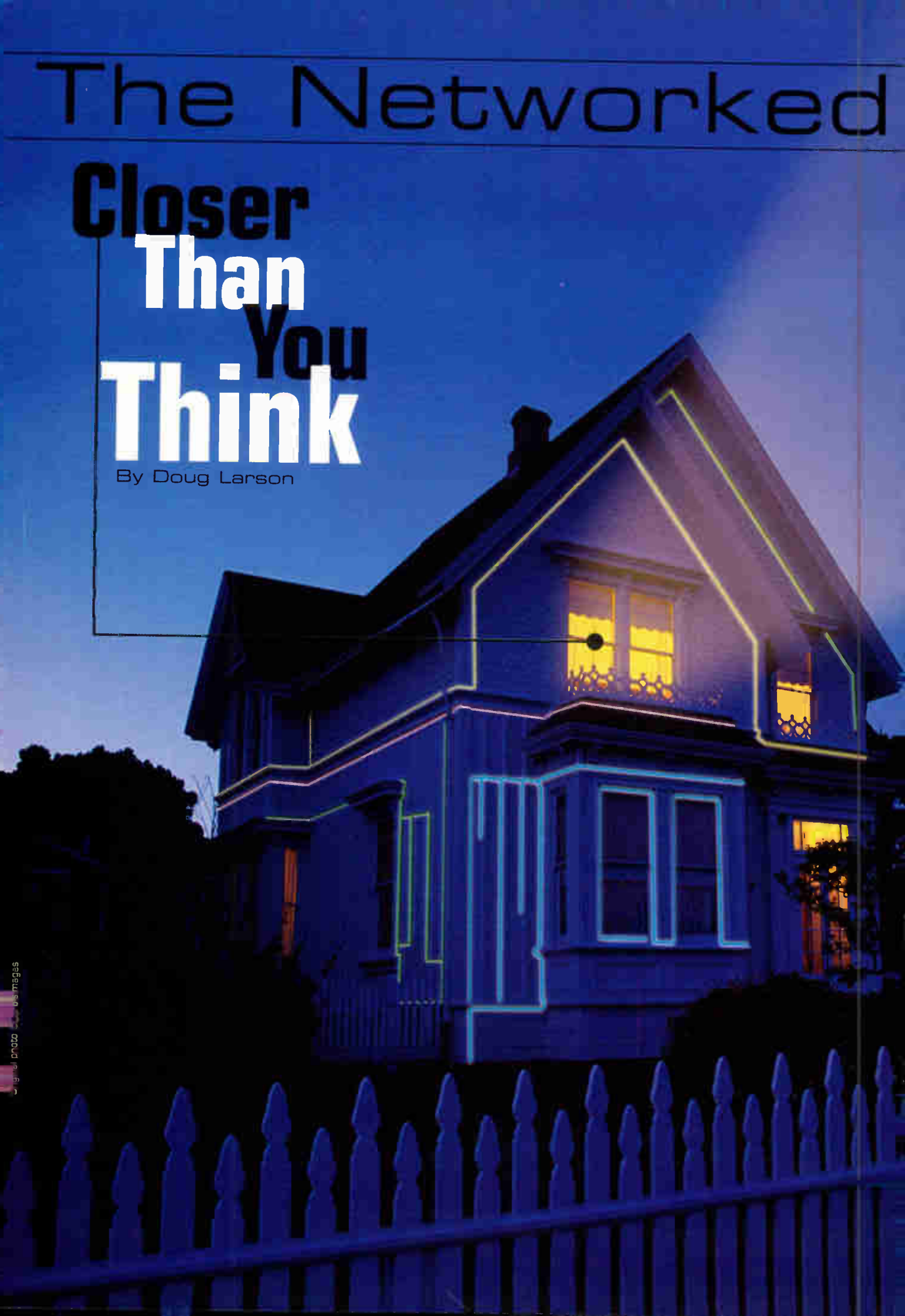
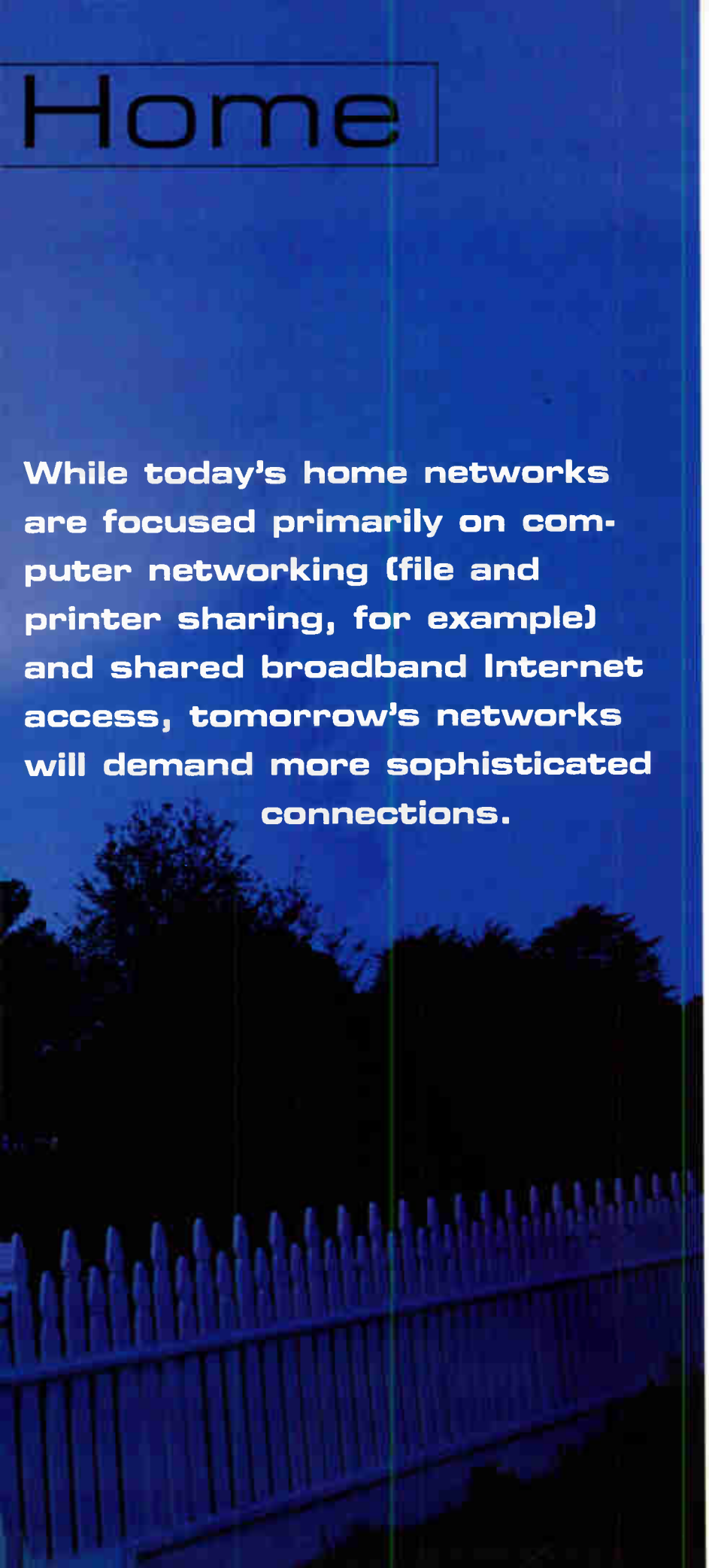
By Doug Larson



Home

While today's home networks are focused primarily on computer networking (file and printer sharing, for example) and shared broadband Internet access, tomorrow's networks will demand more sophisticated connections.



Future home networks will need to be able to process a number of applications, including home control and automation, personal computer (PC) networking, home theater and audio/visual component interconnects, and whole-house media and entertainment distribution.

While some multiple system operators (MSOs), such as Cox Communications, are working with home builders to create master planned communities with all of the necessary wiring for home networking applications, the industry is faced with an entirely different scenario for existing homes.

No new wires

From a cost and labor standpoint, a "no new wires" approach makes the most sense for cable operators looking to support a home network, both to distribute their existing services and to launch new ones. This approach has a number of possible incarnations, including the use of existing telephone wiring, electrical wiring or the ultimate solution—wireless.

One of the leading standards today is HomePNA, which uses existing telephone wiring to carry data at up to 10 Mbps. "HomePNA's 1.0 specification was the first open industry standard based on no-new-wires approach," says Cyrus Namazi, HomePNA's chairman. "The organization has been instrumental in paving the way and laying the foundation for consumer networking by rapidly bringing to market reliable, affordable and interoperable products."

While HomePNA transmission rates preclude bandwidth-intensive multimedia and video transfer, it is ideally suited to Internet sharing, peripheral sharing and gaming.>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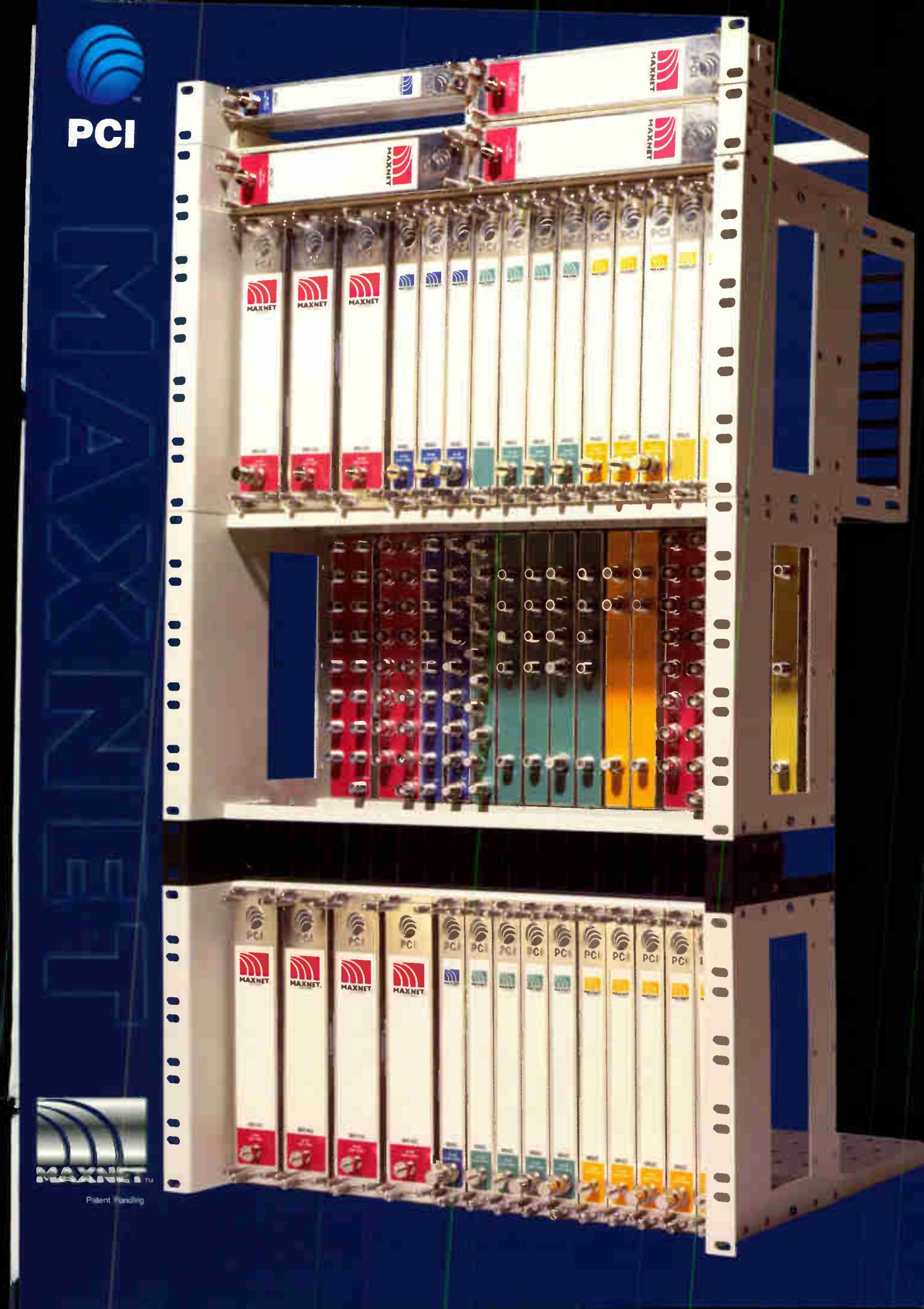
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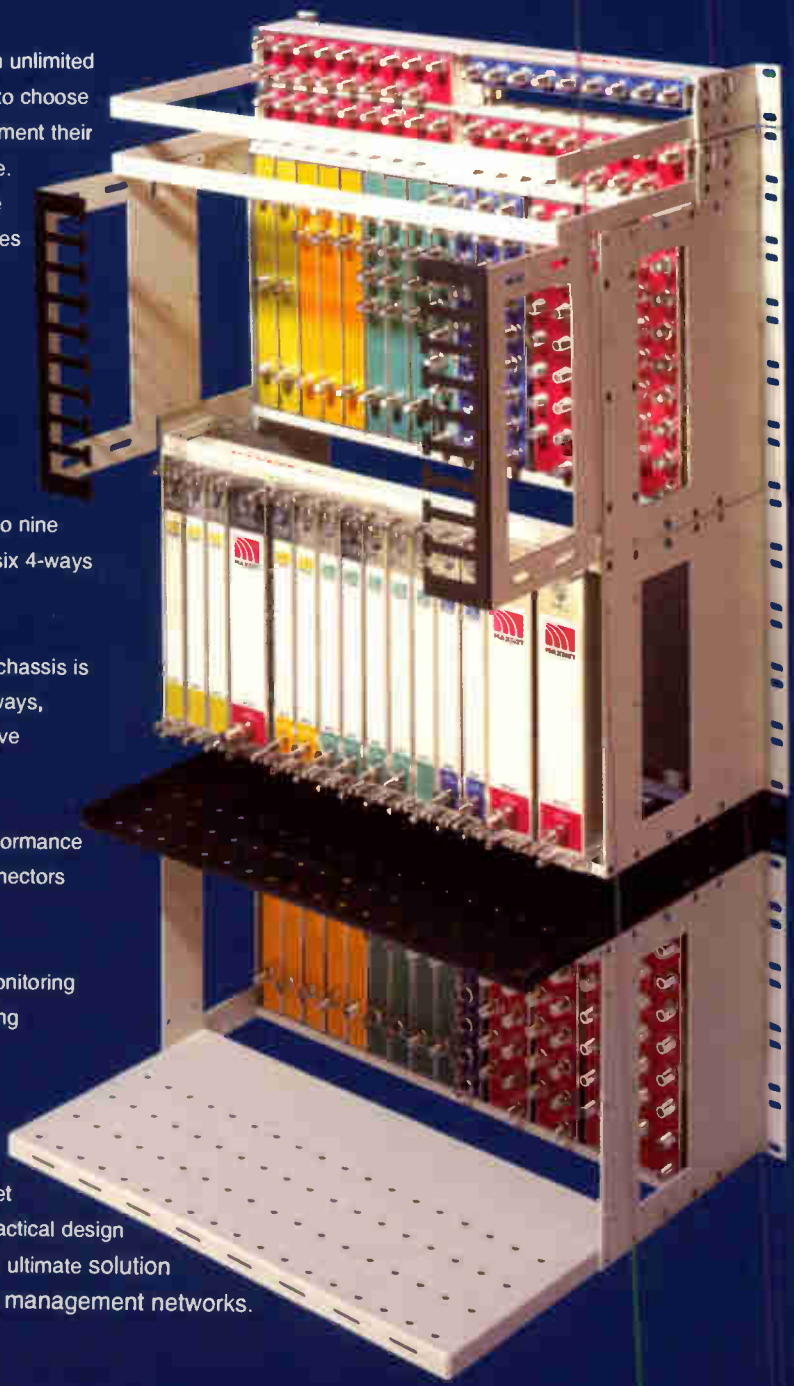

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"HomePNA technology is connectivity agnostic," says Namazi. "The technology is designed to complement cable, xDSL (digital subscriber line), ISDN (integrated services digital network), analog telephone or wireless satellite connections into the home. More specifically, it extends the reach of the broadband connection from the side of the home to the rest of the home."

Namazi adds that using a PC with the appropriate hardware and software, or a dedicated bridge, HomePNA can bridge to phoneline, powerline and wireless media.

A number of companies today are working on HomePNA solutions. Intel's AnyPoint Phoneline Home Network peripheral component interconnect (PCI) card will deliver 10 Mbps data rates and will be able to distribute full motion video down the road, according to the company.

Motorola's PL 100, the first Data Over Cable Service Interface Specification (DOCSIS)-certified home networking-capable cable modem, uses a HomePNA 2.0 interface to support multiple PCs with data rates up to 10 Mbps.

"This product will not only deliver fast Internet access to every computer and device in the home, but will form the basis for a family of advanced services from telephony to security to remote monitoring," says John Burke, vice president of marketing for Motorola's IP (Internet protocol) Network Systems group.

The modem's software includes a dynamic host configuration protocol (DHCP) server and network address translation to enable Internet sharing using a single IP address. Its networking software also allows peer-to-peer networking and sharing of peripherals.

"The certification of the first HomePNA DOCSIS-compliant gateway product demonstrates the continuing innovation of the vendor community based on the DOCSIS technology," says David Bukovinsky, vice president of broadband services and technology at CableLabs.

ADC is using HomePNA technology to tackle the home networking dilemma before even entering the home by integrating it into its cable telephony residential gateway. "The Homeworx

BOTTOMLINE

> The Network Goes Home

Today's home networks are focused primarily on computer networking and shared broadband Internet access. Tomorrow's home networks will be a different story altogether. These networks will be required to handle a number of applications, including home control and automation, personal computer (PC) networking, home theater and audio/visual component interconnects, and whole-house media and entertainment distribution.

While the concept of home networking is a nifty one, cable operators first must decide whether supporting certain home network applications makes good business sense. From there, you must decide which specific types of networking technologies to support, and you've got plenty to choose from—HomePNA, Bluetooth and HomeRF are just a few.

IP-ISU is a primary-line, externally mounted HFC (hybrid fiber/coax) network interface unit (NIU) that provides full IP telephony and DOCSIS 1.1 data," says Ham Mathews, director of marketing for ADC's broadband networks division.

"Not every piece of home networking] technology makes sense as a cable offering."

—Jay Junkus, KnowledgeLink

"The IP-ISU will connect voice and data services over existing twisted-pair residential wiring using HPNA as a transmission method." Although ADC's IP-ISU mainly supports primary line IP telephony, the use of HomePNA now also will enable home networked telephones and computers (with the addition of some software).

A new twist

Also on the telephone wiring front, Silicon Valley start-up Avio Digital has introduced a technology dubbed MediaWire, which promises to deliver multimedia applications over a home network at speeds of up to 100 Mbps in its first-generation product. Avio enables a single phone line to simultaneously deliver 32 audio channels at 24-bit, eight separate Moving Picture Experts Group (MPEG)-2 video channels at 6 Mbps each, 16 separate phone lines, and 12 Mbps of bandwidth for serial control or transmission control protocol/Internet protocol (TCP/IP) data.

In terms of reach, Avio Digital says its MediaWire product will enable connectivity of more than 100 feet between devices using Category-3 (CAT-3) wiring; using CAT-5 wiring, devices can be up to 300 feet apart. Perhaps best of all for the operator, Avio says its network will function even over existing poor quality wiring, including unshielded twisted-pair "Bell" wiring and untwisted "Quad" wire.

The original equipment manufacturer (OEM) solution, which sells for less than $10 per chipset, already is shipping and was demonstrated in a Scientific-Atlanta set-top box at the Western Cable Show two years ago.

"Cable set-top vendors have been a target market for Avio Digital since the company first went public with MediaWire—we are looking at both MSOs and set-top box vendors as partners for MediaWire integration," says Penny Johnson, director of marketing for Avio Digital.

"The company announced at the CES 2000 show in January that we had demonstrated MediaWire running over cable coax to the CableLabs

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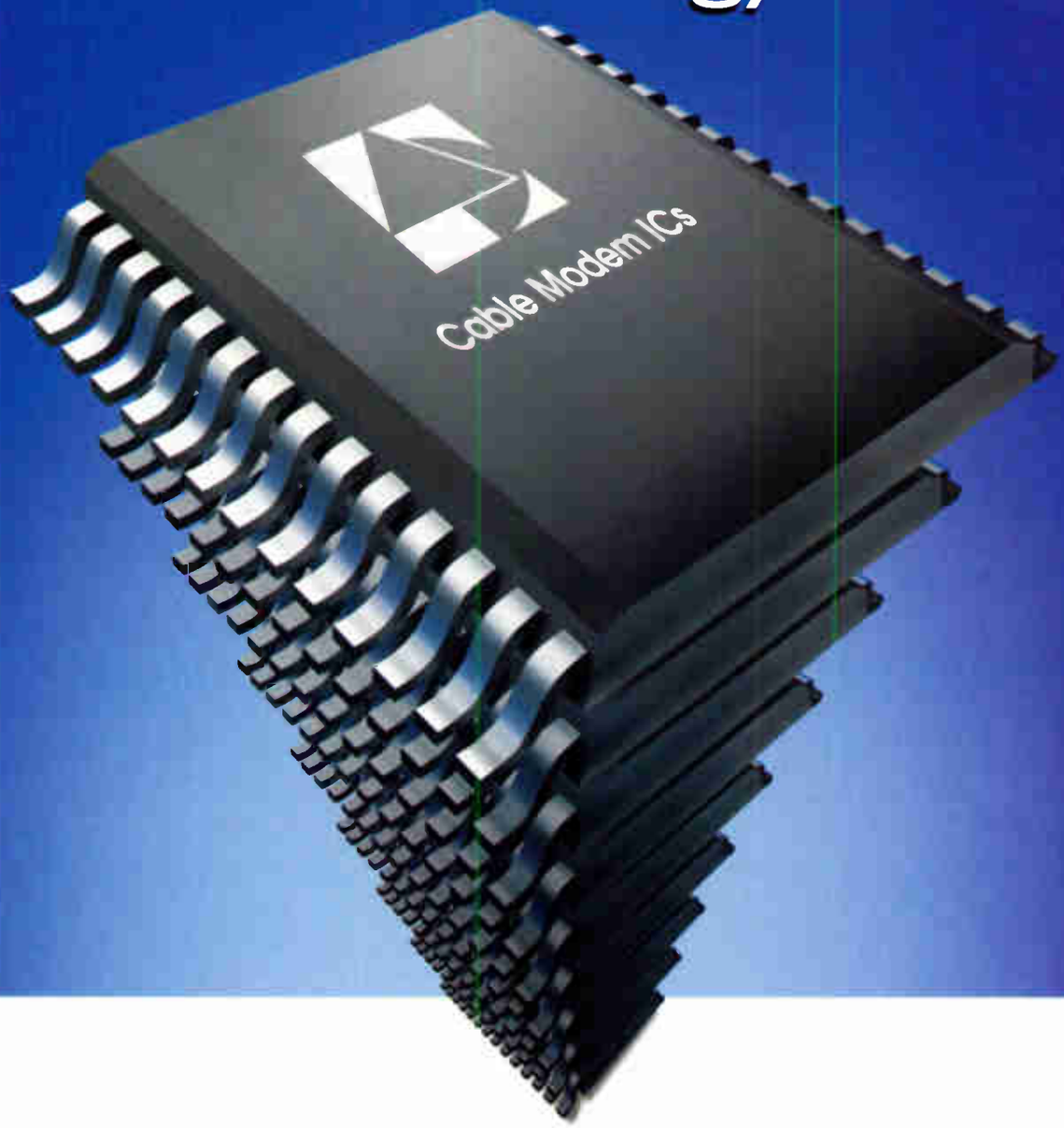

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Consortium, and Avio Digital is currently in discussions with S-A, GI/Motorola, Charter and several other MSO and set-top vendors about MediaWire—all of these discussions have met with positive responses from these vendors," adds Johnson.

The demo with S-A sought to showcase MediaWire's ability to distribute audio, video and control signals using a set-top as the central control device. For S-A, it was a perfect fit.

"Certainly, we think the set-top—because it is connected to the TV, it's typically always on, and you don't have to wait a long time for it to boot up—makes a perfect (device) as the home network controller," says Bill Wall, chief scientist for Scientific-Atlanta.

Wall doesn't see any clear winner in the home networking arena and says his company is looking at a number of technologies in addition to the Avio solution, including wireless.

"It's fairly clear right now that Bluetooth is going to be very popular, and we're certainly working in that arena," says Wall.

Power the home network

Another "no new wires" solution uses electrical wires—a compelling argument when you consider that virtually every room in the United States has an electrical outlet. One provider in this arena is Power Trunk. According to the company, its Channel-Adaptive Technology can transmit data at rates up to 100 Mbps over power lines and at even higher rates over twisted-pair, making it ideal for video and multimedia applications delivered via a cable modem gateway.

Its first product, the PT4400 Integrated Power Line MAC/PHY (media access control/physical layer), is a low-cost complementary metal-oxide semiconductor (CMOS)-based technology initially capable of data rates up to 25 Mbps. The product uses bandwidth above 3 MHz to improve channel response and available bandwidth.

A similar yet lower data rate product soon will be offered by Phonex Broadband. Phonex's solution will enable data rates of up to 10 Mbps over home power lines by using integrated circuit (IC) technology.

"Our power line carrier product will act as bridge to other networking schemes like HomePNA and HomeRF," says Guy Standing, director of sales and marketing for Phonex. "Our first product will be equipped with Ethernet connectors since most of the devices that need linking today have RJ45 Ethernet connections. We will have USB and other connectors shortly thereafter."

Wire ... less

One technology catching the attention of many today is wireless home networking. Its appeal is obvious.

"Wireless is probably the easiest (home networking technology) for an operator to support because you don't need to worry about the availability of

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ATM OC-3/OC-12
Each PCI card provide either four SONET OC-3c, SDH/STM-1, or one SONET OC-12c, SDH/STM-4 compatible output ports capable of supporting either TCP/IP or MPEG-2TS.

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Each PCI card provides TCP/IP as well as other Ethernet-based protocols to the system. It also provides multimedia capabilities over existing LAN infrastructures through the use of UDP/IP. It drives up to four Ethernet interfaces, either 10 BaseT or 100 BaseT.

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outlets where you need them, and interference and ingress concerns are minimal," says Jay Junkus, president of KnowledgeLink.

"It's fairly clear right now that Bluetooth is going to be popular, and we're certainly working in that arena."

—Bill Wall, S-A

The HomeRF Working Group, a consortium of 80-plus companies formed in March 1998, has developed a specification for wireless home networking called Shared Wireless Access Protocol (SWAP). SWAP is designed to carry voice and data traffic at up to 2 Mbps using 2-FSK (frequency shift keying) modulation. It operates in the 2,400 MHz band and uses a digital frequency spread spectrum radio.

A more promising standard on the wireless front, however, is Bluetooth. The Bluetooth Special Interest Group (SIG), led by 3Com, Ericsson, IBM, Intel, Lucent, Microsoft, Motorola, Nokia and Toshiba, today counts more than 1,200 member companies.

"Bluetooth employs a frequency hopping, spread-spectrum technique and hops very quickly—1,600 hops per second using short data packets," says Chuck Merk, vice president of broadband access products for Silicon Wave.

Bluetooth uses binary Gaussian FSK modulation to enable data rates up to 1 Mbps, limiting its use for video and multimedia. However, Merk says Bluetooth's fast hopping rate gives it an edge over HomeRF or the Institute of Electrical and Electronics Engineers 802.11 spec. Cahner's In-Stat Group predicts more than 600 million Bluetooth units will ship by 2005.

While there aren't any products on the market today using Bluetooth, a number of companies have announced plans for product availability this year. Merk's Silicon Wave is one of those. The company is working on a single-chip cable TV tuner IC solution, which will be designed to support DOCSIS cable modem specifications.

Making choices

Obviously, cable operators have a handful of home networking options. Before adopting any specific technology or choosing to support home networks in general, be sure and keep these few things in mind.

"First and foremost, an operator needs to be concerned about the potential profitability of a service offering," says Junkus. "While tying together PCs, entertainment centers and information appliances may be a neat idea for consumers, not every piece of the technology makes sense as a cable offering."

Secondly, Junkus suggests running a cost-benefit analysis of home networking for current and future service revenue generation. Examples include personal TV, home security and appliance control—all of which consumers may be willing to buy monthly.

"Third, an operator contemplating any offering based on in-home networks should have a plan for qualifying or certifying the consumer's network," cautions Junkus. "If you are planning to support services based on that network, you need to be certain the network can support your offering without extensive trouble-shooting and service calls."

Richard Annibaldi, senior manager of technical research for Pioneer New Media Technologies, echoes this sentiment. "Besides avoiding new wiring, cable operators may want to consider how widely supported an approach is and whether it complies with any existing standards." CT

Doug Larson is senior editor of "Communications Technology." Did this story help you? E-mail jwhalen@phillips.com.

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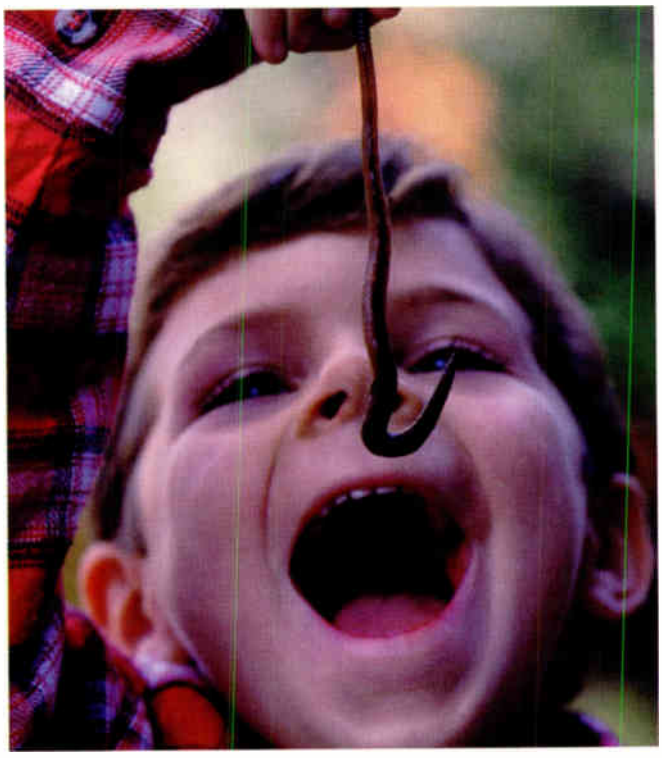

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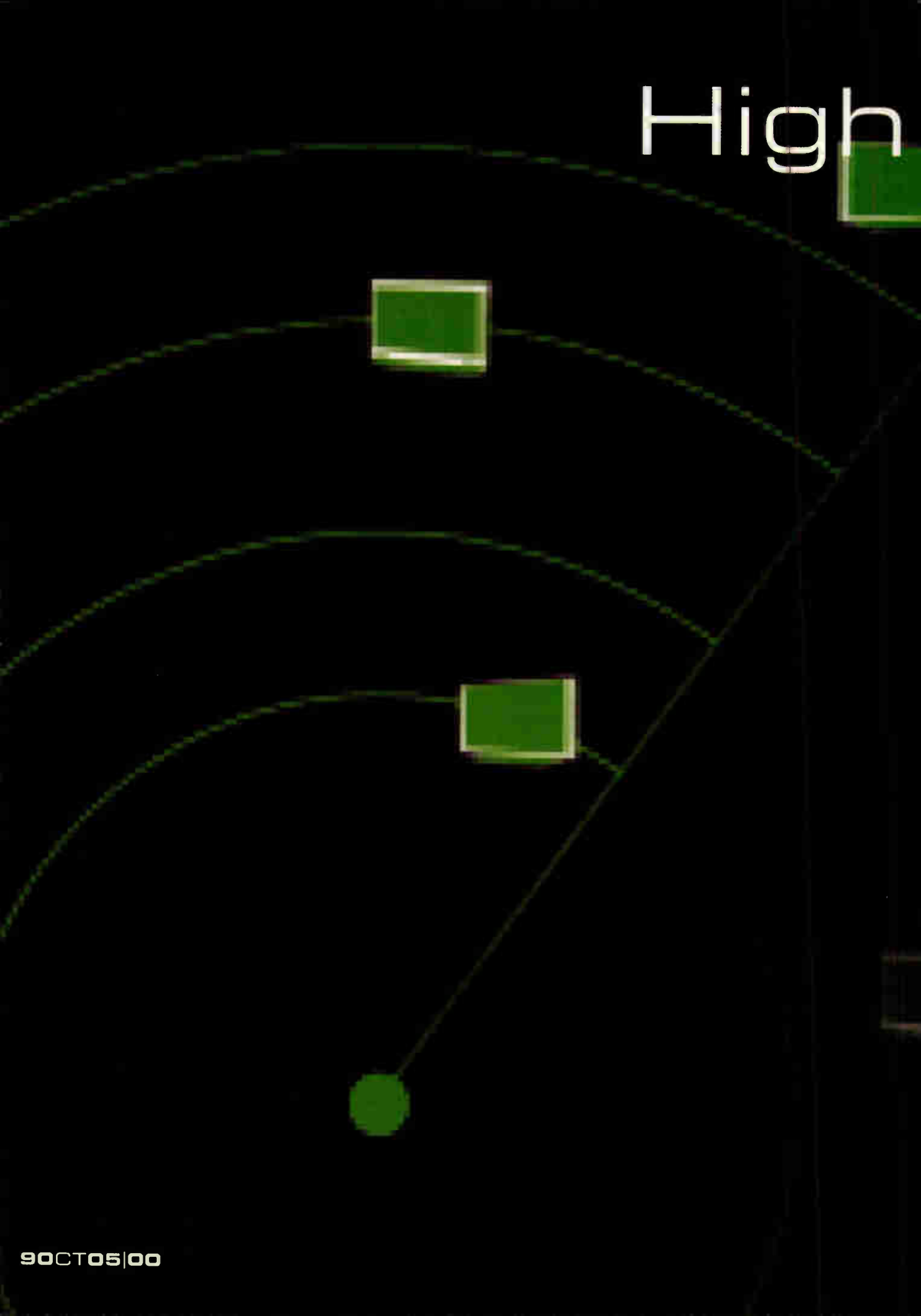
High

Definition HOLDING PATTERN

HDTV Sets Sell, but Cross-Industry Inertia Remains

By Arthur Cole

So the great era of digital high definition TV (HDTV) is upon us, where government and industry groups work hand-in-hand to deliver higher resolution and more robust pictures to the eager masses, right? Not!

Nearly a year-and-a-half into the transition, industry groups are still squabbling, the government is getting annoyed, and the masses don't seem to be exactly eager. So what's gone wrong? And is there a way out of it? Fortunately, the problems are not insurmountable, and the process could easily get back on track with a little good old-fashioned cooperation. Already, there are signs that the industries are starting to work together again and that the government is ready to take on the leadership role.

Players' positions

It's only natural that each industry group has its own best interests at heart with the advent of something like HDTV. Consumer electronics manufacturers want to sell more and better TV sets, and they accuse broadcasters of dragging their feet in getting the signals on the air. Broadcasters don't want to put signals on the air that nobody can watch, and they accuse the set manufacturers of failing to develop sets that can pick up the HD signals without a lot of expensive aerial equipment. And cable? Well, everyone is mad at cable operators, accusing them of being unwilling to pass through HD signals in all their glory. >

Because cable owns the widest pipe into the home, the industry is in the driver's seat when it comes to HDTV. Without cable on board, few viewers are going to make the investment because they'll receive only a few over-the-air channels. Fortunately, most large cable operators are enthusiastic about HDTV, if only because it gives them a competitive advantage over satellite.

"The big question, of course, is whether the technology will catch on with viewers."

"HD will be very good for us if consumers embrace it," says Jim Chiddix, vice president of engineering at Time Warner. "Cable has more bandwidth to carry HD than satellite."

Think about it. A typical cable plant will carry the simulcast feeds of a handful of broadcasters, plus marquee cable networks. Satellite, if it wants to provide a service equivalent to cable, will have to carry the cable nets plus all of the broadcasters that launch HD. That's about 1,500 simulcast feeds. All that data funneled through one or two satellites will put a damper on other advanced services as they come down the pike.

Hurdles, past and future

But the big question, of course, is whether the technology will catch on with viewers. Opinions vary, but many observers say HD will be a big hit if programmers support the format from the outset and set manufacturers can get the price down to a reasonable level. Both of those requisites seem to be falling into place.

Broadcasters in the top markets are putting out a fair amount of original HD programming and are simulcasting their regular programming, even though few sets have found their way into consumers' homes. Thank the Federal Communications Commission for giving the broadcasters a little push in that direction. And a number of cable programmers, such as HBO, are offering HD movies, sporting events and other specials. At the same time, set prices are coming down. Sony and Panasonic are offering cathode-ray tube (CRT) screens in the $3,000 to $5,000 range, with larger projection systems coming in around $7,000.

This is still a stretch for middle America, but it's better than the $10,000-plus models of just a few years ago. And the sets are selling. More than 150,000 units have shipped since they went on sale in August 1998, according to the Consumer Electronics Association. In January, manufacturers shipped more than 20,000 sets, a 475-percent increase over January 1999. The CEA predicts that 10 million sets will have sold by 2003, with an installed base of 30 million sets by 2006. (See Table 1 on page 96.)

For cable operators, the crucial question is whether it is in their best interests to deliver anything less than the full resolution they receive from broadcasters and other programmers. Most programmers will cry foul should they be prevented from reaching viewers in full HD, and that's a reasonable concern for those providing premium movies and other entertainment programming. But do consumers possess a real and pressing desire to view C-Span or CNN in HD?

"There's no hard and fast rule as to what quality you have to devote to each program," says Don Dulchinos, vice president of advanced platforms and services at CableLabs. "There's the quality of the program to consider, whether there's a lot of activity vs. a talking head. These will all determine how much compression to apply and how much data will be devoted to each program."

This fundamental question probably is one of the issues the FCC will look into as it commences the first of what will be many periodic reviews of the transition process. Already, some groups are calling on the Commission to go as far as mandating minimum display requirements, not only for

BOTTOMLINE

> HDTV Status Report

The transition to digital TV (DTV) is moving along at a slow but steady pace, but that fact doesn't necessarily prevent the broadcast, cable and consumer electronics industries from taking pot shots at each other. Everyone wants the market to pick up speed, but fingers are pointing as to who can jump-start it.

As the Federal Communications Commission begins its scheduled review of its rule-making ushering in the DTV era, there are signs that high-definition TV (HDTV) could become a monster, provided industry leaders brush up on their cooperative skills.

A case in point is the recent agreement between the National Cable Television Association and the Consumer Electronics Association to develop a cable-ready HDTV set. That will go a long way toward easing consumer fears that the new sets either won't be compatible with their cable systems or will require additional hardware to connect to cable.

But other steps need to be taken. Set manufacturers need to come up with a good way to overcome the need for expensive antennas to pull the digital signals off the airwaves. This they promised to do last year when some broadcasters were pushing for an alternative transmission system that reportedly fixed many of the HD sets' reception problems. It's time for the set manufacturers to deliver the goods.

And where does cable fit into all this? If the technology catches on with the public, high definition could very well become your best friend because you can deliver it a whole lot easier than the satellite folks can.

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High definition TV sets such as these will soon be entering your customers' homes in ever-increasing numbers, so it's wise to start making provision for HD carriage now. Photos courtesy of Panasonic and Sony

Top left: Panasonic PT42PDI-P
Bottom left: Sony FD Trintiton WEGA
Right: Panasonic CT34WD M60 Tau

> Getting the Gear: HDTV Set Manufacturers

Lest you think that high definition TV (HDTV) is just a flash in the pan, think again: All of the following companies now offer (or will in the next few months) integrated HDTV sets. All use a 1080 interlaced scan format and line doubling, and they range from 30 to 65 inches wide. While they're still pricey—from $3,499 to $11,000 and averaging about $8,200—they're clearly here to stay.

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Pioneer
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RCA
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Sanyo
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SharpVision
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cable operators, but for set manufacturers as well.

The cable industry and the manufacturers already are taking steps in this direction. The National Cable Television Association and the CEA recently announced a set of specifications for the cable-ready HD sets, which would avoid the need for a separate converter box.

"Technically, it's resolved, although there are still some labeling issues to work out," says Bill Check, vice president of science and technology at the NCTA. "There are some companies that aren't sure if they want things like an IEEE 1394 connection, but these issues can be easily resolved."

The agreement specifies the signal level and quality of the picture, as well as the video formats to be used. It also sets the program and system information protocol (PSIP) to be used for on-screen guides, advisory information and other program data.

CableLabs has incorporated the specs into the OpenCable platform to ensure that the sets are fully compatible with compliant cable systems. >

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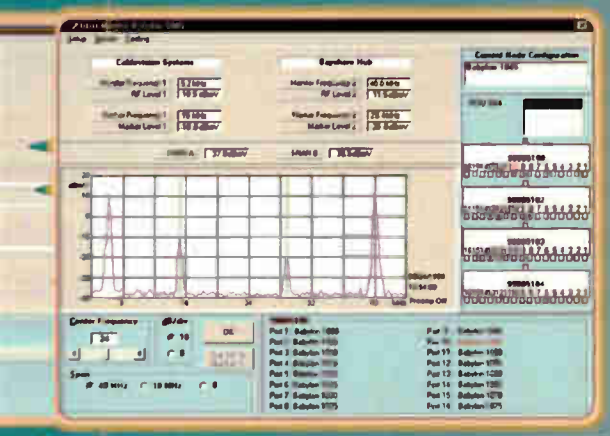

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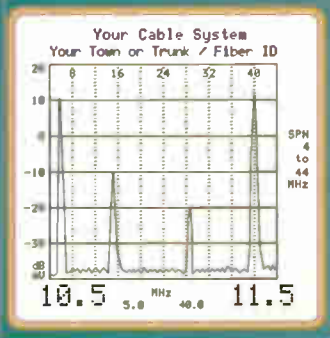
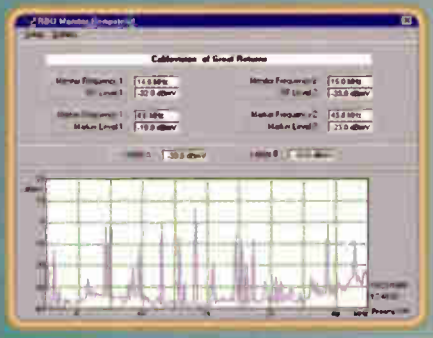
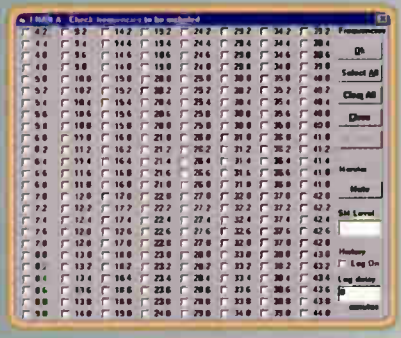


Video Output with Test Carrier Levels



Monitor Screen; Impulse Noise Present



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The single biggest stumbling block to an HD universe is over-the-air transmission. Late last year, a good 25 percent of the broadcast industry petitioned the FCC for the right to use a competing transmission scheme to the 8-VSB (vestigial sideband) method approved by the Commission. The broadcasters wanted to use a method known as coded orthogonal frequency division multiplexing (COFDM), which already has been adopted in Europe and Japan; however, it isn't compatible with anything commonly used here in the States.

TABLE 1 PROJECTED HIGH DEFINITION TV SALES

1998-2003:	10 million
2004-2005:	10 million
2006:	10.8 million

Source: Consumer Electronics Association

Not too surprisingly, the request was denied, leaving many broadcasters grumbling that the current system leaves too many dead spots in urban areas and does not work at all with mobile antennas.

Set manufacturers argue that new generations of receivers will be able to overcome this problem, but until those units hit the mass market, the transition to HD likely will remain in the slow lane.

Make haste slowly

Still, it's fair to say that there remains considerable enthusiasm for HDTV across all of the industries involved. And the transition really is taking place, although not at the rapid pace for which some advocates had hoped.

"We are moving forward; there is a lot of forward momentum," says Mark Richer, executive director of the Advanced Television Systems Committee, which developed the digital broadcast system. "Broadcasters are implementing digital TV each day. It's just that some people are losing sight of the progress we have made." CT

Art Cole is a contributing editor to "Communications Technology." To comment, e-mail acole602@aol.com.

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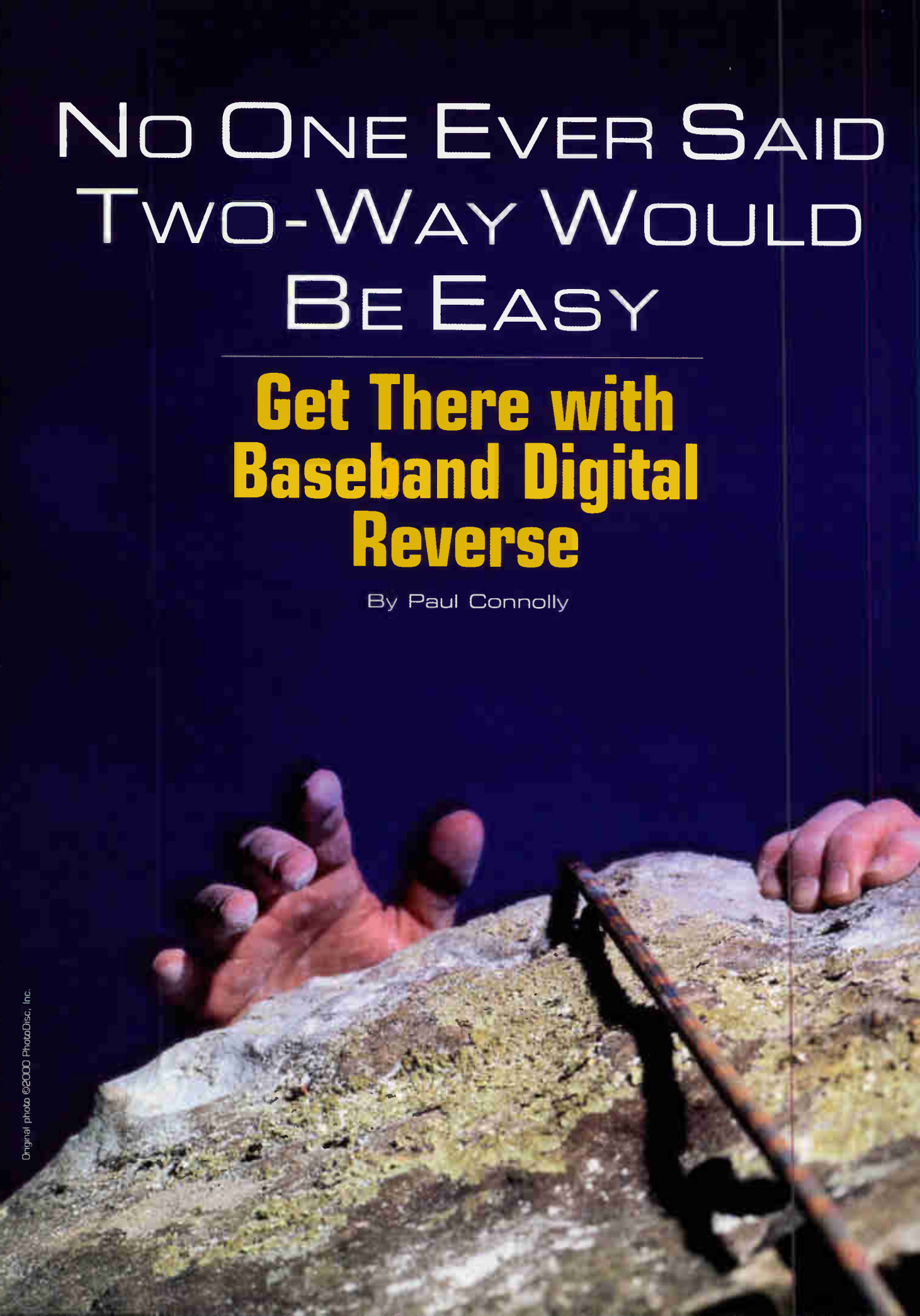
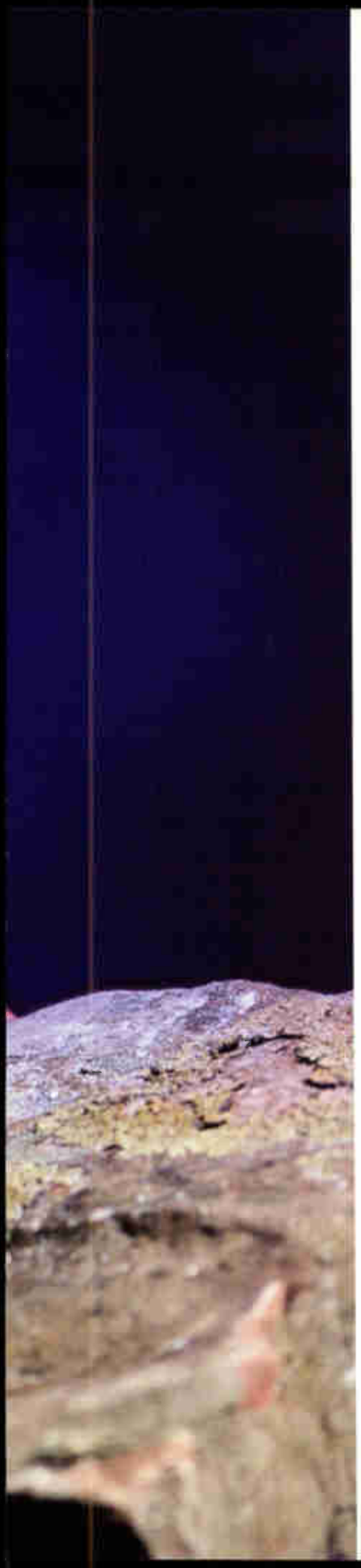
By Paul Connolly





As interactive services flood the network, cable engineers are faced with a dilemma. They must create additional reverse path capacity for bandwidth-consuming interactive traffic, while trying to control costs. They also need to reduce the number of users per node to allow multiple services on a single fiber.

Digital reverse technologies can help engineers increase reverse path bandwidth without significantly raising costs.

The simple, yet major, architectural challenge facing operators is that they designed their existing networks to transmit in one direction to many locations. Interactive services make it mandatory that signals also be carried from many locations to one source—often over long distances. Plus, as operators face increased competition, network reliability becomes increasingly important.

Architectural challenges

Because analog signals become weaker over long distances, some operators have designed their networks to handle reverse path traffic at the hub. The complicated process of receiving, converting and retransmitting analog signals from multiple nodes and the necessary associated equipment has resulted in hubs' becoming large, expensive structures.

Then, to transmit the signal from the hub to the headend, some operators have tried a variety of options, including dense wavelength division multiplexing (DWDM), frequency stacking and RF combining. These can be effective, but with reduced node sizes and a large number of upstream paths, these solutions can become costly.

Headend consolidation also impacts this portion of the network and results in increasing distances between the headend and the homes. As mentioned, the analog signal is subject to noise as distance increases, especially in the upstream direction. The resulting dilemma: A reliable signal and high bandwidth requires headend equipment to be closer to the homes. But maintenance and capital costs related to that equipment force it away from the homes. (See Figure 1 on page 100.)

The digital solution

One solution to this predicament is the implementation of baseband digital technology in the reverse path. While the cost of applying digital solutions was prohibitive in the past, the use of digital signal processing (DSP) has become more affordable. Overall, baseband digital reverse can be less expensive when considering upgrade costs for new services and its ability to reach more subscribers with a single fiber.

Because the digital signal is relatively immune to the effects of noise and temperature, it offers more reliable performance and transmission over long distances. Digital also offers greater bandwidth than analog, which

FIGURE 2 DIGITAL REVERSE PERFORMANCE

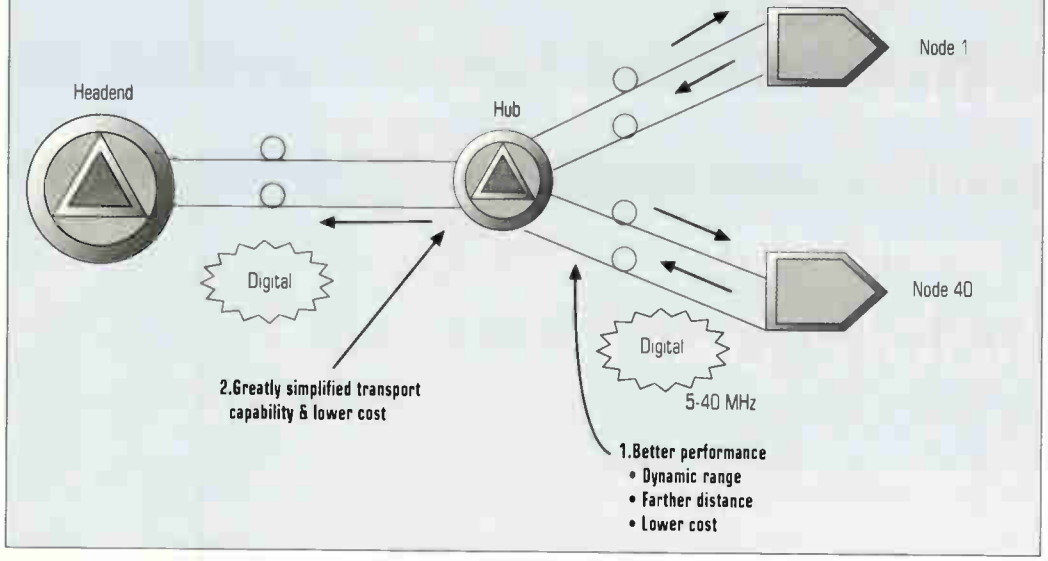
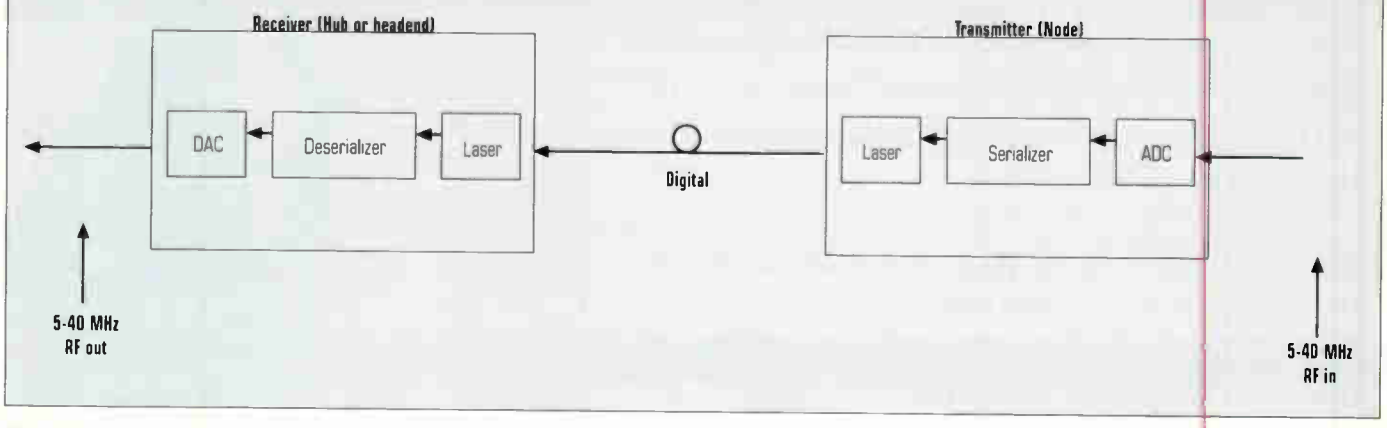


FIGURE 3 INCREASING CAPACITY



digital reverse path solutions. For example, AT&T Broadband & Internet Services has deployed the technology in its systems in Dallas, Denver and Pittsburgh to handle the increased traffic related to the introduction of multimedia and interactive services in those areas.

"Because a digital signal is more robust than analog, maintenance costs are reduced."

Because a digital signal tends to be rather more robust than analog, maintenance costs are reduced; transmission is less likely to be affected by noise, temperature, frequency drops and other analog problems. Subscribers are happier because the signal is less likely to be interrupted for maintenance. And the option of completely bypassing the hub and transmitting directly from the node to the headend also reduces expenses for operators who are in the process of building networks or want to create passive hubs. (See Figure 2.)

Variety of applications

Digital technology's flexibility makes it applicable to many situations. In existing networks, receivers can be installed at the hub or headend, depending on the operator's preference, architectural choices and constraints for where the information is processed.

Digital reverse path technology also is useful for densely populated areas because its high capacity allows a large number of subscribers to be processed through one fiber. It also offers the extra bandwidth necessary for future network expansions.

As cable adds interactive services and expands channel lineups, digital solutions in the reverse make considerable sense. The need to efficiently transmit numerous signals to one location, carry high volumes of multimedia content, and improve the reliability and management of the network make digital technology another useful tool in the battle for bandwidth. CT

Paul Connolly is vice president of marketing and network architectures for Scientific-Atlanta. He can be reached via e-mail at paul.connolly@sciatl.com.

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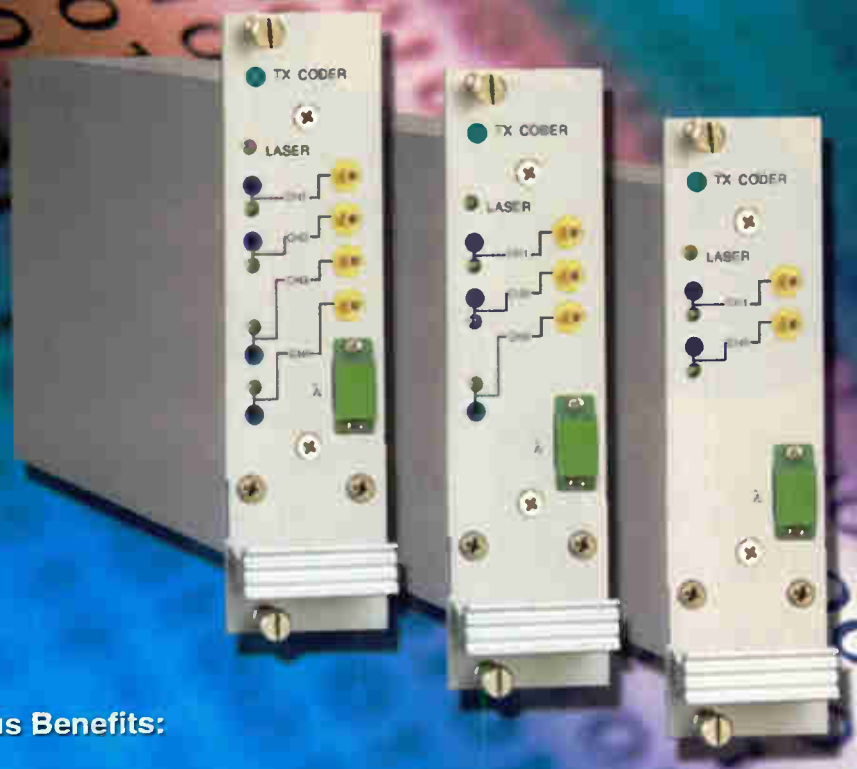

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can be replaced with a 56 kbps link, this would equate to about $1,500 per month.

Architectures for regional control

Figure 1 provides two examples of the many cable architectures commonly in use today.

Configuration A consists of a regional headend and control center connected to other remote headends using fiber ring distribution for digital and analog video services. Each remote headend feeds several hubs, with each hub servicing several nodes. The satellite receivers, local encoders, remultiplexers and other signal processing equipment are consolidated at the regional headend where the intermediate frequency (IF) signals are generated and then distributed to the remote locations via fiber.

This configuration is well-suited to cable systems where the bulk of the subscribers are concentrated in a relatively confined geographical area. If the system is spread over a large area, the cost of the fiber distribution may become prohibitive.

An alternative for cable operations that cover a larger area is shown in Configuration B. Signal collection is done at each of the primary headends, eliminating the need for a broadband distribution network connecting the headends. Satellite distribution of video and point-to-point data links replace the fiber distribution system.

Most cable systems are a combination of these two architectures. A system that predominantly utilizes fiber distribution may have the occasional satellite receiver and remultiplexer at some headends. Another system that uses satellite feeds for its headends may have a fiber distribution system hanging off one of the larger headends.

While cable operators are quickly upgrading their plants to support two-way operation, very few systems are 100-percent two-way capable. The larger the system, the more likely it is that sections of plant are operating in a one-way or phone-return mode. >

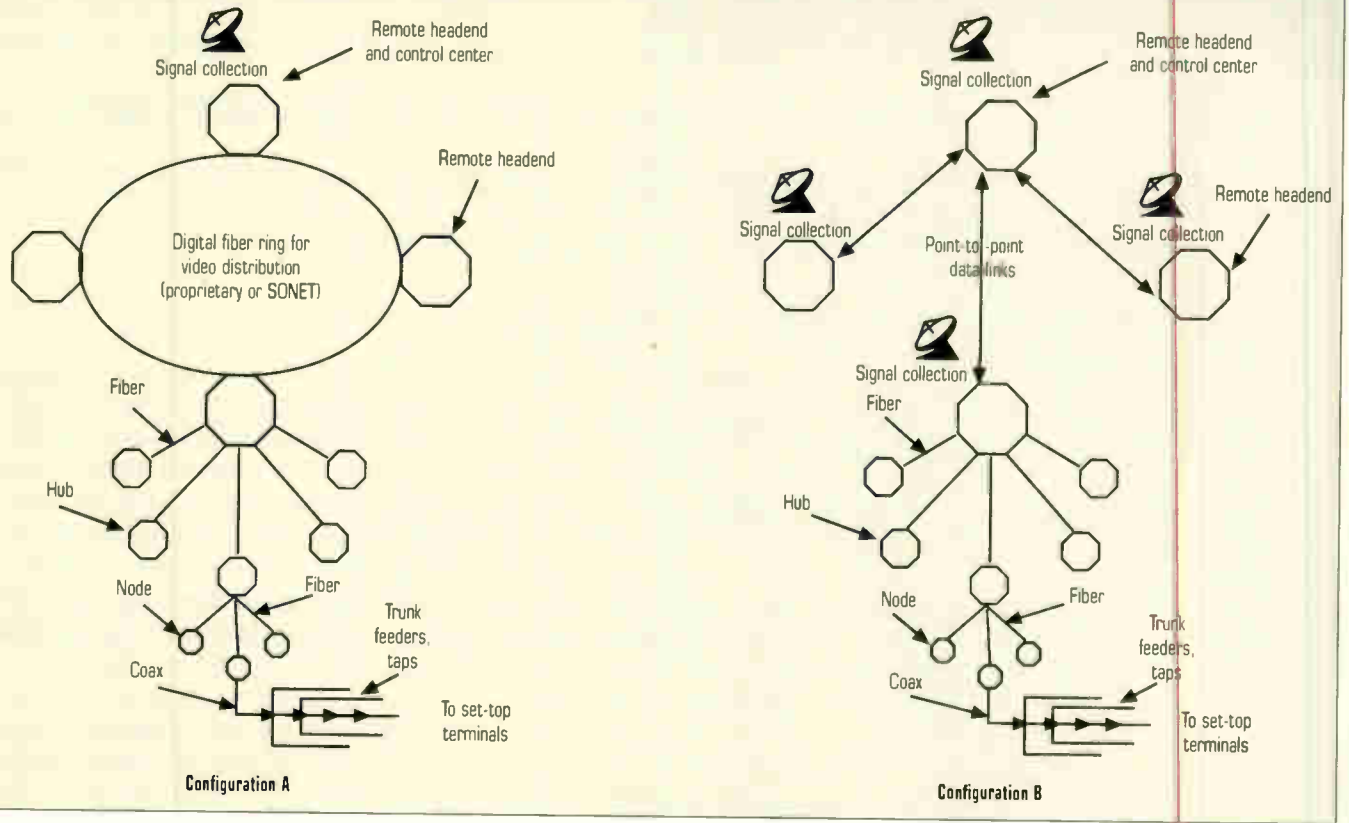
BOTTOM LINE

> Centralize Headend Control

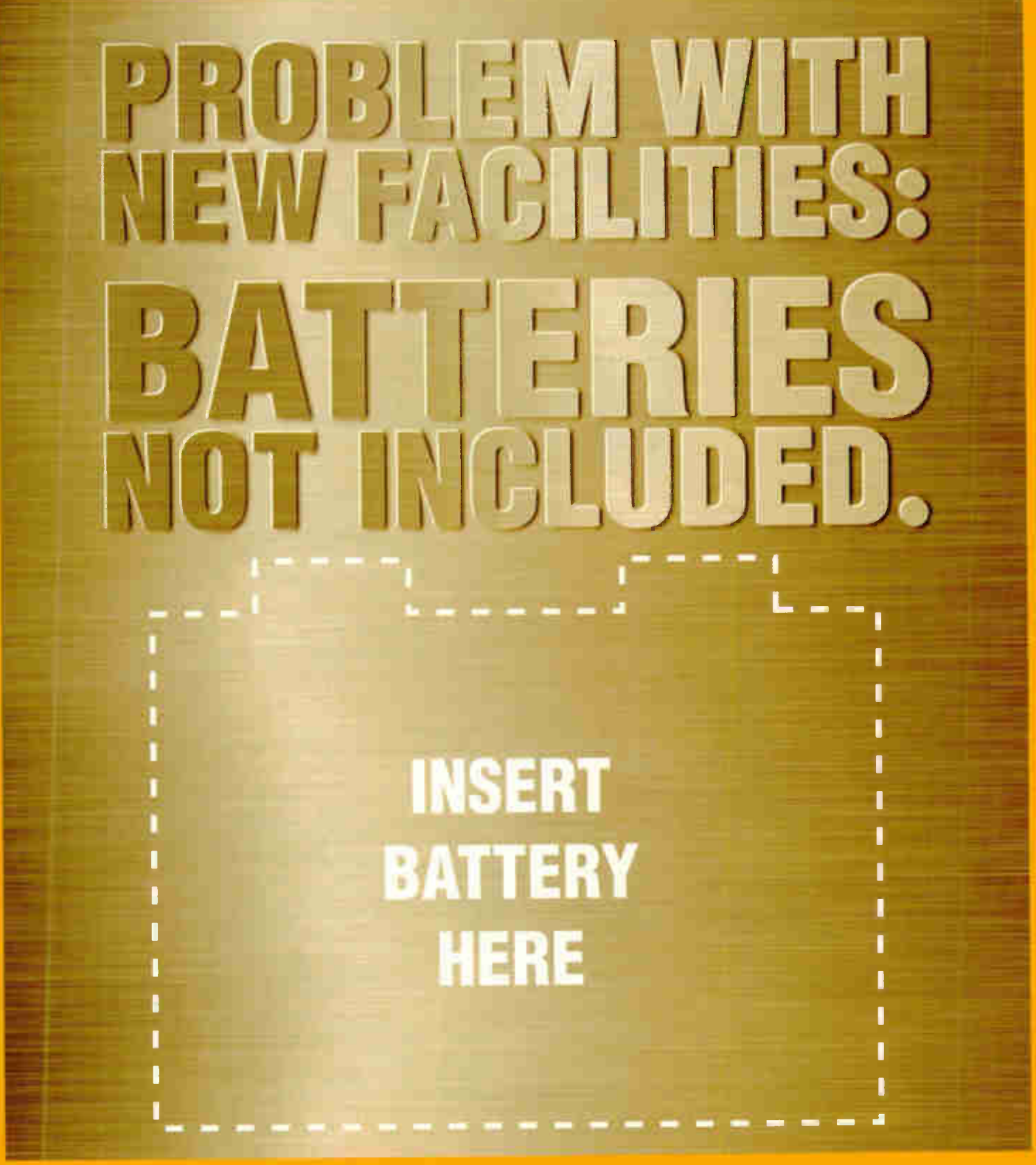
It's more important today than ever for cable operators to select a headend control system that will be scalable and flexible enough to accommodate future expansion. A digital addressable controller (DAC) system capable of regional control can reduce both upfront investment in equipment and ongoing operating expenses.

From a single location, a regional DAC can control multiple small, medium and large headend facilities, even if they have independent satellite receivers, different channel lineups and different out-of-band (OOB) frequencies. Because the cable operator does not need to deploy a local controller at each remote headend facility, operating costs are reduced, and fewer high-level engineers are needed at each remote headend.

FIGURE 1 MULTIPLE HEADEND SYSTEM ARCHITECTURES



PROBLEM WITH NEW FACILITIES: BATTERIES NOT INCLUDED.



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> Shaw Touts Regional Control

By Barry Middlebrook

Shaw Cablesystems, Canada's second largest multiple system operator (MSO), continues its digital cable rollout. More than 150,000 subscribers across seven provinces have access to digital technology via more than 50 cable systems supported by 20 regional headends. Shaw's goal is to give all of its subscribers access to digital cable by the end of the year.

Shaw's widespread digital deployment stems largely from a flexible and scalable network whereby a centralized Unix-based digital addressable controller (DAC) serves the entire company. The central DAC, located in Calgary, Alberta, is based on Motorola's (formerly General Instrument's) multiple regional headend control technology and manages 20 remote digital headends via satellite. (See Figure 3 on page 110.) Because Shaw's systems span Canada, the MSO uses satellites to supply its headends with digital programming.

Shaw's hybrid data network sends downstream data destined for set-tops over one-way satellite links and the remaining data over a variety of standard transmission control protocol/Internet protocol (TCP/IP) terrestrial data networks. Minimal bandwidth is needed on the terrestrial data links—less than 56 kbps per link. The satellite data link is piggybacked on Shaw's uplinked video multiplexes that already are being distributed to the remote headends, so the additional cost to implement the satellite data circuits is minimal.

The controller uses terrestrial network links to configure and manage all the headend devices, such as satellite transcoders and out-of-band (OOB) modulators. Upstream traffic from set-tops to the regional DAC also uses these links. All of Shaw's digital cable boxes are two-way cable

return using Motorola StarView modems.

The satellite data link carries all downstream traffic destined for set-tops. Most of this traffic is broadcast in nature, so satellite distribution works well. The same code download streams and electronic program guide (EPG) data feeds, for example, are shared by all headends in the system. Other traffic, such as set-top authorizations and channel maps are more localized and have been split into separate satellite data streams to feed different regions. Satellite transcoders at the remote headends have a secondary function to extract the data and route it to OOB modulators for transmission to set-tops.

Shaw replaced customers' analog set-tops with new digital versions and turned down the unsecured analog scrambling to make those channels available for new services. Shaw harnessed its existing data network to deploy digital cable technology quickly, seamlessly and cost-effectively.

Shaw is finalizing plans to expand its Calgary-based central DAC, which will enable Shaw to deploy more services, such as server-based pay-per-view (PPV), video-on-demand (VOD), Internet routing and interactive TV.

—Barry Middlebrook is director of advanced technology for Shaw Cablesystems. He may be reached via e-mail at barry@shaw.ca.

Top: Shaw Digital Centre, Calgary—The Shaw Digital Centre provides the company's national authorization as well as TV compression and data uplinks.

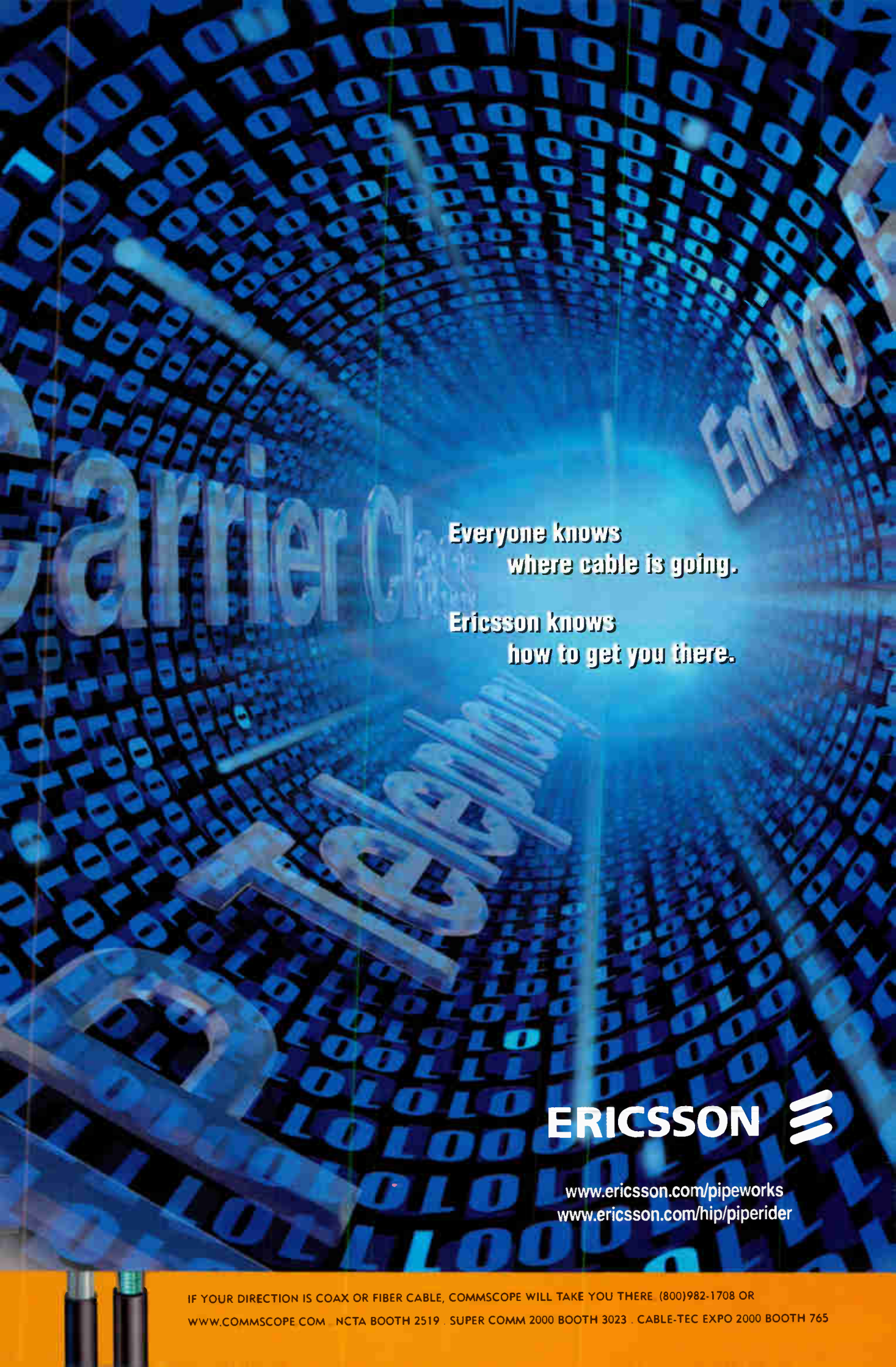
Bottom: Digital Network Technician Neil Rao (left) and Digital Engineer Jeff Tokar (right) operate the regional DAC and NetSENTRY digital status monitoring system for Shaw's digital cable network. Production and backup DAC server are located in the equipment rack on the right. Each DAC is a quad-Pentium 400 MHz server with 1 GB of RAM operating under SCO Unix.

A regional DAC needs to be flexible enough to deal with all types of terminals simultaneously—from one-way through Data Over Cable Service Interface Specification (DOCSIS) return. The alternative is to leave pockets of the operator's subscriber population without the ability to take advantage of any digital services offered on the cable plant.

Although the regional DAC system design allows for a "reasonable" duration network outage during which these remote sites can operate for a significant time period without communicating with the central controller, operators must take the necessary steps to ensure the reliability of their network links. The repercussions of a catastrophic disaster (fire, earthquake and so on) that destroys an entire facility can be mitigated by having a backup facility in a different geographic location and the mechanisms in place for bringing the backup facility online with the necessary network connectivity.

Alternatives to regional control

A couple of alternatives to a regional control scheme are available today. These include using a national control



service or implementing a local control scheme where a DAC is located in

for smaller operators that want to take

tional control service provider would

This arrangement frees the cable operator from the need to purchase, install and manage a control system while letting him offer digital cable services. Similarly, national control may be a good alternative for some large multiple system operators' (MSOs') smaller headends that are not robustly connected to the rest of the system.

Local control is the traditional way to run a cable operation. Each headend has a dedicated controller for its local operations. This setup gives the cable operator complete control over the system, but at the price of installing a DAC and providing personnel technically capable of maintaining such a system at each location.

Desirable features

If you do choose to go with a regional DAC system, the key features to look for are flexibility and scalability. Let's examine each of these in turn.

System flexibility

Because every cable system is different, one of the most important features of a regional DAC is flexibility. The controller must be able to adapt to any number of configurations and allow the system's headend components and set-top terminals to be managed efficiently and effectively.

One approach for ensuring flexibility is to design a generic system hierarchy into the controller that can be overlaid onto the physical cable plant topology. For example, a cable system can be viewed as a collection of downstream plant sections and upstream plant sections. Video and other in-band services as well as OOB services are available on downstream plant.

In different parts of a system, various services may be available (in different hubs, for example). Each of these sections could be considered a different downstream plant. Similarly, each physical return path could be considered a different upstream plant.

Once the regional DAC knows about the various upstream and downstream sections in a system, logically grouping them into headends becomes a straightforward process. Creating this logical overlay on the physical cable plant enables flexible control, because it can adapt to virtually any cable system. System attributes, such as emergency alert system (EAS) overrides, can be defined to have different configurations in different parts of the system. An example of mapping from physical to logical topology is shown in Figure 2 (on page 110).

System scalability

Another key attribute is scalability. An operator must be able to expand existing headends, add entirely new headends, and reconfigure hubs and nodes. These changes will come about because of acquisitions, expansion of digital services into new areas, changing subscriber populations and the

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addition of new interactive services.

With a hierarchy such as the one described earlier, the expansion of the system can be managed easily. New upstream and downstream plant sections are added and then organized under either an existing or new headend to reflect the physical topology. Because the new sections of the cable system are treated as independent entities, the expansion is accomplished without affecting existing operations.

"Auto-discovery allows subscriber set-top installation and automatic configuration by the DAC."

The billing system interface to the regional DAC needs to be carefully considered, especially after separately managed headends are brought together under the control of a single DAC. The regional DAC needs to allow each billing system to control the portion of the cable system that it is responsible for managing, including pay-per-view (PPV) schedule loading and terminal authorizations as appropriate. Ideally, the regional DAC will enforce this separation and reject any billing commands that attempt to control parts of the operation outside the domain of that billing system. Without this capability, consolidating the headends under a single controller would require significant changes to billing operations.

As the number of set-tops at a remote location increases, so does the bandwidth needed between the regional DAC and the remote headend. At a certain point, it becomes cost-effective to install an intelligent message server at the remote site, allowing it to offload the repetitive traffic generation from the centralized DAC, thereby reducing the network bandwidth needed to support the remote headend.

By implementing regional control, you can install message servers at large headends that need it, while smaller headends or hubs can be operated from the regional DAC.

Simplified operation

The hierarchy described here results in simplified operation. Rather than have the billing system manage all set-top terminal attributes on a terminal-by-terminal basis, attributes can be managed by the regional DAC at the level in the hierarchy where they make the most sense.

Many attributes can be managed in this manner, removing some of the burden from customer service

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representatives (CSRs) and the billing system. A couple of examples that tend naturally to correspond to location in the system include channel maps and time zone.

Managing cable system operations at the headend also offers benefits. Polling operations can be scheduled on a headend basis to correspond with the schedules expected by the billing systems responsible for each headend. If the return path frequency is to be changed on a given hub, refreshing set-top parameters limited to the affected upstream plant sections helps keep the system running smoothly.

Polling performance is improved when the regional DAC can associate each set-top with an upstream plant. The regional DAC can implement a parallel-polling algorithm that allows multiple set-tops to be polled simultaneously without any chance for upstream data collisions. This improves the overall polling performance, allowing large populations of set-tops to be polled in a short time.

If the regional DAC cannot associate set-tops with upstream plant sections, the alternative may be to poll all set-tops serially, which is not practical in a large system—polling would take a prohibitively long time. Another possibility would be to poll in parallel anyway, accepting the inefficiency of having some percentage of responses lost because of transmission collisions.

Auto-discovery

To take advantage of the benefits described earlier, the regional DAC needs to know where each terminal is located in the system, including the headend, downstream plant and upstream plant.

Traditionally, operators have relied on the billing system to pass that information to the DAC, but often the location information was inaccurate or incomplete. The billing system generally knows the headend and hub where a set-top is installed, but often lacks node-level information.

A better approach is to let the regional DAC determine set-top location automatically, based on a downstream and upstream message transmissions. Once the regional DAC determines where the set-top is, it can pass the information back to the billing system.

This approach helps enable the distribution of set-tops from retail outlets. In the retail model, it is difficult to know where a given set-top will end up in the cable system. Auto-discovery allows subscriber set-top installation and automatic configuration by the regional DAC based on the discovered location. The billing system can then be informed about the set-top and customize its configuration and authorizations based on the subscriber's account information.

A regional control system enables a cable operator to reduce up-front investment in control system equipment and ongoing operating costs. Once implemented, a regional control system offers many benefits, including simplified overall system operation, improved performance, and a clear path for system expansion. CT

Art Jost is senior staff engineer of Motorola's Broadband Communications Sector. He can be reached at (215) 323-1759.

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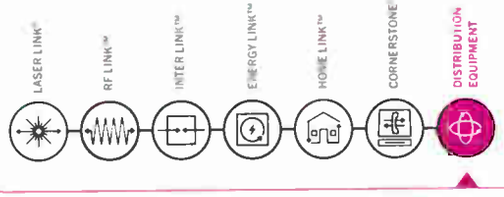

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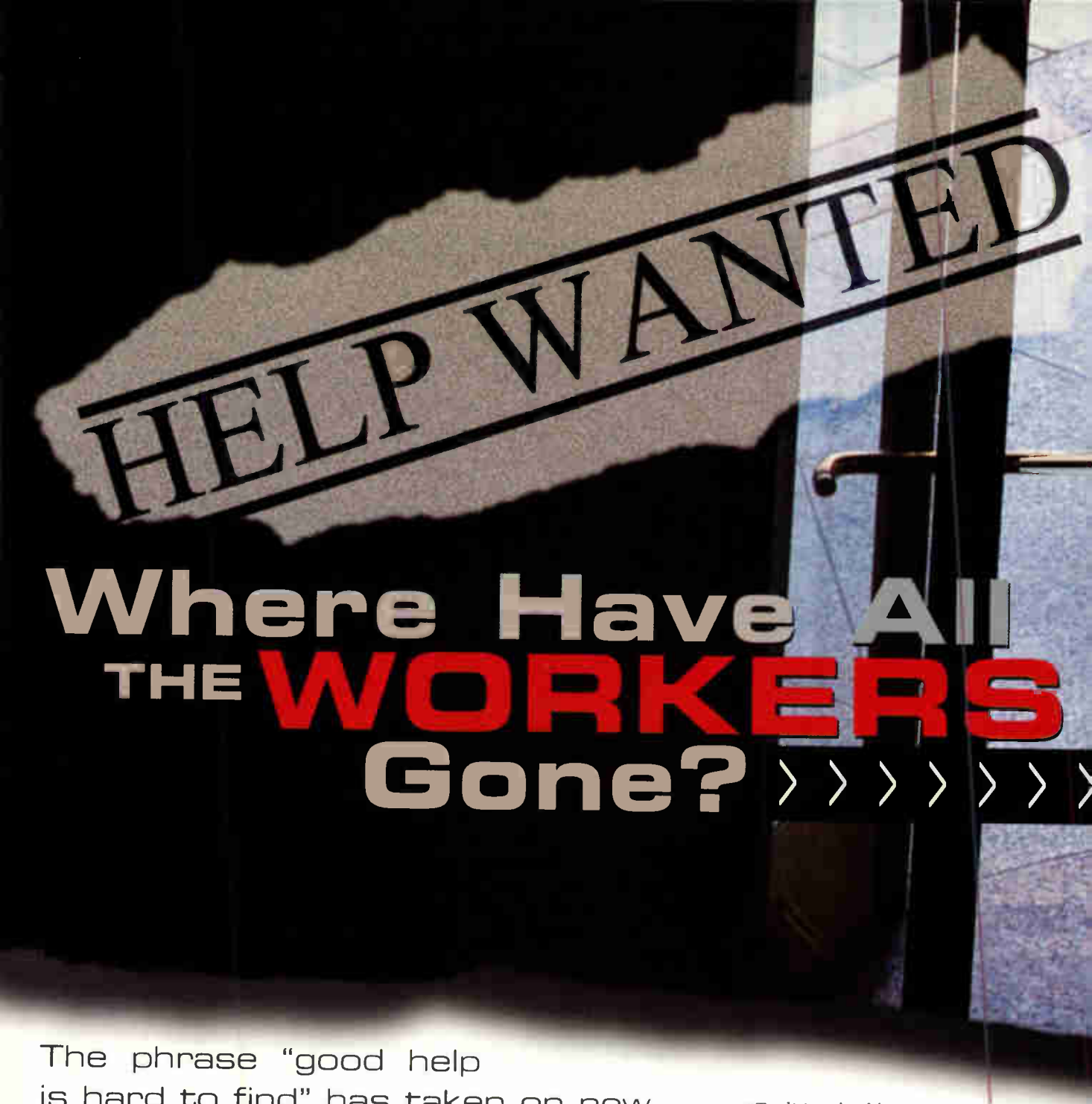


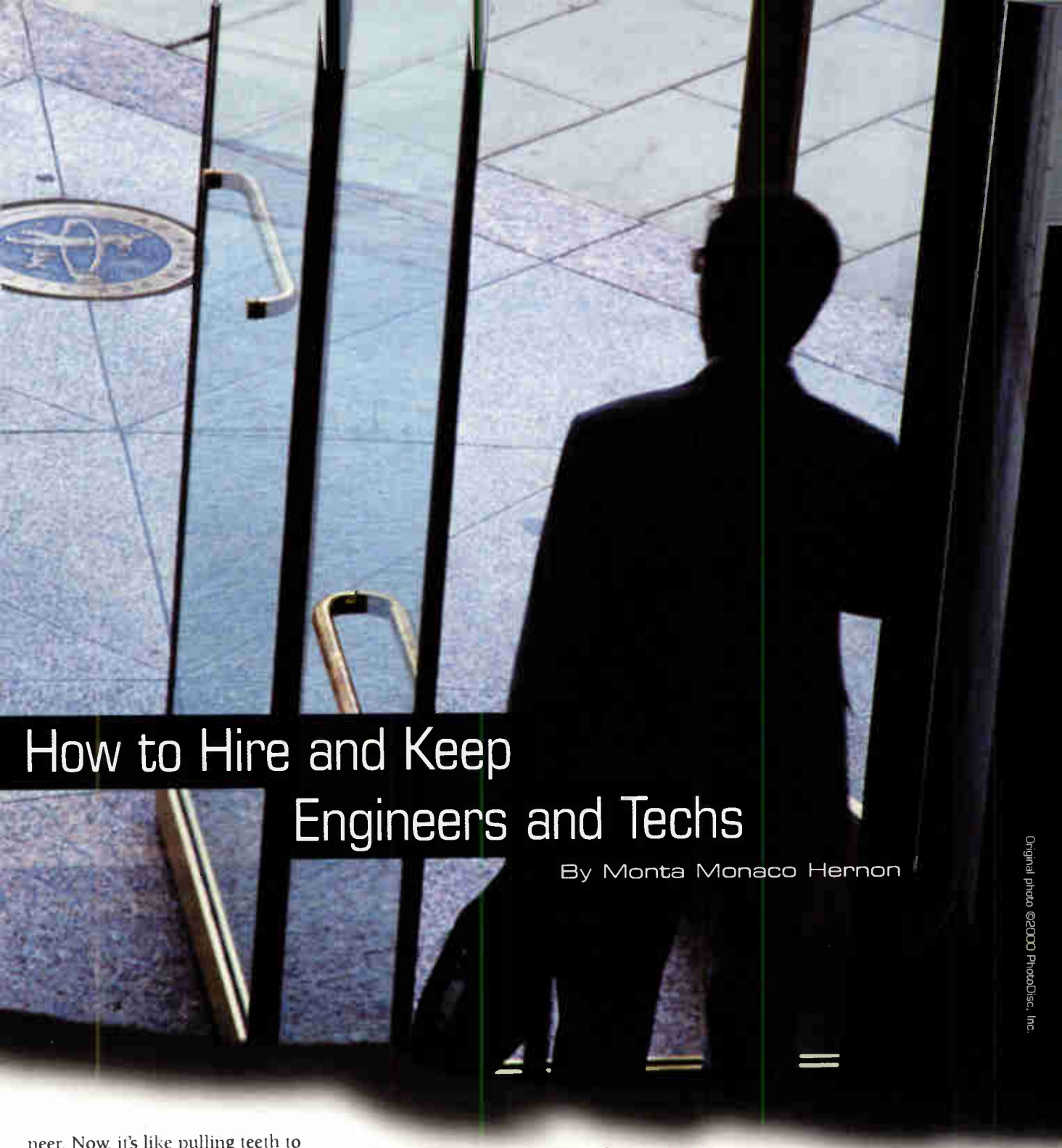
Where Have All THE WORKERS Gone?

The phrase "good help is hard to find" has taken on new meaning for the cable industry in the past few years. Convergence has meant that multiple system operators (MSOs) are competing with telcos, Internet service providers (ISPs) and high-tech start-ups for the same engineers and technicians.

"Traditional cable television engineers are in demand with the overbuilders and new ventures that are going to provide voice, video and data services," says Chuck Morris, founding partner of Warren, Morris & Madison, a telco and cable search firm.

According to Scott Shelley, vice president of operations for Prime Communications, a 15-year veteran, the employment situation has never been so competitive.

"It used to be that we could always find a good cable technician or engi-



How to Hire and Keep Engineers and Techs

By Monta Monaco Hernon

neer. Now, it's like pulling teeth to find someone," he says.

Numbers indicate that turnover has increased as well.

Cox Communications Vice President of Human Resources Judy Henke says she has seen a 5-percent rise in turnover in the employee segment that includes engineers and technicians as compared to 1995. At her company, the rate currently is about 15 to 20 percent.

An offer they can't refuse

One problem for cable companies is that high-tech start-ups, including some of the so-called "dot com" firms, are offering attractive stock options. An employee might take a risk in signing on with them, but gets to work in a highly energized make-or-break environment that offers the potential for becoming wealthy very quickly.

"Early stage stock options allow everybody (in the company) to go out and capture the rainbow or earn multiples of income that they couldn't receive (otherwise)," says Morris.

Cox, for example, lost several employees when a new company in Atlanta waved stock options at them.

"It was the promise of becoming very wealthy very fast," says Dick

Mueller, vice president of operations and engineering for Cox.

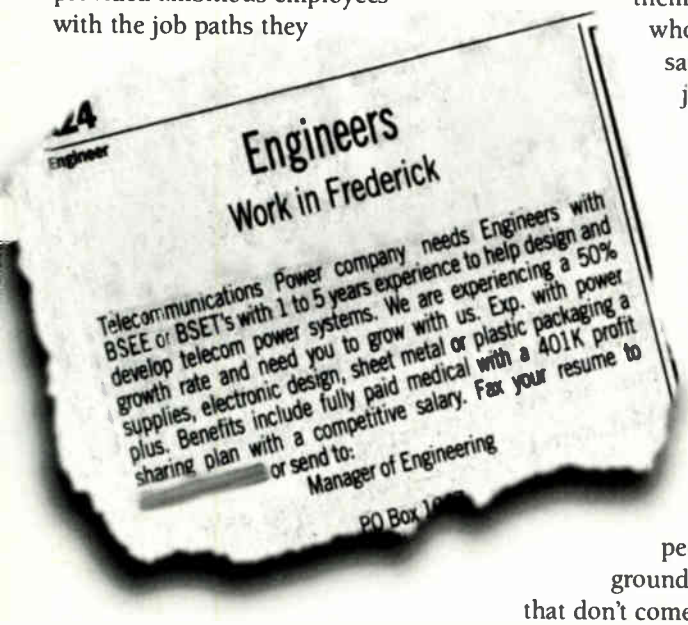
In general, as cable companies developed networks and rolled out video and data services, they recruited a lot of people at "traditional" cable TV wages. These wages couldn't compare to those offered by the telephone companies, Shelley says.

"The cable industry created this problem themselves," he adds.

Correcting it might not be easy, says Morris.

"It's difficult to provide stock options when you haven't done so in the past," he explains, adding that the cleanest way would be to create new divisions for telephony or high speed-data services. Stock could be offered for these new entities, while not affecting the foundation of the existing business.

Aside from compensation, however, sometimes the cable industry has not provided ambitious employees with the job paths they desire. Greg Morley was a plant manager for TCI (now AT&T Cable Services). When TCI began looking at advanced services, he investigated his chances of becoming involved in data and telephony projects.



When things didn't look good for advancement in that direction, he took a position at Tellabs as a senior applications engineer, working with cable telephony devices.

"It used to be that we could always find a good cable technician or engineer. Now, it's like pulling teeth."
— Scott Shelley, Prime Communications

"I wanted to be part of the bigger picture," he says. "My ambitions conflicted with the daily operations of the cable company."

It's the economy

The general state of the economy is adding to the burden. Cable execs cite unemployment rates of 2 to 3 percent in their respective markets.

"The job market is not as rich as it normally would be," says Debora Davis, executive director of staffing and recruitment for MediaOne. "We have to find more innovative ways to recruit. People actually have jobs."

This means that cable companies, even the overbuilders, sometimes find themselves hiring people who don't have the necessary skill set to do the job.

"The job market is tight, and the available pool of qualified people is relatively small," says Michael Adams, president of RCN Corp.'s Technology and Network Development Group. "There are a fair number of people who know a little bit, but not a lot of people who can hit the ground running. Any skill sets that don't come with the employee means training."

And training can be a double-edged sword. Training programs allow cable companies to build teams of employees skilled in many of the convergent technologies. However, these trained individuals quickly become attractive to the competition.

"That is a tough thing companies are dealing with," Morris says. "Those people are being taken away."

Prime, for example, started hiring people with computer backgrounds, but not enough credentials to work for an information technology (IT) company. After providing some training, Prime put the new hires on data projects.

"Now they are in high demand and can name their price," Shelley says.

Although it may seem paradoxical, traditional cable companies also can be at a disadvantage because of their responsibility to unions. They might not have the freedom to revamp compensation packages at will.

"When you have a union, you have to abide by a contract negotiated by

BOTTOMLINE

> **The Vanishing Workforce**

A talent war is underway. Cable operators are finding themselves battling with telcos, overbuilders, and even start-up "dot com" companies for the same engineers and technicians.

Convergence means that cable companies still have to fill their traditional cable positions, while searching for high-speed data and telephony expertise. At the same time, they are trying to keep current employees from leaving to the competition.

One of the biggest challenges cable companies are facing is the incredible stock option packages being offered by the start-ups. Others include a tight job market and restrictive union contracts.

In response, some are revamping compensation strategies while others are stressing work culture.

In the end, cable companies are finding they have to be more aggressive than ever to catch and retain the best talent as they move forward in this converged environment.

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the union," Shelley says. "You are locked into a contract. You couldn't just arbitrarily give everyone a raise or change the way you do bonuses without union approval. It could involve a long negotiation process."

He adds, however, that cable unions are continuing to decertify, giving companies such as Prime more flexibility.

A search for solutions

Cable operators are working to find the right combination to keep employees they have and entice new ones.

"It's not just about money," says Jim Chiddix, chief technical officer for Time Warner Cable. "It's also about giving folks a sense of doing things that really are meaningful and about recognizing good work. People stay with a job if it is a fulfilling, stimulating job. I think we have a lot of those in cable."

Though Time Warner is a gigantic organization, the company has decentralized. The cable division is broken up into a collection of approximately 40 locally managed systems. This way, business is conducted on a more personal level, people are treated well and encouraged to do their best, Chiddix says.

MediaOne, which does offer some stock options, also prides itself on having an employee service culture. The company believes annual employee satisfaction surveys—delving into benefits, pay, leadership and communication—help it stay on top of things.

"There is action planning and follow-up. We continually improve services and everything we provide to employees," says Davis, adding that

> 10 Tips For Hiring Success

Everyone we spoke with had their own ideas for attracting and retaining engineers and technicians. Here are their top suggestions:

1. Offer stock options.
2. Increase wages.
3. Create progressive job tracks and pay scales for data and telephony positions.
4. Provide training and wage incentives to encourage employees to learn new skills.
5. Offer prequalification testing to bring skilled technicians in at higher wages.
6. Award monthly cash or stock bonuses for outstanding performance.
7. Survey employees each year to determine satisfaction with company benefits, and add new benefits based on survey responses.
8. Use the Internet to recruit technical employees.
9. Offer referral bonuses with no trial period.
10. Support a culture of employee empowerment.

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MediaOne believes it can compete with anybody for talent.

In addition, cable companies point out that an employee doesn't have to go to an overbuilder or a "dot com" start-up to work with sexy technology.

"They have the opportunity to team with other talented people and to work with technology that is very new and evolving and nonexistent in any level of maturity anywhere in the world," says Henke. "We have begun to understand what technicians are attracted to. They want to play with the new stuff."

At the same time, they still want the opportunity to make more money.

Prime is implementing prequalification testing. Level of knowledge will determine starting wage. The company also has initiated a program where employees designate whether they want to follow an RF or data path and enroll in the requisite training programs. However, should someone at step A complete training to get to step B, but finds there aren't any B positions available, they will get B pay for doing A work.

This provides employee incentive, but also helps Prime. Cable companies often have not had a deep enough bench to compensate for departing employees, Shelley says. With Prime's new program, if a step B person leaves, an A person will be qualified to fill the post.

"This (program) allows us to backfill positions when people leave," Shelley says.

Even newer cable companies are fine-tuning incentive packages. RCN is implementing performance programs whereby a cash or stock award is granted monthly to employees meeting certain criteria.

"We would motivate the people who perform," Adams says. "Hopefully, this will help us to retain the best people."

Recruiting strategies

Cable companies are honing recruitment skills as well. The Internet has proved a useful tool.

"The Internet is going to be the only place to find (technology professionals)," Cox's Henke says. "They live in that world. It is fast and easy."

Her company is beginning to use career fairs and special interest organizations with job banks as well.

"We didn't need them before, so we didn't build relationships with them," she explains. "Now, we are picking out which are the most productive and offer the best results."

Henke adds that Cox also is trying to strengthen its ties with the military, which always has been a "good source of talent."

"The military is one of the best training grounds in the world," she says, noting that the armed forces train people in technology, accountability, discipline and work ethic.

Employee referral programs are

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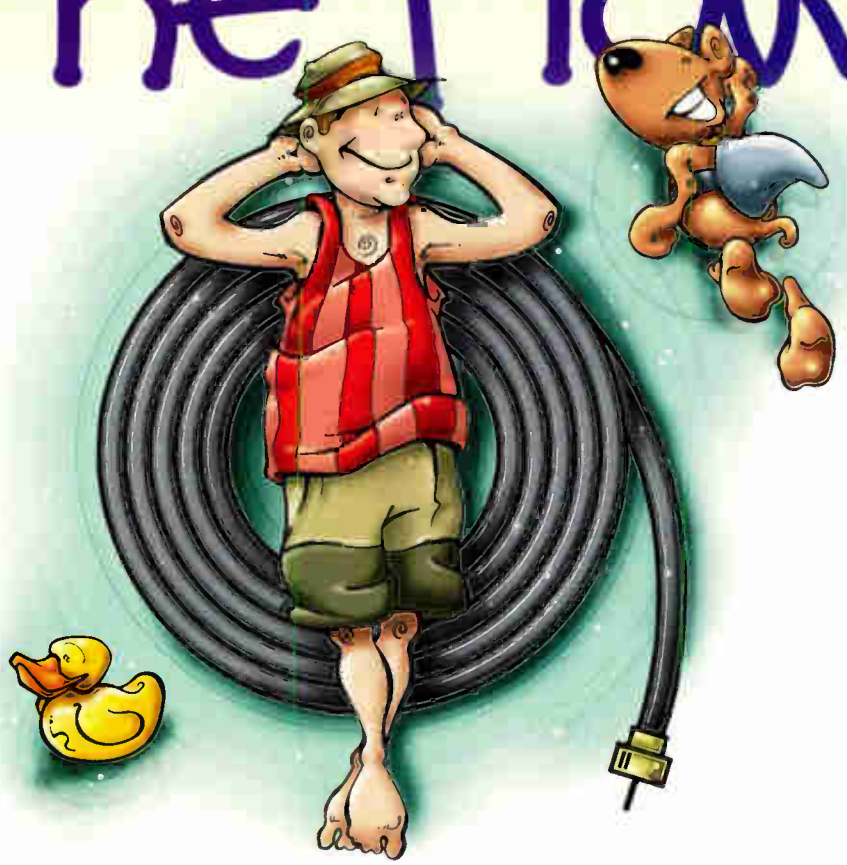

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growing in popularity. At MediaOne, for example, bonuses are given when recommended recruits sign on, says Davis. There isn't a trial period.

Outsourcing options

Cable companies always have the option of outsourcing.

"I think we will see more of it as time goes on," Morris says, adding, however, that companies hand over control only if necessary.

Many outsource only if they need to start a project or fill a position faster than they can hire someone full-time.

"Our preference is to staff with permanent employees, but we do fill voids in the interim with contract talent," says Chris Bowick, vice president of technical development for Cox.

Start-ups are in a unique position.

"It's hard to put on a whole staff right away," he says. "Alliances and outsourcing responsibilities to third parties are good ways to start up quickly."

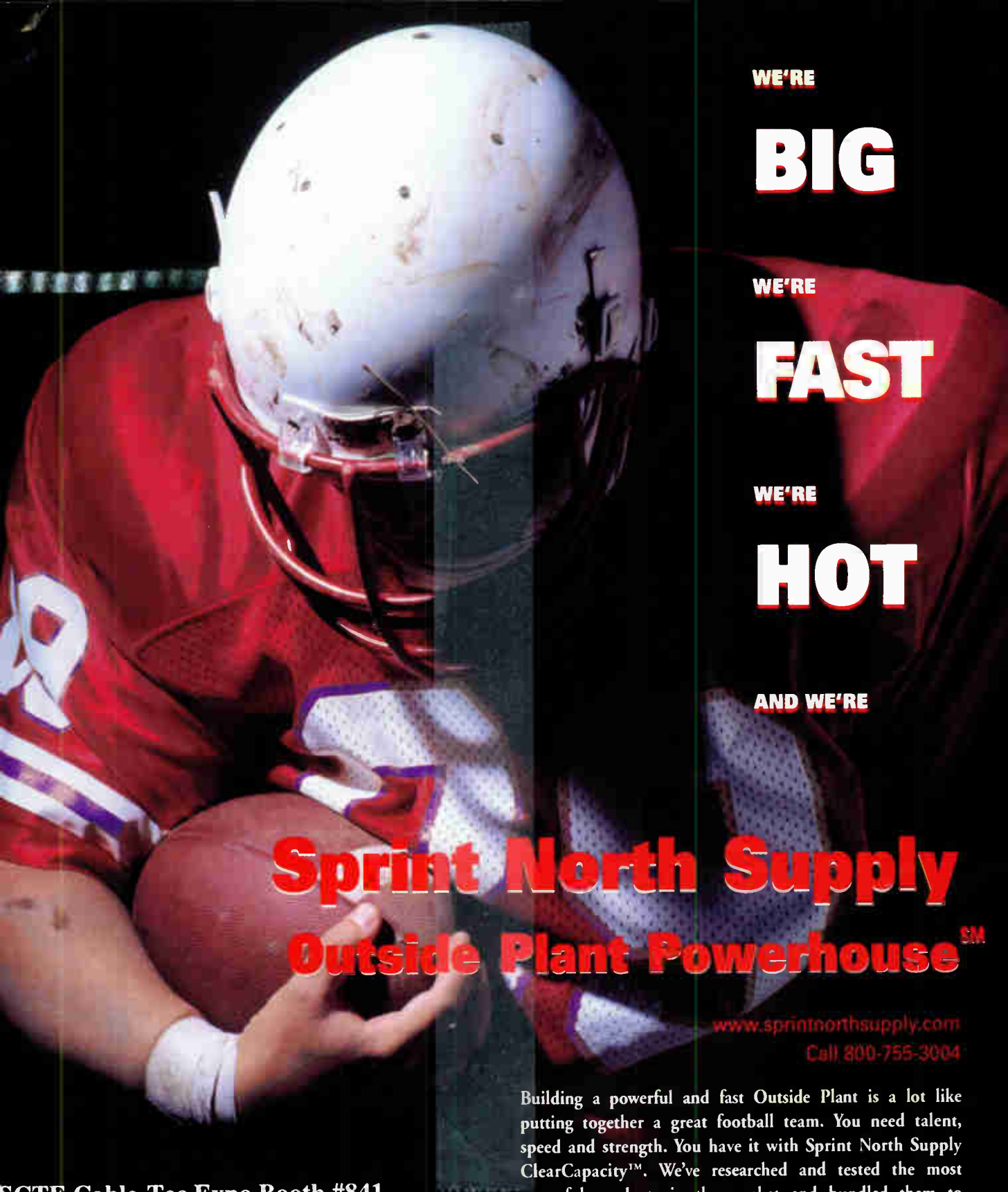
At the same time, the outsourcing companies are competing for the same talent. Lewis Solomon, chairman of Broadband Services Inc., is finding it difficult to find quality people as well.

"We have made a big investment in a training facility," he says. "We have gotten our board's approval to give digital technicians stock options. Most companies don't give options at that salary range. We think it will attract and keep these people with us and build loyalty to our new company."

In the end, all companies competing for these individuals are having to be more aggressive. Sometimes this means compromising for someone with a little less experience. Other times, it may mean offering a better package, but the bottom line is that a "talent war" is taking place.

"Companies are starting to get that," Morris says. "They are beginning to make changes." CT

Monta Monaco Hernon is a telecommunications writer based in Arlington, Va. If you have other hiring tips or comments, send them to Editor Jennifer Whalen at jwhalen@phillips.com.



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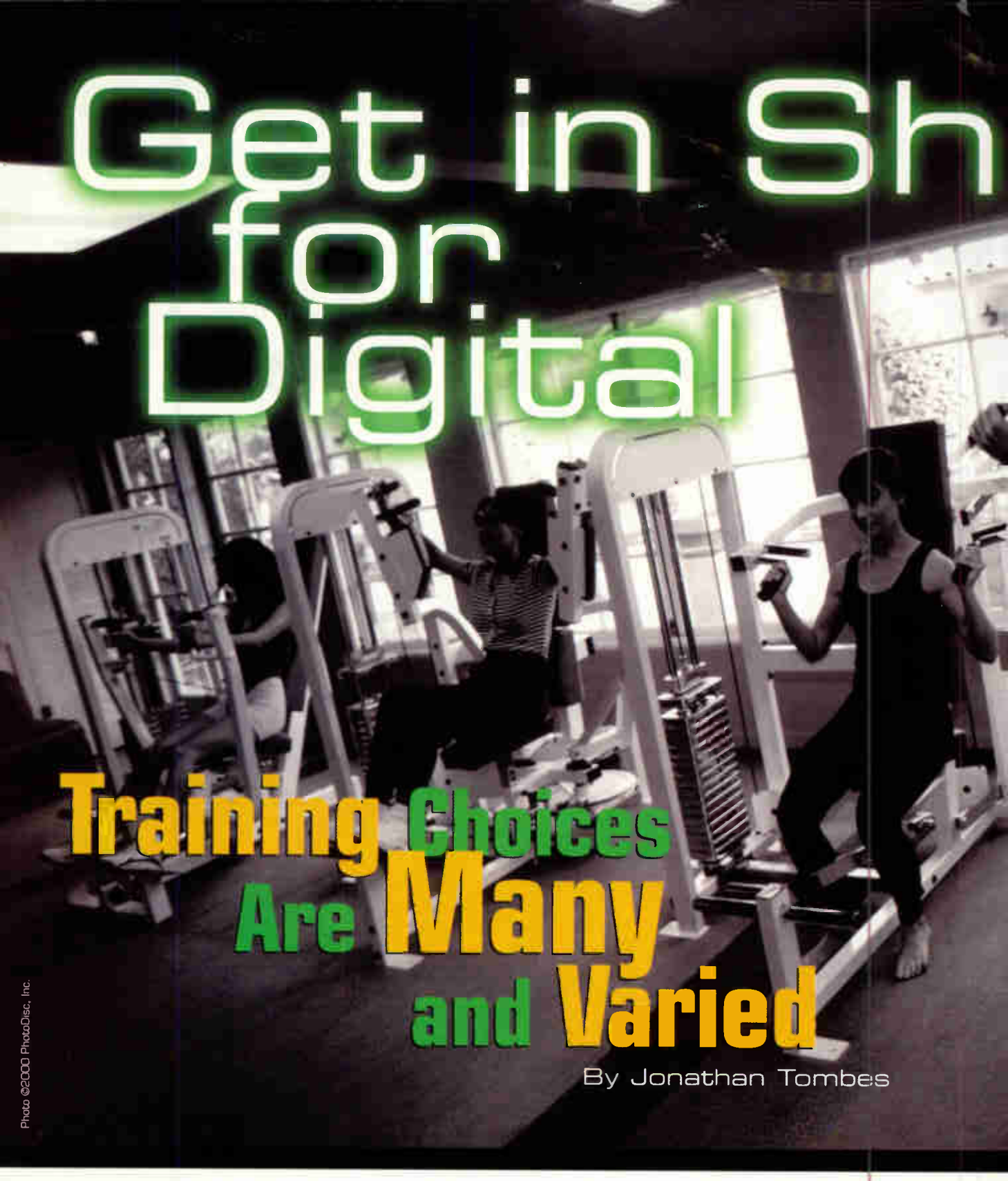
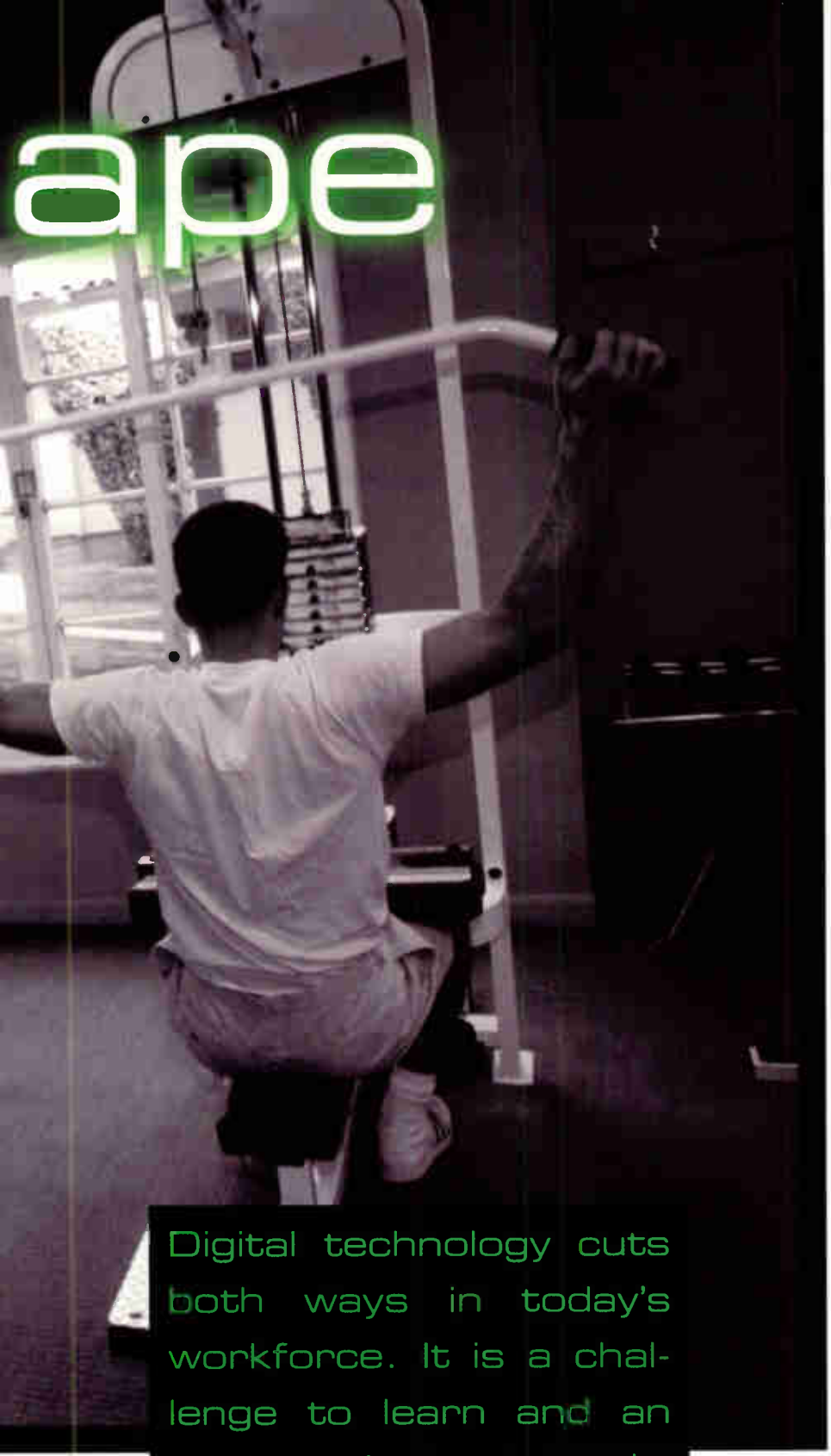


Get in Sh for Digital

Training Choices Are Many and Varied

By Jonathan Tombes



ape

Digital technology cuts both ways in today's workforce. It is a challenge to learn and an opportunity to teach. The trick is matching the right trainer with the right students.

Today's training includes the creative and the tried-and-true. Among the novel approaches are firms dedicated to training, online "universities" and courses involving cross-functional participation. More conventional solutions include vendor-provided education and initial rollout training from operation headquarters. And then there are combinations of these.

In short, there is no one solution to digital training. At the same time, there appear to be few exclusively "digital" solutions. Good training, in large part, is simply good training.

Training blitz

Much training for digital services so far has coincided with initial rollouts of new services. These compressed sessions feature a lot of material, sometimes relying on the train-the-trainer model for extended shelf life.

"Early last year, we put together a series of modules that we offered to trainers and supervisors who are responsible for making sure the front-line folks know what they're doing," says Kent Vermillion, director of Time Warner's National Training Center.

In a training blitz that accompanied Time Warner's digital TV (DTV) rollout, the company covered interactive services, customer premises equipment, hybrid fiber/coax (HFC) architecture and the set-top itself.

AT&T offers a similar regime with its Digital Success Training, an eight-hour on-site course. Paul Stranahan, director of training for AT&T's Headend In The Sky (HITS), says about 7,000 employees have completed the course, which has resulted in improvements in nonresponder rates.

> Getting the Gear

Every cable system has its own training methods and materials. Here is a nonexhaustive list of books, vendor Web sites and additional resources that can enhance any training regime.

Books

- *Digital Basics for Cable TV Systems*, by Jeffrey L. Thomas and Francis M. Edgington. (Hewlett-Packard Professional Books, 1999). Society of Cable Telecommunications Engineers Chairman Jim Kuhns recommends hearing Edgington in person.
- *DigiPoints Volume 1*, by Justin Junkus and Michael Sawyer and *DigiPoints Volume 2*, by Justin Junkus. Volume 1 covers the basics of digital data communications, and Volume 2 covers cable systems' digital equipment. Portions of these SCTE-published works are available at www.scte.org.

Vendors

- Scientific-Atlanta provides customer education through its Scientific-Atlanta Institute. Training for digital video products is offered at its Toronto, Canada facility. For more information, contact S-A at www.scientificatlanta.com.
- Motorola's Broadband Communication Sector (formerly General Instrument) gives a two-day Introduction to Digital Transmission at its Horsham, Pa., laboratory facilities. For more information, contact Motorola at www.motorola.com.
- Wavetek Wandel Goltermann (now merging with TTC) includes course outlines, published articles and PowerPoint presentations on its training page and offers regular training at its Indianapolis site. For more information, contact WWG at www.wwgsolutions.com.
- Hukk Engineering offers return path testing, digital measurements, and other digitally related seminars online. For more information, contact Hukk at www.hukk.com.
- Cisco's Internetworking Technology Overview is an extensive online resource on local area networks (LANs), wide area networks (WANs), bridging, switching and other internetworking topics. Contact Cisco at www.cisco.com.

Additional Resources:

- From trade shows to regional vendor days to SCTE chapter meetings, any gathering of cable techs is an opportunity to match trainers with students.
- The SCTE itself, through its books, seminars and technical certification, offers several answers to the digital training question.
- Selling directly to companies, the NCTI has been in the training business since 1969 and is upgrading its offering with several digital courses. Contact NCTI at www.ncti.com.

Demystification

Such training sometimes looks different from the individual systems' perspective. William Catlett, technical training manager for Prime Cable in Rockville, Md., says his employees had both vendor education and a four-day site visit to a company-owned digital system.

"The only problem once you come back is that everyone hasn't yet grasped how complex it is," says Catlett. This common response to information overload suggests the need for taking a measured approach.

"There are two reactions when you start talking about digital stuff," says Vermillion. "The first is, 'Yeah, digital—ooh, that's cool, that's sexy;' and the next thing is, 'That's scary—I'm supposed to learn this?'"

Vermillion wants to demystify the digital issue. "What we spend a lot of time doing is trying to relate what is new to what they already know, so it's not so scary," he says. "We try to say, 'It's still the same stuff: It's still an amplifier, it's still a tap, it's still a connector.'"

The point of reassuring technicians is not to make them comfortable, but rather to make sure they know what they're supposed to know so that they can learn what they don't.

"I start my full day of digital training with about an hour of comparing analog and digital," says Jim Hooper, a regional trainer for Time Warner in North Carolina. "Then I do Base 10 vs. Base 2 and use something like a magic trick with yes/no cards to get them to see how a computer thinks."

Do you really understand?

An exercise Vermillion uses is to ask veteran technicians in front of a white board to do a block diagram of a typical amplifier in their system, following the signal flow and identifying all the pieces. "What you find out really quickly is that they aren't really sure," he says. "And so if they don't understand how the forward signals are getting worked on, then the upstream paths aren't going to make any sense."

John Downey, a trainer for Wavetek Wandel Goltermann, also finds techs "who think they know more than they do." Part of the problem comes from naming a course "digital basics."

"They come in thinking that it's just going to be a basics course, when even my basic course is more advanced than just basics," says Downey. "If you put that in the title of anything, then they think, 'I'm above all that.'"

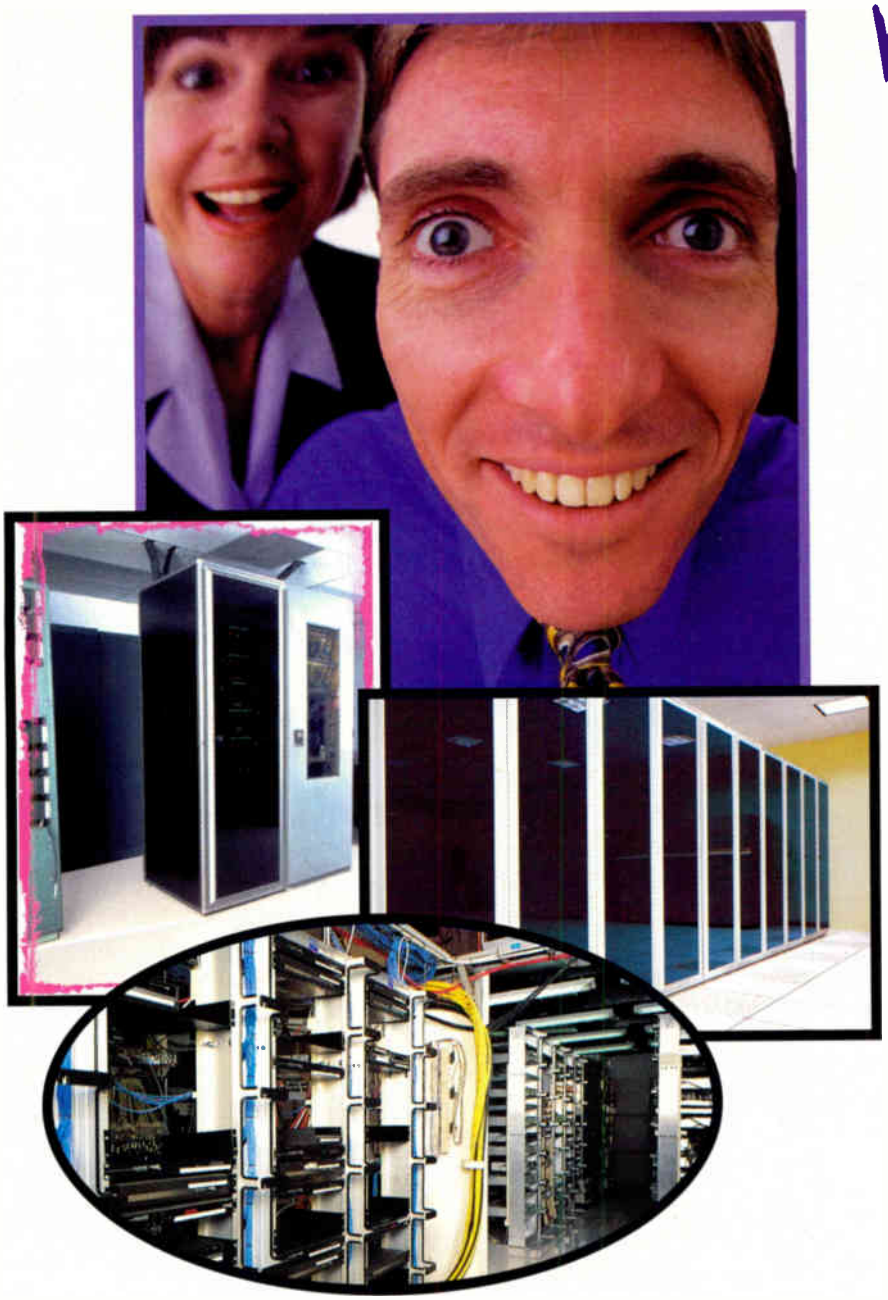
Downey describes a classic dilemma: "You either bore some people, or you're over some people's heads."

Generic training?

Just as vendors have difficulty tailoring their presentations, multiple system operators (MSOs) have to face their own diverse audiences.

"The biggest challenge is that individual systems have unique digital applications," says Pam Nobles, manager of technical development at Comcast. She says she is looking to see what kind of generic training might best suit the Comcast system.

Time Warner also is assessing its situation. "It's been really hard to come up with any type of training because we just didn't have enough anecdotal experience," says Vermillion. >



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If an MSO can create a standardized training course, could the industry as well come up with a generic solution? Keith Hayes, a director of technical operations for MediaOne and a member of the Society of Cable Telecommunications Engineers' training subcommittee, thinks it could and should. While time and materials are scarce, Hayes says the industry risks "re-inventing the wheel six times" in training.

"We should integrate resources of the MSOs, the training providers such as the NCTI and the SCTE, as well as the equipment vendors, and make modularized training that at the core level is not specific to a particular technology or particular vendor," says Hayes.

"Digital services are both revolutionizing cable and reinforcing fundamentals."

Headend training

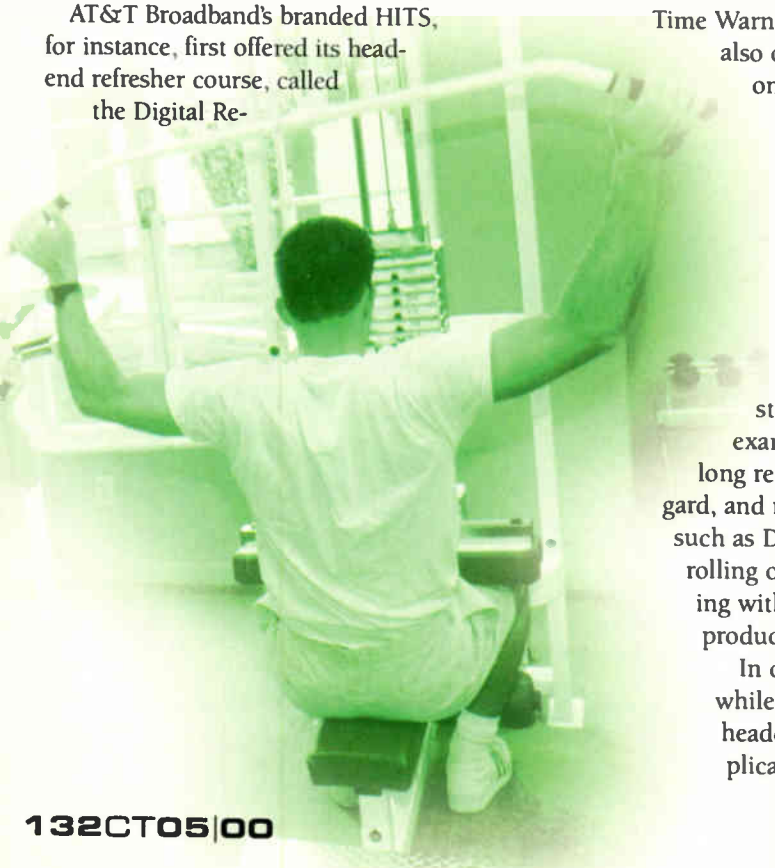
Meanwhile, MSOs are pushing ahead where possible with specific training, particularly on the headend, where digital has made a huge impact.

AT&T Broadband's branded HITS, for instance, first offered its headend refresher course, called the Digital Refresher Seminar, in 1998. Before continuing last year, it looked at its incoming calls and results from a survey of headend technicians around the country and refashioned its program.

The three-day seminar (offered to HITS customers) covers key headend features such as addressability and polling, billing systems, and the personal computer (PC) that runs the headend management system (HMS), which may be the first PC that many headend techs have ever had in their facility.

"We think one of the key strengths of the seminars is getting the management people—the general managers, billing system managers, information systems managers, installation managers—in the same room at the same time with the technical people—the headend techs, tech ops managers and engineers—talking about the same thing and hearing the same message," says AT&T's Stranahan.

In other words, the digital headend may be more integrated than the team that surrounds it. Stranahan says the HITS seminars enable participants "to connect the dots."



Time Warner and Cox also offer courses on digital headends. Vendors naturally want their customers to understand these products as well. The Scientific-Atlanta Institute, for example, has a long record in this regard, and newer vendors such as Divicom are rolling out new training with their own products.

In other words, while the digital headend is a complicated system, there are multiple opportunities for learning the technology.

Techs for hire

Emphasizing the relative complexity of headend technology is not to minimize the importance of fieldwork. In fact, customer premise work is an increasingly sophisticated part of the cable equation.

The market provides frequent updates on the rising value of a versatile and highly trained workforce. C-COR.net's purchase of Worldbridge, for instance, was largely a matter of getting 420 proven technicians.

Labor constraints have spawned other interesting solutions. Former General Instrument exec Lewis Solomon and former TCI president J.C. Sparkman launched Broadband Services Inc. with the goal of creating a pool of some 2,500 digital technicians who can perform outsourced installations for cable operators.

Another entrant into the technical training arena is a company called FatPipeU. Founder Matthew Feshbach, a private investor, says his

BOTTOMLINE

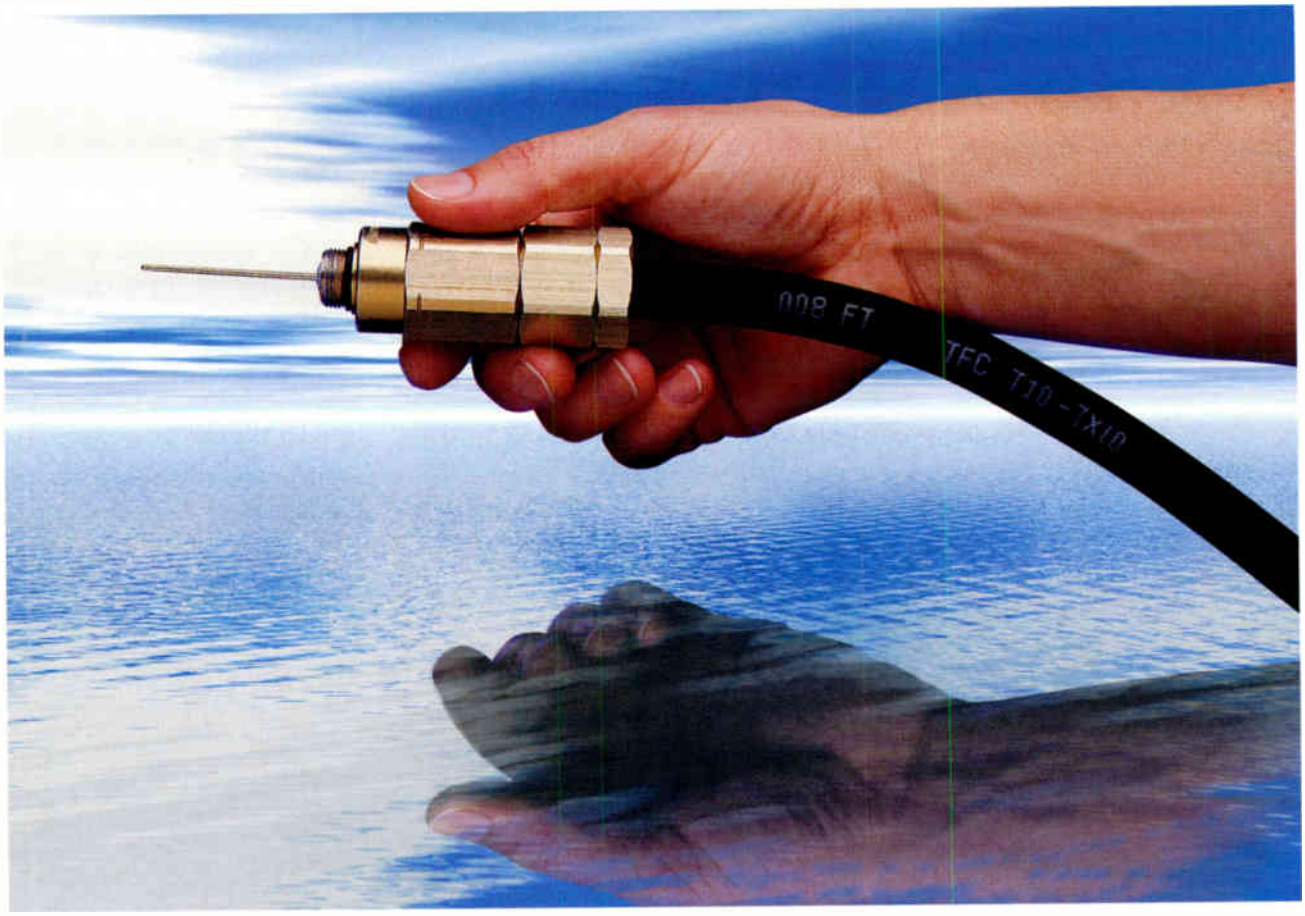
> **Digital Basics**

Training for digital services is a hodgepodge of vendor-provided education, outsourced contracting, system-specific applications and shared industry resources. Whatever the source, training that incorporates these suggestions can yield better results:

- Make sure employees know what they're supposed to know first.
- Use cross-functional training, especially at the headend.
- Tighten up the plant and strengthen employees' technical skills.

In short, digital services require new training, but also place a premium on basic technical knowledge, cross-functional teamwork and sound craftsmanship that are good things in and of themselves.

No Reflection



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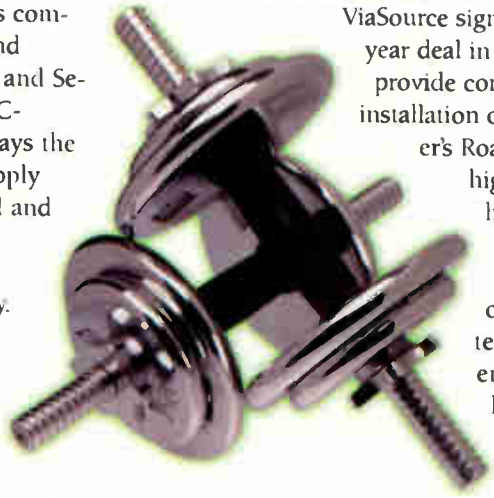
mission is "to solve the installation logjam for broadband."

Part of FatPipeU's solution involves a self-paced training technology that Scientology founder L. Ron Hubbard developed and which Cisco uses in its worldwide manufacturing operations. Endorsing this venture as a board member is Dr. Walter Ciciora, co-author of the book *Modern Cable Television Technology*.

FatPipeU already has completed a test project, and Worldbridge President and Senior Vice President of C-COR.net Paul Janson says the start-up is slated to supply training and residential and telephony installs for a C-COR.net project in Evansville, Ind., in May.



Original photo ©2000 Eyewire

Searching for Super Tech

Worldbridge's own scheme bears emulation. For the higher, mid-tier skill level (node certification, forward and reverse sweep and ingress mitigation), Worldbridge gives candidates a week of classroom training and testing and then assigns them a mentor in the field. Candidates then get four weeks, tops, to prove themselves in the field.

Another technician incubator is ViaSource, a company with 2,500 employees in multiple sites across the country. ViaSource signed a three-year deal in February to provide complete home installation of Time Warner's Road Runner high-speed online service.

One challenge for outsourcers is teaching its employees how a client's system works. Earl Bennet, ViaSource director of training, safety and quality, says the company has access to the RoadRunner network operations in New York, but that's not always the case.

"The idea is not just hearing, not just seeing the product, but also working with it," says Bennet. His training scheme is a mixture of checks and balances and practice.

In the case of Time Warner's New York system, outsourcing "solved" its cable modem training problem. "A lot of places decided off the bat that they didn't want anything to do with customers' computers," says Time Warner's Vermillion. But other operators want the super tech, or uni-tech, who can handle anything.

"We call it Comm Tech," says Comcast's Nobles, "creating a one-stop shopping tech, so that whatever request the customer has, whether it's RF installation or digital telephony or whatever, then that one person can do it—that's our overall goal," she says. >

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Back to basics

Digital services are both revolutionizing cable and reinforcing fundamentals. Similarly, trainers such as WWG's Downey are both emphasizing the basics and finding new ways—such as a proposed online university—to deliver that message.

"We had sweep techs who thought that they knew their stuff, but were enlightened by (Downey's) training," says Gary Allridge, of Channel Communications, a full service contractor.

Confirming employees' baseline knowledge not only makes good training sense, but also reflects the challenges of the dawning digital era.

"The pipeline that we're using was optimized to transport analog video, with the assumption being that if we can run analog video through it, then sending a bunch of zeros and ones through should be a piece of cake. But that presumes that our craftsmanship is at the level that it should be," says Vermillion. He suggests questioning that presumption.

"The upstream path is real susceptible to outside interference, and so we want to make sure that the plant is tight," says Vermillion. But while digital services require secure return paths, he adds, "a tight plant is a good thing, no matter what."

AT&T's Stranahan agrees with this assessment: "Make sure the good things you were doing before (digital) you're still doing."

Big picture keeps changing

"The biggest issue is keeping up with the change in the industry," says MediaOne's Hayes. "We know today that high-speed data training and telephony training are sorely needed. We also know that in today's competitive marketplace, customer relations training is incredibly important. What we don't know, clearly, is what's going to be needed in two years or three years or five years."

While Hayes' previously mentioned proposal for an industry-wide digital training solution remains only a proposal, to some extent the kernel of that solution already exists in the form of NCTI's distributed courses and the SCTE's certification process and educational seminars.

Familiar sources such as NCTI and SCTE will be a part of any solution for digital training. The overall solution also will include service-oriented vendors, enterprising outsourcers, and home-grown applications. Moreover, successful training seems to emphasize the basics. While these services are new, to the extent that their delivery is an extension of current good or best practices, then launching zeros and ones is a good excuse for simply getting your house in order. CT

Jonathan Tombes is deployment editor for "Communications Technology." He can be reached via e-mail at jtombes@phillips.com.

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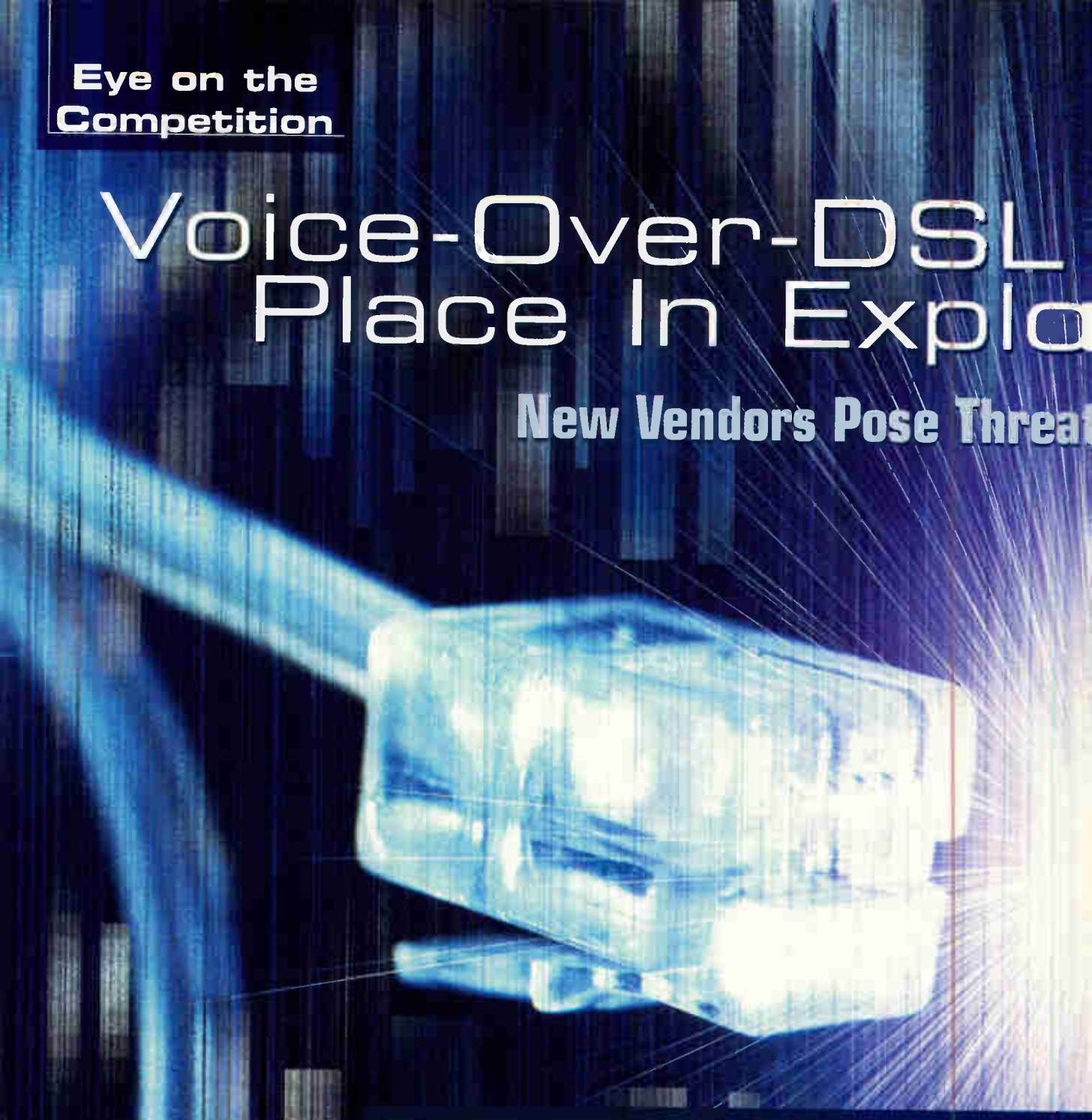
Eye on the Competition

Voice-Over-DSL Place In Explo

New Vendors Pose Threat



Despite its relatively nascent presence in the broadband universe, voice-over-digital subscriber line (VoDSL) technology now is forcing industry players large and small to pursue a wide range of strategic maneuvers.

Upstarts Seek ding Market

o Cable Telephony

By Mark Mueller

Among equipment providers of VoDSL services, there has recently been a particularly large amount of activity. Mergers, alliances, product upgrades and big-dollar financing deals have all taken place as these firms attempt to differentiate themselves from one another. Such efforts will place additional competitive pressures both on cable operators, as they seek to launch cable telephony services over the coax plant, and on makers of cable telephony equipment.

An expected explosion in DSL subscriber levels, and the role of VoDSL as the technology's "killer app," is behind many of these actions. A report by Newton, Mass.-based consultancy Cahners In-Stat projects broadband subscribers to reach 9 million worldwide by the end of 2000. (See sidebar "DSL Deployment Levels" on page 142) >

Dollars and service sense

While VoDSL's business case is easy to make, it is sometimes tough to stand out in a crowd of vendors, the firms' executives admit. The companies' primary customers—incumbent local exchange carriers (ILECs) and competitive local exchange carriers (CLECs)—usually are focused on only one thing: pricing. And for the most part, pricing has remained relatively inflexible among providers.

"Everybody is trying to change the equation a little bit in their favor, and bundling DSL (technology) allows them to do that to an extent," says Agnes Imregh, vice president of marketing for Santa Clara, Calif.-based vendor TollBridge Technologies.

"Yet any way you cut it, (service providers) are still offering services based on the existing protocols, the existing Class 5 services, so you're not able to do anything much different from what everybody else does," Imregh says. "But you are able to package it differently, and packaging can be (a big) advantage."

"In the future, if you're a CLEC, you'd like to compete on something other than price," she says.

TollBridge competes with other VoDSL equipment vendors including: Accelerated Networks, CopperCom and Jetstream. All four firms have ambitious plans for expanding their scope of offerings and are acquiring the necessary capital to do that. (See sidebar "VoDSL Providers Going Public.")

"There's really no loser out of this pack," says Ron Westfall, senior analyst for Sterling, Va.-based consultancy Current Analysis. "It's just a question of how many LECs they can penetrate as these services become more commercialized."

"The market really is heating up—there are projections saying VoDSL services can be as heady as $1 billion by 2002, combining residential and business. All of these companies are well-positioned to capitalize on the explosion of voice-over-broadband services," Westfall says.

> Voice Gateway Providers Going Public, and Soon

If you're tired of reading about hi-tech firms materializing from nowhere, oozing big-time losses, yet turning out far too many baby-faced initial public offering (IPO) millionaires in the space of a few years—well, don't read on.

The leading voice-over-digital subscriber line (VoDSL) equipment makers aren't having difficulty raising money to fund their fledgling operations. With additional financing coming in, these companies will be better positioned to aggressively pursue equipment contracts with incumbent local exchange carriers (ILECs) and competitive local exchange carriers (CLECs). Thus, competition for the voice customer for both cable operators and vendors of cable telephony products will increase.

The emerging market for VoDSL services currently is led by four gateway providers: Accelerated Networks, CopperCom, Jetstream Communications and TollBridge Technologies. All these firms are now privately held, but this is about to change.

Moor Park, Calif.-based Accelerated Networks filed registration papers in March for an IPO of up to $64.4 million of common stock.

Santa Clara, Calif.-based TollBridge, founded in 1998, plans to go public by the end of the year, says Agnes Imregh, vice president of marketing for the company.

Los Gatos, Calif.-based Jetstream landed $40.8 million of mezzanine financing in November 1999, led by Bowman Capital Management.

CopperCom, based in Santa Clara, Calif., also has plans for an IPO, although a specific time frame has not been given, says Ron Nash, vice president of product management for the company.

Getting the gear

While clearly are not all of the players in the VoDSL space, these four are making waves in today's market. To get the skinny on their product offerings, call them or visit their Web sites.

Accelerated Networks, (805) 553-9680, www.acceleratednetworks.com
CopperCom, (408) 567-9277, www.coppercom.com
Jetstream, (408) 399-1300, www.jetstream.com
TollBridge, (408) 585-2100, www.tollbridgetech.com

BOTTOM LINE

> Telephony Arms Race

Watch out, cable telephony: voice-over-digital subscriber line (VoDSL) technology is coming out to eat your lunch for you.

VoDSL equipment providers have been busy of late with mergers, alliances, product upgrades and big-dollar financing deals, all of which could make business life rather more difficult for both cable operators and manufacuters of cable telephony equipment.

Besides the business dealings, market predictions suggest that the timing for a VoDSL boom is ripe. A report by Newton, Mass.-based consultancy Cahners In-Stat projects broadband subscribers to reach 9 million worldwide by the end of 2000.

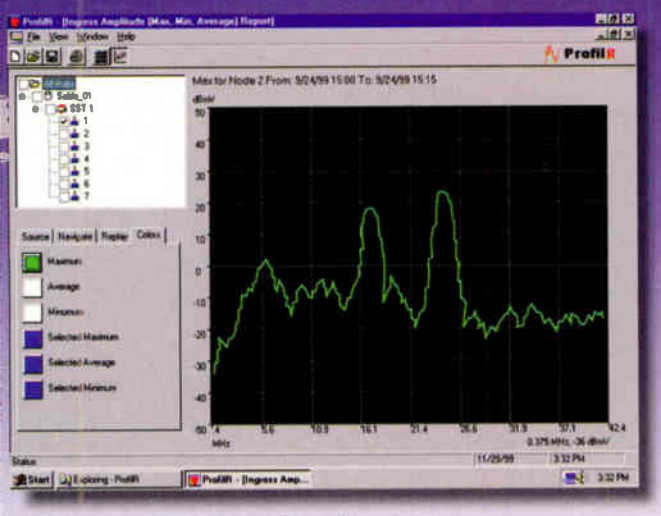
While none of this presages the end of the cable telephony world, competition is heating up, so it'll be wise to keep an eye on it and plan accordingly.

CopperCom stokes growth With DTI deal

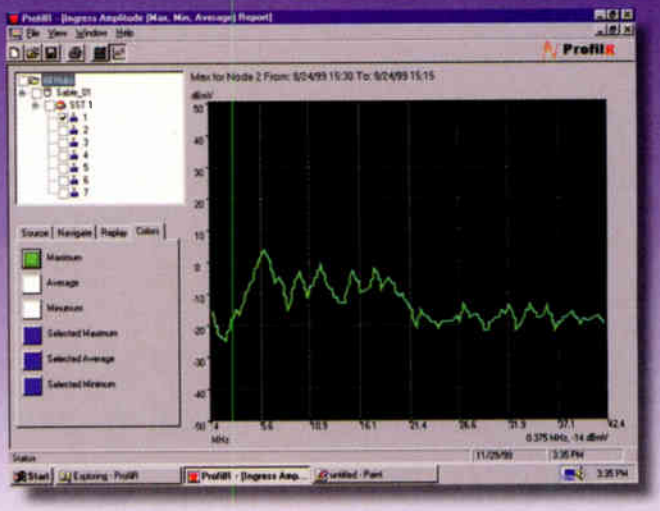
Santa Clara, Calif.-based CopperCom is taking big strides to separate itself from the pack. The company, formed in 1997, recently announced a merger with Boca Raton, Fla.-based DTI Networks, a provider of softswitch technology. Terms of the deal were not disclosed.

The goal of the deal is to move the VoDSL firm beyond pure transport and to expand services to include local exchange switching and

Crisis. Management.



Without TraffiControl™, ingress events remain hidden under return traffic



TraffiControl™ measures and plots ingress spectra of bands fully occupied by return traffic

New *TraffiControl*™ lets you see the ingress inside your system's return traffic

TraffiControl™ Now Available On Trilithic's Guardian™ 9580 SST Return Path Analyzer

No doubt about it: where the return path is concerned, ingress is a big problem. Left unchecked, ingress outbreaks can prevent your system from delivering the Internet and other premium services your subscribers have come to expect. It's tough enough now to catch ingress outbreaks and fix them before the phone starts ringing. It'll be even tougher as new services fill your return spectrum, because the majority of ingress will be hidden by the increased return "traffic."

YOU CAN'T BEAT THE SYSTEM

How will you detect ingress when it's hiding in your occupied bandwidths? Fortunately Trilithic, the leader in digital return path maintenance technology, has engineered a solution – a solution that will quite literally change the way you look at ingress. It's called *TraffiControl*™ and it's a new feature of the Trilithic Guardian 9580 SST Return Path Analyzer.

TraffiControl is an advanced Digital Signal Processing (DSP) technology that identifies and removes all the legitimate signals from your scanned return spectrum. What remains is the once elusive ingress spectrum of your entire return band, which the system analyzes against user-set ingress limits. The best part is that *TraffiControl* can be programmed to work automatically. Then, when ingress occurs, the system will tell you about it, giving you time to respond before it causes problems.

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standard voice calling features, say CopperCom officials.

"Softswitch is the key technology for our customers to maximize the value of packet voice in their access networks," says Cynthia Ringo, president and chief executive officer of CopperCom. "DTI brings a unique combination of local telephony switching know-how and innovation in call processing and feature creation software, which are required for the access network."

Ringo will serve as CEO of the combined company, and Dennis Chateauneuf, DTI's CEO, will act as president and chief operating officer.

Three primary emerging VoDSL competitive factors challenge service providers, says Jennifer Stagnaro, CopperCom vice president of marketing. They are:

- The high cost of entry into new markets, with Class 5 switches costing more than $5 million
- The inability to differentiate voice services beyond price
- The lack of an obvious migration path to end-to-end packet networks

The combined CopperCom/DTI will allow providers to enter new markets and offer VoDSL without having to install the Class 5 switch, saving money, she says. >

> DSL Deployment Levels To Topple Cable

More sky-high projections about voice-over-digital subscriber line (VoDSL) growth are coming from telecom research firm Cahners In-Stat Group. According to a report by the Newton, Mass.-based consultancy, DSL subscribers will surpass cable subscribers worldwide in 2001. DSL is not projected to pass cable in the North American market until 2002, however.

The reason: VoDSL, the first killer app to increase widespread DSL usage, the report says.

The In-Stat study follows the company's August 1999 projections that VoDSL was capable of generating $1 billion in revenues by the end of 2000. According to the latest report, the installed base of broadband subscribers is expected to reach nearly 9 million worldwide by the end of 2000 and will be close to 49 million by 2003.

Keep an eye on the North American market to see which providers take charge in the marketplace, says Shannon Pleasant, senior analyst for In-Stat's voice and data group. "Service providers with the deepest pockets, more favorable regulatory environment, most aggressive pricing, and the most attractive value-added service bundling will lead the race for the residential subscriber," she says.

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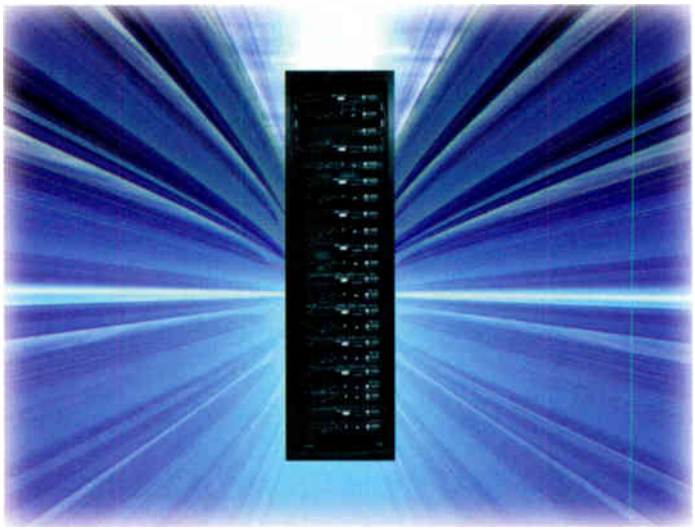

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IP base: the TollBridge focus

Accelerated Networks, CopperCom and Jetstream have based their VoDSL platforms on asynchronous transfer mode (ATM) technology. TollBridge's platform, however, is IP-based.

"We chose from the very beginning to base the platform on IP," TollBridge's Imregh says. "At the beginning, everyone was (questioning the decision), but now with our cable and wireless (business), it's pretty obvious why we are going to be able to have substantial relationships and products related to all the broadband medium, and that's because we are IP-based."

"One of the reasons we based the company on an IP architecture when everybody said we should be doing ATM is because we saw IP as the path to the future, just as long as we could provide quality of service," Imregh says.

"That's how we've chosen (to differentiate ourselves).

Photo ©2000 Eyewire

CopperCom has chosen to focus on vertical integration," she says.

The IP platform gives the firm a definite leg up in sales to cable providers, Current Analysis' Westfall says.

"TollBridge is doing a good job of addressing things like DOCSIS (Data Over Cable Service Interface Specification) compliance, to enable voice-over-cable services," he says. "And because they rely on an IP architecture, they are able to address this market today, whereas the other three VoDSL vendors are relying on ATM orientation. So TollBridge is unique in its ability to address voice-over-cable and voice-over-wireless applications."

Partnerships flourishing

One area TollBridge lags behind its competition, Westfall says, is in its lack of original equipment manufacturer (OEM) agreements with major vendors. Jetstream's VoDSL gateway is sold OEM by Alcatel, Nortel and Lucent. CopperCom has deals with Alcatel and Lucent; Accelerated Networks has an OEM deal with Siemens, as well as a promising partnership with MCI/WorldCom.

"Channel efforts are paying off," Westfall says. "They have these major partners who can integrate their VoDSL gateways into a comprehensive broadband solution, including the Class 5 switch, the DSL component and the DLC (digital loop carrier)."

One can expect that all four vendors will seek additional partnership opportunities as competition for this burgeoning market heats up. CT

Mark Mueller is editor of sister publication "Broadband Networking News." He can be reached via e-mail at mmueller@phillips.com.

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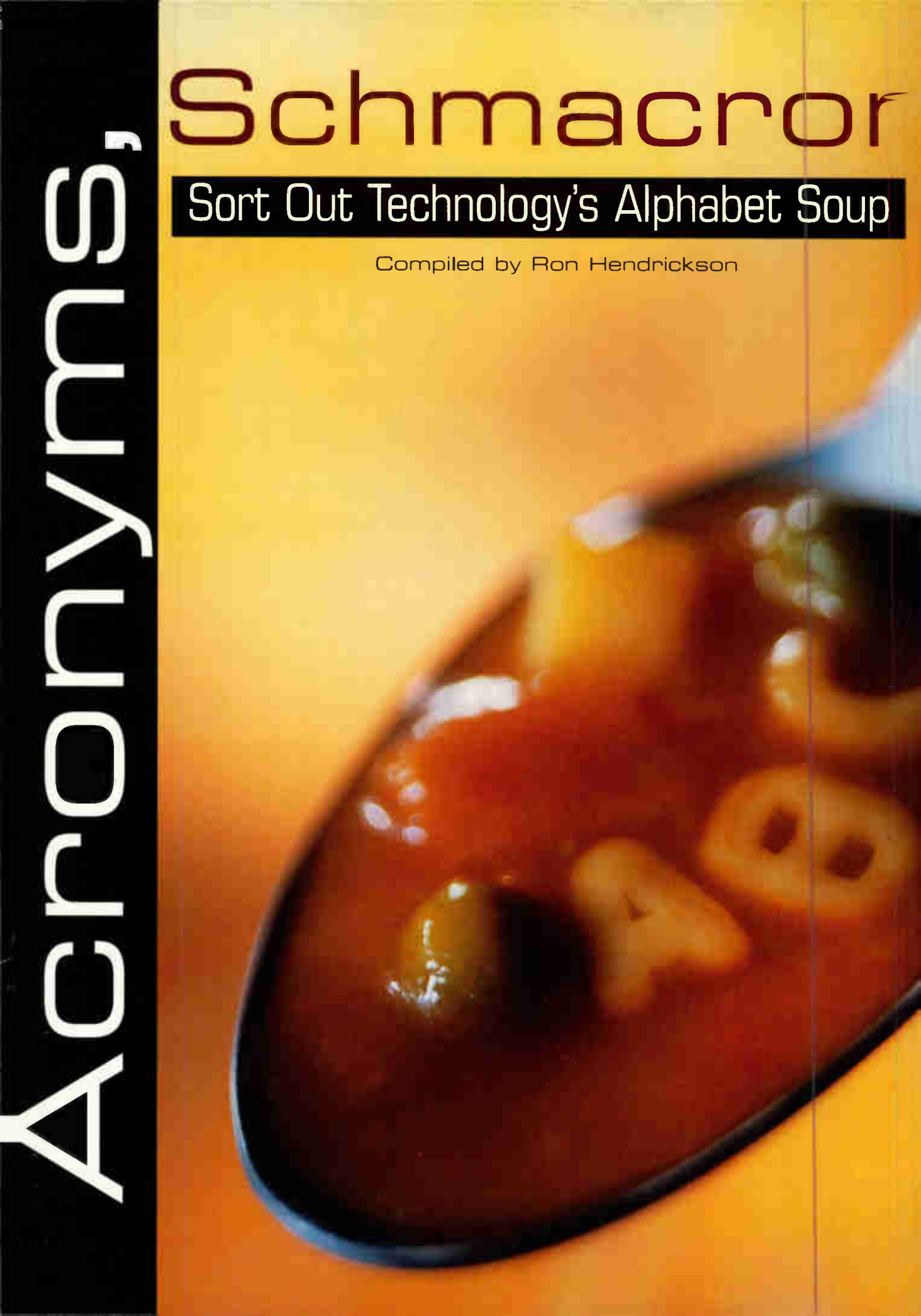
Acronyms, Schmacronyms

Sort Out Technology's Alphabet Soup

Compiled by Ron Hendrickson



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You want acronyms? We've got acronyms—got 'em by the bushel-basketful, in fact. Technically speaking, this list contains both acronyms and initialisms (acronyms are pronounced as words, while initialisms are pronounced as strings of letters—think "QAM" vs. "QPSK"), but let's not quibble over semantics.

In any event, because our industry spawns these things at about the same rate that bunnies multiply, *Communications Technology*'s editorial staff maintains this "little" reference list to help us keep them all straight.

The bones of the list come from Ted Woo of the Society of Cable Telecommunications Engineers (*CT* February 1998, page 77), and we continually flesh out those bones with information from all manner of other sources. Still, the monster's body is far from complete.

In short, this list is a work in progress. We add new items as we stumble across them. If your favorite acronym isn't in here, let us know. Send your acronyms (and what they *mean*) to Ron Hendrickson, Managing Editor, *Communications Technology*, 1900 Grant St., Suite 720, Denver, CO 80203. Or e-mail rhendrickson@phillips.com Please don't send trade names.

So without further ado, here follow the acronyms. Feel free to copy them to give to a friend.

A-B

AAL: ATM adaptation layer
AC: Alternating current
ACD: Automatic call distribution
ACL: Audit command language
ACP: Adjacent channel power
A/D: Analog-to-digital converter
ADI: Area of dominant influence
ADM: Add/drop multiplexer
ADP: Automatic data processing
ADPCM: Adaptive differential pulse code modulation
ADSI: Analog display services interface
ADSL: Asymmetrical digital subscriber line
ADX: Automatic data exchange
AEL: Audio engineering laboratory
AFC: Automatic frequency control
AFT: Automatic fine tuning
AGC: Automatic gain control
AID: Application identifier
AIN: Advanced intelligent network
AIS: Alarm indicating signal
ALC: Automatic level control
AlGaAs/ZGaAsHBT: Aluminum Gallium arsenide/Gallium arsenide heterojunction bipolar transistor
AlGaAs/InGaAsPHEMT: Aluminum Gallium arsenide/Indium Gallium arsenide pseudomorphic high electron mobility transistor
ALI: Automatic location identification
ALSC: Automatic level and slope control
ALU: Arithmetic logic unit
AM: Amplitude modulation
AM/FM: Automated mapping/facilities management
AML: Amplitude modulated link
AMPS: Advanced mobile phone service
AM-VSB: Amplitude modulation-vestigial sideband
ANI: Automatic number identification
ANSI: American National Standards Institute
AOS: Alternative operator services
APA tape: Aluminum-polypropylene-aluminum tape
APDU: Application protocol data unit
API: Application programming interface
APL: Automatic picture level
APS: Automatic protection switching
ARRL: American Radio Relay League
ARU: Audio response unit
ASC: Automatic slope control
ASCII: American Standard Code for Information Interchange
ASGC: Automatic slope and gain control >

ASIC: Application specific integrated circuit
ASK: Amplitude shifting key
ASN.1: Abstract syntax notation one
AT: Access tandem or Automatic tandem
ATEL: Advanced television laboratory
ATIS: Alliance for Telecommunications Industry Solutions
ATM: Asynchronous transfer mode
ATSC: Advanced Television Systems Committee
ATTC: Advanced Television Test Center
ATV: Advanced TV
AWC: Area-wide Centrex

BASIC: Beginner's All-purpose Symbolic Instruction Code
BBTH: Broadband to-the-home
BCD: Binary code decimal
BCT/E Certification: Broadband Communications Technician/Engineer Certification
BECN: Backward explicit congestion notification
BER: Bit error rate
BERT: Bit error rate tester
BETRS: Basic exchange telecommunications radio service
BHCC: Busy hour call completion
BIP-8: Bit interleaved parity-8
BISDN: Broadband integrated services digital network
BML: Business management layer
BNC: Bayonet nut coupling
Bootp: Boot protocol
bps: Bits per second
BPSK: Binary phase shift keying
BRI: Basic rate interface
BSLBF: Bit string (serial) leftmost bit first
BSS: Business support system
BTA: Basic trade area
BTSC: Broadcast Television Systems Committee

C

CA: Commercial announcement or Conditional access
CAC: Carrier access code
CACS: Classified ad channel system
CAD: Computer-aided design
CAI: Computer-assisted instruction
CAN: Cable area network
CAP: Carrierless amplitude and phase technology
CAPs: Competitive access providers
CARS: Community antenna relay station/service
CAS: Conditional access system
CAT: Conditional access table or Computer-assisted training
CATV: Community antenna TV
CB: Citizens band radio
CBC: Cipher block chaining
CBR: Constant bit rate
CCD: Charge coupled device
CCF: Custom calling features
CCIS: Common channel interoffice signalling
CCITT: Comite Consultatif Internationale de Telegraphique et Telephnique (see also ITU)
CCS: Common channel signaling
CCU: Camera control unit
CDMA: Code division multiple access
CDPD: Cellular digital packet data
CDT: Carrier definition table
CDV: Cell delay variation
CE: Consumer electronics
CEBus: Consumer electronic bus
CER: Cell error rate
CEV: Controlled environmental vault
CGI: Common gateway interface
CIC: Cable in conduit or Carrier identification code
CID: Cable in the ditch
C/IMN: Carrier-to-intermodulation noise
CISC: Complex instruction set computer
CIR: Committed information rate
CLASS: Custom local area signaling services
CLEC: Competitive local exchange carrier
CLI: Cumulative leakage index
CLID: Calling line identification
CLP: Cell loss priority
CLR: Cell loss ratio
CM: Computer modem
CMIP: Common management information protocol
CMTS: Cable modem termination system or Computer modem termination system
CNR or C/N: Carrier-to-noise ratio
CO: Central office
COBOL: Common business-oriented language
CODEC: Coder/decoder
COFDM: Coded orthogonal frequency division multiplexing
CO/HE: Central office/headend >

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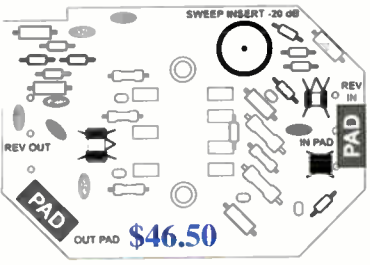

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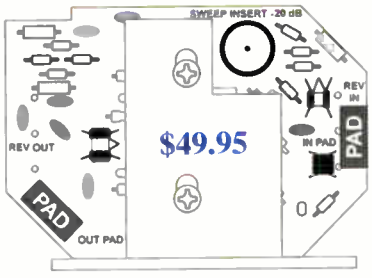

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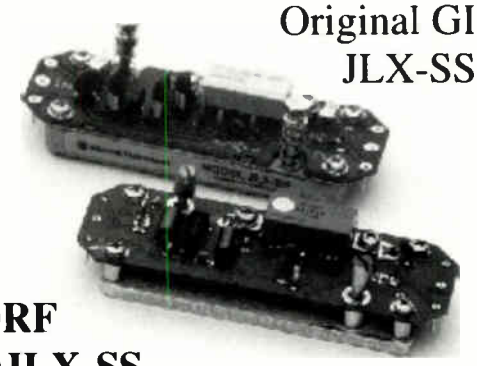

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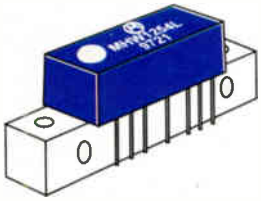

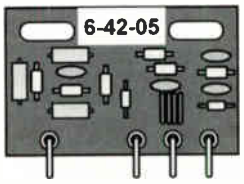

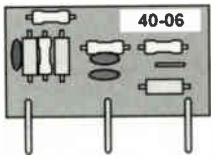

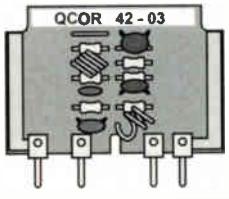

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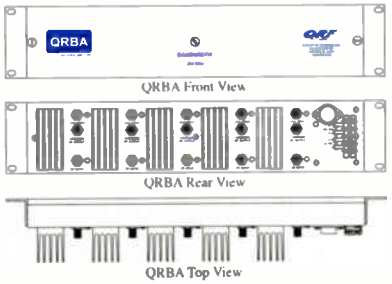

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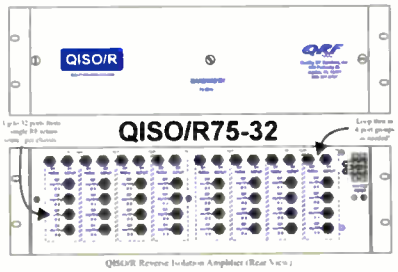

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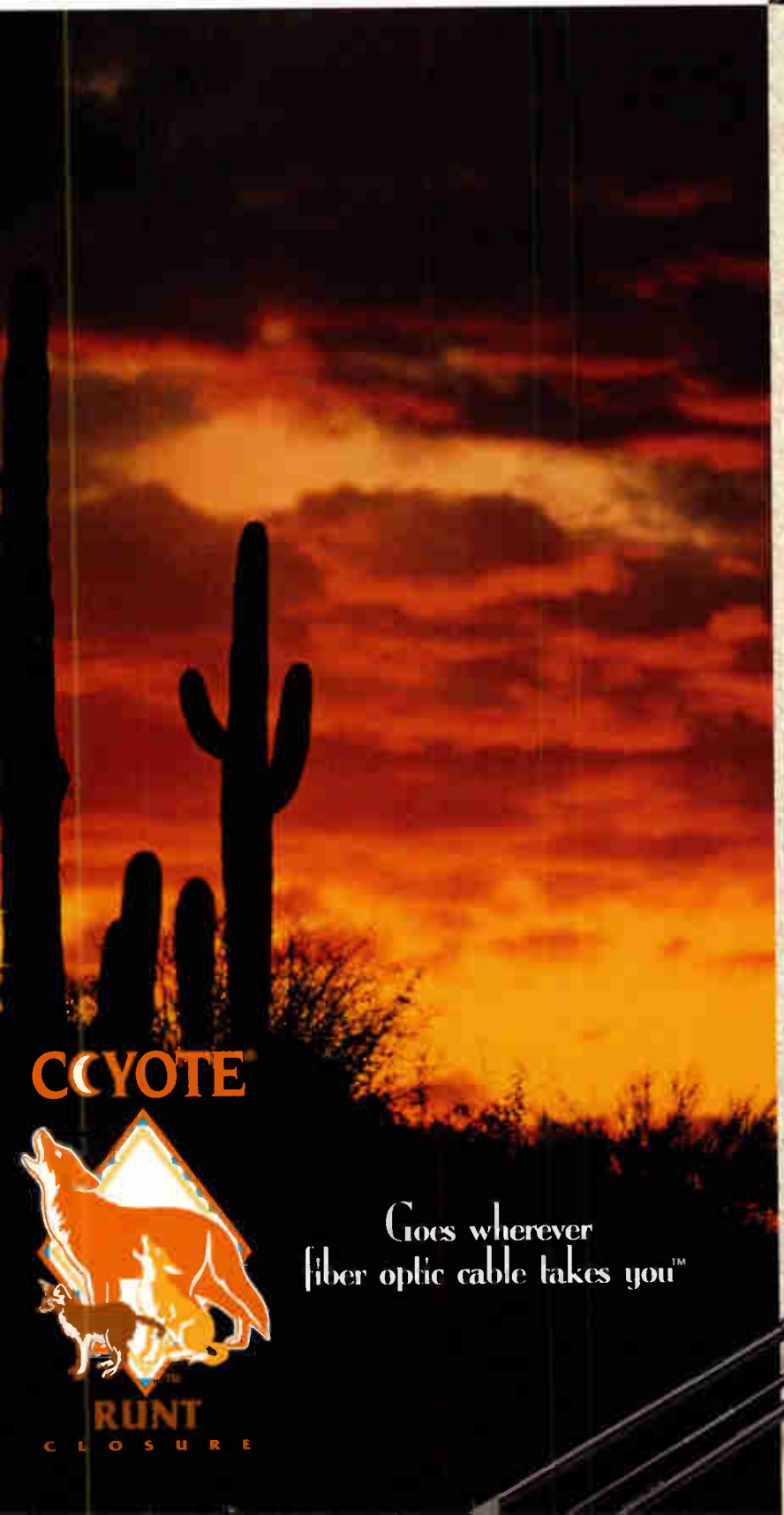
CoS: Class of service
COS: Corporation for open systems
COT: Customer-originated trace
CP: Content provider
CPB: Constrained parameter bitstream
CPCS-PDU: Common par convergence sublayer-protocol data unit
CPD: Common path distortion
CPE: Customer premises equipment
CPR: Capital purchase request
CPS: Characters per second
CPU: Central processing unit
CRC: Cyclic redundancy check
CRO: Cathode ray oscilloscope
CRT: Cathode ray tube
CS: Convergence sublayer
CSA: Canadian Standards Association
CSMA/CD: Carrier sense multiple access with collision detection
CSO: Composite second order
CSR: Customer service representative
CSU: Channel service unit or Customer service unit
CT: Cordless telephone
CTB: Composite triple beat
CTD: Cell transfer delay
CTI: Computer telephone integration
CTN: Cable termination node
CW: Continuous wave or Control word
CWS: Can we serve

D

D/A: Digital-to-analog converter
DA: Directory assistance
DALS: Dedicated access lines
DAVIC: Digital Audio Visual Council
dB: Decibel
dBc: Decibel-carrier
dBd: Decibel-dipole
dBi: Decibel-isotropic
dBm: Decibel milliwatt
dBmV: Decibel millivolt
DBS: Direct broadcast satellite
dBV: Decibel volt
dBW: Decibel watt
DC: Directional coupler or Direct current
DCC: Data communications channel or Digital cross section
DCE: Data communications equipment or Data circuit-terminating equipment
DCS: Digital cross-connect
DCT: Discrete cosine transform
DDS: Digital data service
DE: Data element or Discard eligibility
DES: Data encryption standard >

You want a small job done big? Sic the COYOTE® RUNT on it.



Introducing the closure that goes where others can't. The COYOTE family of fiber optic closures is proud to present its newest member. Under 15" long and designed for node applications in low-count fiber distribution networks, the COYOTE RUNT Closure offers a compact, low-cost closure for use in most environments. It accepts two cables with up to two drops, holds two 12-count splice trays and has two studs for external grounding. To learn how the COYOTE RUNT (or other members of the COYOTE Pack) can answer your call of the wild, call us at (440)461-5200, or visit our Web site at **www.preformed.com** or e-mail us at **inquiries@preformed.com.**

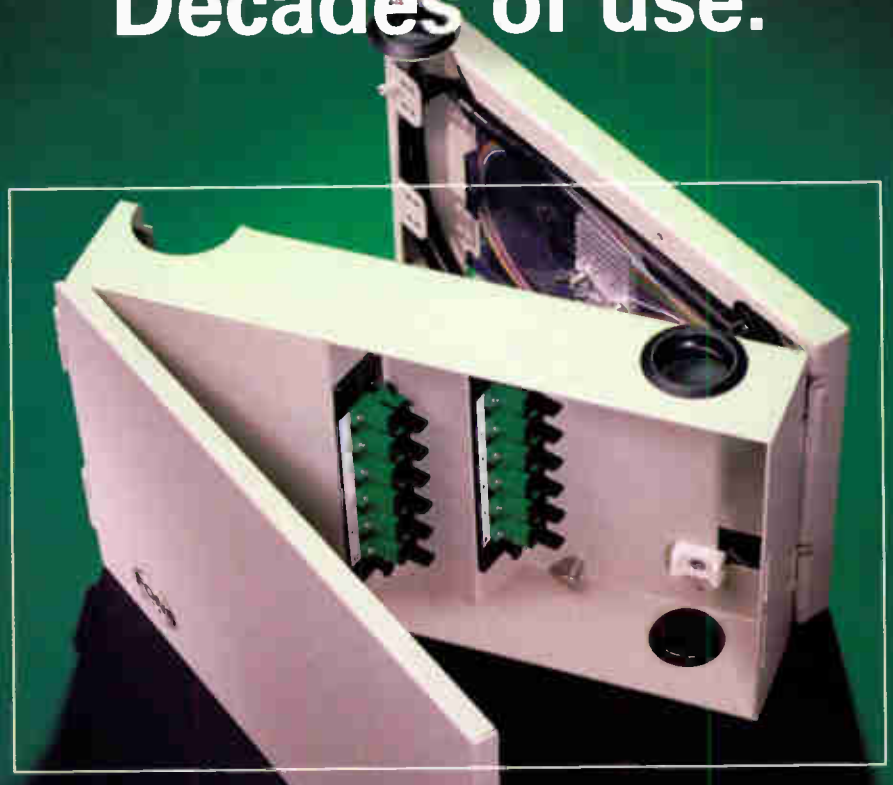
PREFORMED LINE PRODUCTS

DF: Dedicated file
DFB: Distributed feedback laser
DHCP: Dynamic host configuration protocol
DHTML: Dynamic hypertext markup language
DID: Direct inward dialing or Drop-in-duct
DIR: Directory file
DLC: Digital loop carrier
DLCI: Data link connection identifier
DMA: Direct memory access
DMS: Digital multiplex systems
DMT: Discrete multitone
DO: Data object
DOCSS: Data Over Cable Security System
DOCSIS: Data Over Cable Service Interface Specification
DPN: Data packet network
DR: Dynamic range
DRAM: Digital recorded announcement machine or Dynamic random access memory
DS: Digital signal
DSB-SC: Double sideband-suppressed carrier
DSE: Data-switching exchange
DSI: Digital speech interpolation
DSL: Digital subscriber line
DS0: Digital service, level zero
DSM: Digital storage media
DSM-CC: Digital storage media-command and control
DSP: Digital signal processing
DSS: Digital Standards Subcommittee
DSU: Data service unit
DTC: Decoder time clock
DTE: Data terminal equipment
DTH: Direct to home
DTMF: Dual tone multifrequency
DTS: Decoding time stamp
DVB: Digital video broadcast
DVB-C: Digital video broadcast via cable
DVB-SI: Digital video broadcast service information
DVCR: Digital videocassette recorder
DVD: Digital video disc or Digital video display
DVR: Digital video recorder or Digital video recording
DVS: Digital Video Subcommittee
DWDM: Dense wavelength division multiplexing
DWS: Dialable wideband service

E-F

EAEO: Equal access end office >

Minutes to install. Decades of use.



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EAROM: Electronically alterable read-only memory
EAS: Emergency Alert System or Extended area service
EBCDIC: Extended binary coded decimal interchange code
EBU: Equivalent billing units
ECM: Entitlement control message
ECSA: Exchange Carrier Standards Association
EDFA: Erbium-doped fiber-optic amplifier
EDI: Electronic data interchange
EF: Elementary file
EFTS: Electronic funds transfer system
EIA: Electronic Industries Association
EIRP: Effective isotopic radiated power
EISA: Extended industry standard architecture
EMC: Electromagnetic compatibility
EMI: Electromagnetic interference
EML: Element management layer
EMM: Entitlement management message
ENG: Electronic news gathering
ENIS: Element management system
E/O: Electrical-to-optical (Technically, it's RF-to-optical.)
EO&C: Expert observation and commentary
EOL: End-of-line
EPG: Electronic program guide
EPROM: Erasable programmable read-only memory
EROM: Erasable read-only memory
ERP: Effective radiated power
ES: Elementary stream
ESA: Emergency stand-alone
ESC: Engineering service circuit
ESD: Electrostatic discharge
ESP: Enhanced service provider or Encapsulated security protocol
ESS: Electronic switching system
ET: Emerging technologies
ETDMA: Enhanced time division multiple access
ETSI: European Technical Standards Institute
ETU: Elementary time unit
EVM: Error vector magnitude

FAQ: Frequently asked questions
FCC: Federal Communications Commission
FCOT: Fiber central office terminal
FD: Floppy disc
FDDI: Fiber distributed data interface
FDM: Frequency division multiplexing
FDMA: Frequency division multiple access
FEC: Forward error correction
FECN: Forward explicit congestion notification
FEP: Front end processor
FERF: Far end receive failure
FIFO: First in, first out
FITL: Fiber-in-the-loop
FM: Frequency modulation
FML: Frequency modulated link
FMO: Frequency modulated oscillator
FN: Fiber node
FOSE: Fiber-optic splice enclosure
FOTS: Fiber-optic transmission systems
F-P: Fabry-Perot laser
FP: Filter program
FPLL: Frequency and phase-locked loop
FS: Filter set
FSA: Fiber serving area
FSK: Frequency shift keying
FSM: Field strength meter
FTP: File transfer protocol
FTTB: Fiber-to-the-bridger
FTTC: Fiber-to-the-curb
FTTF: Fiber-to-the-feeder
FTTH: Fiber-to-the-home
FX: Foreign exchange
FYI: For your information

G-K

G: Giga-
GA: Grand Alliance
GaAsFET: Gallium-Arsenide-field-effect-transistor
GB: Gigabyte
GFC: Generic flow control
GI: Graded index
GIS: Geographic information system
GMT: Greenwich mean time
GOP: Group of pictures
GPS: Global positioning system
GSM: Global system for mobile communication
GUI: Graphical user interface
GUN: Group and unknown

HCS: Header check sequence
HDBH: High day busy hour
HDLC: High level data link control
HDNI: Home digital network interface
HDSL: High bit rate digital subscriber line
HDT: Host digital terminal >

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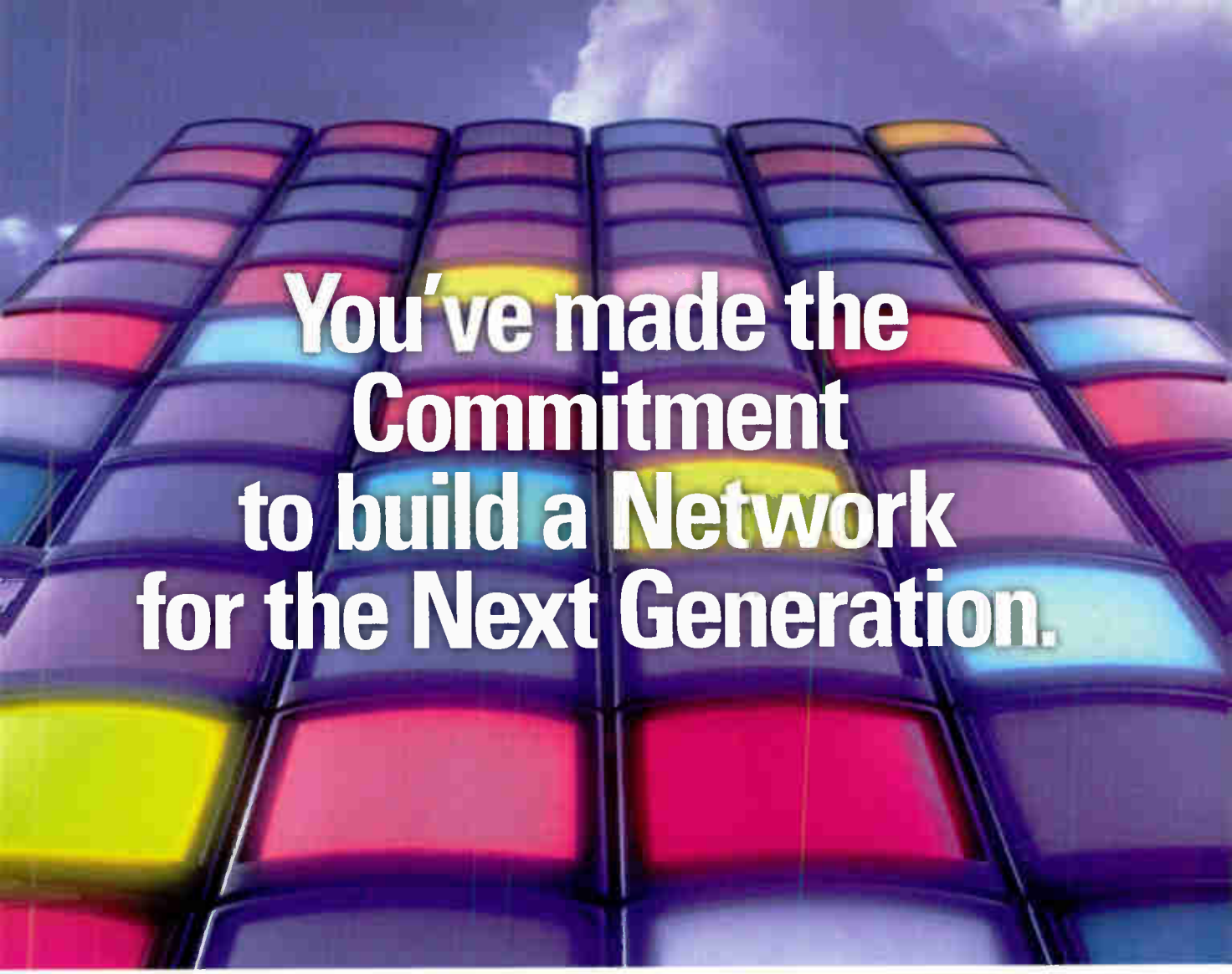
HDTV: High definition TV
HEC: Header error control
HEP: Header extension processing
HFC: hybrid fiber/coax
HFW: Hybrid fiber/wireless
HHP: Household passed
Hi-8: High band 8 mm
HiPHY: High (performance) Physical (modulation)
HITS: Headend In The Sky
HPF: High pass filter
HRC: Harmonically related carriers
HSCD: High-speed cable data
HSTM: High-speed transport multiplex
HTML: Hypertext markup language
HTTP: Hypertext transfer protocol

IC: Integrated circuit
ICC: Incremental coherent carriers; sometimes called Incrementally related carriers
ICCF: Industry Carriers Compatibility Forum
ICN: Integrated community network
ICS: Integrated communication system
IDDD: International direct distance dialing
IDL: Interface definition language
IDLC: Integrated digital loop carrier
IDO: Inter-industry data object
IE: Information element
IEC: International Electrotechnical Commission
IEEE: Institute of Electrical and Electronics Engineers
IETF: Internet Engineering Task Force
IF: Intermediate frequency
IGP: Interior gateway protocol
IGMP: Internet group messaging protocol
IHC: In-home cabling subcommittee
ILEC: Incumbent local exchange carrier
IM: Intermodulation
I-Net: Institutional network
IN: Intelligent network
INET: Intranet
INMS: Integrated network management system
InPHEMT: Indium Phosphide high electron mobility transistor
I/O: Input/output
IOC: Independent operating companies
IOR: Index of refraction
IP: Intelligent peripherals or Internet protocol
IPPV: Impulse pay-per-view
IPR: Intellectual property rights
IPS: Interface Practices Subcommittee
IPV4: Internet protocol version 4
IR: Infrared or infrared remote
IRC: Incrementally related carriers
IRD: Integrated receiver/decoder
IRE: Institute of Radio Engineers or a unit of video measurement; 140 IRE = 1 volt peak-to-peak
IRT: Integrated receiver/transcoder
ISA: Industry standard architecture
ISDN: Integrated services digital network
ISO: International Standards Organization
ISP: Internet service provider
ISR: International simple resale
IT: Information technology
ITS: Insertion test signals
ITU: International Telecommunication Union
ITU-T: International Telecommunication Union-Telecommunications
ITU-TSS: ITU-Telecommunications Standards Sector
IVR: Interactive voice response >



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To find out more about Tollgrade's next-generation cable status monitoring solutions, stop by **Booth #1759** at Cable 2000 in New Orleans, May 7-10. We'll welcome the opportunity to tell you about the latest in LIGHTHOUSE status monitoring and how it will enable you to maintain a proactive approach to network management.

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IXCs: Interexchange carriers (sometimes abbreviated IECs)

JEC: Joint engineering committee
JEDEC: Joint Electron Device Engineering Council

k: kilo-
KSU: Key service unit

L-M

LAN: Local area network
LAPB: Link access control-B
LAPD: Link access control-D
LATA: Local access and transport area
LCD: Liquid crystal display
LCS: Leased circuit service
LDAP: Lightweight directory access protocol
LDS: Local distribution service
LEC: Local exchange carrier
LED: Light emitting diode
LEO: Low earth orbit
LFE: Low frequency effect
LIFO: Last in, first out
LILO: Last in, last out
LLC: Logical link control
LMDS: Local multipoint distribution service
LNA: Low noise amplifier
LNB/LNC: Low-noise block converter
LO: Local origination
LOP: Local origination programming
LOS: Line of sight
LPF: Low-pass filter
LPM: Lines per minute
LRN: Location routing number
lsb: least significant bit
lsB: least significant byte
LSI: Large-scale integration
LSMS: Local service management system

µ: Micro-
m: Milli-
M: Mega-
MAC: Media access control
MAN: Metropolitan area network
MATV: Master antenna TV system
MAU: Medium attachment unit
Mb: Megabit
MB: Megabyte
MBE: Molecular beam epitaxy
MBG: Multilocation business group
MCC: MAC common convergence
MCNS: Multimedia cable network system
MCPT: Multiple carriers per transponder
MCR: Master control room
MD: Minidisc digital
MDF: Main distribution frame
MDPE: Medium density polyethylene
MDS: Multipoint distribution service or Message delivery service
MDU: Multiple dwelling unit
MeSFET: Metal-semiconductor field effect transistor
MER: Modulation error ratio
MF: Multifrequency
MFJ: Modification of final judgment
MFN: Mini-fiber node
MGCP: Media gateway control protocol
MIBS: Management information bases
MIPS: Million instructions per second
MIS: Management information system
MM: Multimode
MMDS: Multichannel multipoint distribution service or Microwave multipoint distribution service
MMI: Man machine interface >

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MMT: Modulation mode table
MODEM: Modulator/demodulator
MPEG: Moving Picture Experts Group
MP@HL: Main profile at high level
MP@ML: Main profile at main level
MSA: Metropolitan service area or Metropolitan statistical area
msb: Most significant bit
msB: Most significant byte
MSC: MAC service control
MSO: Multiple system operator
MSPS: Megasamples per second
MTBF: Mean time between failure
MTS: Modem termination system or Multichannel TV sound or MPEG transport stream
MTSO: Mobile telephone switching office
MTTR: Mean time to repair
MUTCD: Manual for Uniform Traffic Control Devices
MUX: Multiplexer

N-O

NA: Numerical aperture
NAB: National Association of Broadcasters
NAD: Network access device
NAMIC: National Association of Minorities in Cable
NAMPS: Narrowband AMPS
NANP: North American numbering plan
NAP: Network access points
NAT: Network address translation
NCOS: Network class of service
NCP: Network control program or Network control point
NCTA: National Cable Television Association
NCTI: National Cable Television Institute
NDYAG: Neodymium Yttrium Aluminum Garnet
NE: Network element
NEC: National Electrical Code
NEDA: National Electronics Distributors Association
NEMA: National Electronic Manufacturers Association
NESC: National Electrical Safety Code
NET: National educational TV
NFS: Network file system
NIC: Network information center or Network interface card
NID: Network interface device
NII: National information infrastructure
NIM: Network interface module
NIU: Network interface unit
NML: Network management layer
NMS: Network management system
NNI: Network/network interface or Network/node interface
NOC: Network operations center
NP: Network provider
NPA: Numbering plan area
NPR: Noise-to-power ratio
NPRM: Notice of proposed rulemaking
NTC: Network Transmission Committee
NTSC: National Television System Committee
NVM: Nonvolatile memory
NVOD: Near-video-on-demand

OAM&P: Operations, administration, maintenance and provisioning
OC: Optical carrier
OCC: Other common carrier
OC-N: Optical carrier level N
OCR: Optical character recognition
O/E: Optical-to-electrical (Technically, it's optical-to-RF) >

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OEM: Original equipment manufacturer
OFDM: Orthogonal frequency division multiplexing
OMG: Object management group
OMI: Optical modulation index
ONA: Open network architecture
ONU: Optical network units
OOB: Out-of-band
OOP: Object-oriented programming
OPX: Off-premises extension
OQPSK: Offset quadrature phase shift keying
OR: Optical receiver
OS: Operating systems
OSD: On-screen display
OSI: Open system interconnection
OSPF: Open shortest path first
OSS: Operations support systems
OTDR: Optical time domain reflectometer
OTG: On-time guanantee
OTN: Optical transfer nodes
OTP: Office of Telecommunications Policy

P-Q

PABX: Private automatic branch exchange
PAD: Packet assembler and disassembler
PAE: Power-added efficiency
PAL: Phase alteration line
PAT: Program association table
PBX: Private branch exchange
PC: Personal computer or printed circuit
PCI: Peripheral component interconnect
PCIA: Personal Communications Industry Association
PCM: Pulse code modulation
PCMCIA: Personal Computer Memory Card International Association
PCN: Personal communications network
PCR: Program clock reference
PCS: Personal communications services
PDH: Plesiochronous digital hierarchy
PDN: Primary directory number or Public data network
PDU: Protocol data unit
PE: Polyethylene
PEG: Public, educational or government access
PES: Packetized elementary stream
PHB: Packet hop behavior
PHD: Power hybrid doubler
PHY: Physical layer
PICS: Protocol implementation conformance statement
PID: Packet identifier
PIN: Personal identification number
PIX: Proprietary (application) identifier extension
PLL: Phase locked loop
PM: Phase modulation or Physical medium
PMD: Physical medium dependent
PMT: Program map table
PNNI: Private network to network interface
POP: Points of presence or Proof of performance
POTS: Plain old telephone service
PPK: Private-public key
PPM: Peak program meter
PPP: Point-to-point protocol
PPV: Pay-per-view
PRI: Primary rate interface
PROM: Programmable read-only memory
PS: Power supply
PSC: Public Service Commission (also called PUC)
PSI: Program specific information >

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PSK: Phase shift keying
PSTN: Public switched telephone network
PTI: Payload type identifier
PTS: Protocol type selection
PTT: Post, Telegraphs and Telephones
PU: Presentation unit
P/V: Peak-to-valley
PVC: Permanent virtual circuit or Polyvinyl chloride

QAM: Quadrature amplitude modulation
QoS: Quality of service
QPSK: Quadrature phase shift keying

R

RAD/RASP: Remote antenna device/remote antenna signal processing
RADIUS: Remote authentication dial in user service
RAID: Redundant array of independent discs
RAM: Random access memory
RAO: Revenue accounting office
RBOC: Regional Bell operating company
RBW: Resolution bandwidth
RCC: Radio Common Carrier
RDBMS: Relational database management system
RDM: Reverse data multiplexing
REA: Rural Electrification Administration
RF: Radio frequency
RFC: Request for comments
RFI: Radio frequency interference
RFP: Request for proposal
RFU: Reserved for future use
RHC: Regional holding company
RID: Registered (application provider) identifier
RIN: Relative intensity noise
RIP: Routing information protocol
RISC: Reduced instruction set computing
RL: Return loss
RMS: Root mean square
ROM: Read only memory
RP: Record pointer
RPC: Remote procedure call
RPCHOF: Remainder polynomial coefficients, highest order first
RSA: Rural service area
RSVP: Resource reservation protocol
RTCP: Real time control protocol
RTP: Real time protocol
RTSP: Real time streamline protocol
RTU: Remote test unit

S

SAP: Secondary audio program >

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SAR: Segmentation and reassembly
SAW: Surface acoustic wave
SBE: Society of Broadcast Engineers
SBS: Satellite Business Systems or Stimulated Brillouin scattering
SCA: Subsidiary communications authority
SCADA: Security, CATV, data
SCAI: Switch-to-computer applications interface
SCBA: Small Cable Business Association
S-CDMA: Synchronous code division multiple access
SCE: Service creation environment
SCP: Service control point
SCR: System clock reference
SCSI: Small computer system interface
SCTE: Society of Cable Telecommunications Engineers
SD: Super density
SDH: Synchronous digital hierarchy
SDO: Standards Development Organization
SDSL: Single-line digital subscriber line
SDTV: Standard definition TV
SGDF: Supergroup distribution frame
SHL: Studio-to-headend link
SI: Step index
SiCSIT: Silicon carbide static induction transistor
SiGeHBT: Silicon Germanium heterojunction bipolar transistor
SIF: Standard image format (such as NTSC)
SIM-ME: Subscriber identity module-mobile equipment
SIR: Sustained information rate
SIT: Satellite information table
SLIP: Serial line Internet protocol
SLM: Signal level meter
SLS: Single line service
SM: Single mode
SMATV: Satellite master antenna TV system
SMDR: Station message detail recording
SMDS: Switched multimegabit data service
SML: Service management layer
SMPTE: Society of Motion Picture and Television Engineers
SMR: Specialized mobile radio
SMS: Service management system
SMTP: Simple mail transfer protocol
SNR or S/N: Signal-to-noise ratio
SNA: Systems network architecture
SNAIP: Simple network management protocol
SNMP: Simple network management protocol
SOHO: Small office, home office
SONET: Synchronous optical network
SP: Service provider
SPC: Stored program protocol
SPE: Synchronous payload envelope
SPI: Security parameter index
SRL: Structural return loss
SSB: Single sideband or Star-star-bus
SSP: Service switching point
SS7: Signaling System 7
STB: Set-top box
STD: System target decoder
STL: Studio-to-transmitter link
STM-1: Synchronous transfer mode 1
STP: Signal transfer point
STS: Synchronous transport signal
STU: Set-top unit
STV: Subscription TV
SVB: Switched video broadcast
SVC: Switched virtual circuit

T-U

TA: Technical advisory
TAI: International atomic time
TAMI: Television Accessory Manufacturers Institute
TASO: Television Allocation Study Organization
TC: Transmission convergence
TCC: Telephone coordinating circuit
TCM: Trellis coded modulation
TCP: Transmission control protocol
TCP/IP: Transmission control protocol/Internet protocol
TDD: Telecommunications device for the deaf
TDM: Time division multiplexing
TDMA: Time division multiple access
TDR: Time domain reflectometer
TDT: Transponder data table
TFTP: Trivial file transfer protocol
TIA: Telecommunications Industry Association
TL: Transaction language
TLV: Tag length value
TMN: Telecommunications management network
TNT: Transponder name table
ToS: Type of service
TOV: Threshold of visibility
TR: Technical reference >

SIGNAL VISION = INNOVATION

1984 — *SVI introduces passives using solder-sealed backplates for EMI protection.*

1986 — *SVI redesigns the ground screw enclosure on die-cast housings to eliminate breakage.*

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1992 — *SVI develops subscriber passives with a minimum 20 dB Return Loss.*

1995 — *SVI eliminates intermodulation distortion in subscriber passives.*

1997 — SVI conceives a ground-plane management system (Patent Pending) for subscriber passives.

1998 — *SVI achieves Return Path Isolation of -35 dB in subscriber splitters without compromising high-end performance. (1999: -45 dB Return Path Isolation).*

1999 — *SVI complies with IEEE-62-41 A3 for surge protection in drop passives.*

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TS: Transport stream
TSI: Time slot interchange
TVRO: Television receive-only earth station

UAR: Universal asynchronous receiver
UBR: Unspecified bit rate
UCD: Upstream channel descriptor message
UDP: User datagram protocol
UHF: Ultra-high frequency
uimsbf: Unsigned integer, most significant bit first
UNI: User network interface
UPS: uninterruptible power supply
URL: Uniform resource locator
USB: Universal serial bus
USTA: United States Telephone Association
UTC: Universal coordinated time
UTP: Unshielded twisted-pair

V-Z

VAN: Value-added network
VANC: Voice actuated network control
VAPN: Virtual access to private networks
VBI: Vertical blanking interval
VBR: Variable bit rate
VBV: Video buffering verifier
VC: Virtual channel
VCI: Virtual channel identifier
VCN: Virtual channel number
VCR: Videocassette recorder
VCT: Virtual channel table
VCXO: Voltage controlled crystal oscillator
VDSL: Very high data rate digital subscriber line
VDT: Video dial tone or Video display terminal
VF: Voice frequency
VHF: Very high frequency
VHS: Video home system
VIRS: Vertical interval reference test signal
VITS: Vertical interval test signal
VLAN: Virtual local area network
VLCF: Variable length convergence function
VLSI: Very large scale integration
VOD: Video-on-demand
VOIP: Voice over Internet protocol
VOP: Velocity of propagation
VP: Virtual path
VPI: Virtual path identifier
VPN: Virtual private networks
VRU: Voice response unit
VSAT: Very small aperture terminal
VSB: Vestigial sideband
VSWR: Voltage standing wave ratio
VT: Virtual tributary
VTR: Videotape recorder
VU: Volume unit

WAIS: Wide area information servers
WAN: Wide area network
WATS: Wide area telecommunications service
WDM: Wavelength division multiplexing
WICT: Women in Cable & Telecommunications
WPBX: Wireless private branch exchange
WTN: Wiring termination node
WWW: World Wide Web

XDS: Extended data system
xDSL: any variant of digital subscriber line technology
XMOD: Cross modulation
XO: Crystal oscillator CT

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MARKETPLACE

DACS FOR DVD

Two digital-to-analog converters (DACs) from Analog Devices provide 113-117 dB of dynamic range to digital versatile disk (DVD) applications. The AD1852 is a 24-bit stereo audio DAC that is a lower cost, voltage-output, follow-up to the AD1853 and uses proprietary data conversion technology that improves audio performance at sample rates from 32 kHz to 192 kHz. The AD1854 is a single-chip, stereo digital audio playback system capable of sampling data at 16, 18, or 24 bits. It consists of a multibit sigma-delta modulator with dither, continuous time analog filters, analog output drive circuitry and clickless volume control and mute.

For more information, contact Analog Devices at (800) 262-5643 or on the Web at www.analog.com.

CHIP FAMILY

The MicroTuner 2030 is the third generation of Microtune's tuner RF integrated circuits (ICs). The 2030-series

devices are single-chip, fully integrated (including low noise amplifier), dual-conversion tuners that support both analog and digital applications. MicroTuner chips are available with performance optimized for specific markets, including interoperable cable set-top boxes, cable modems, personal computers (PCs)/TV sets, and digital TV sets. The chips feature a 30-percent power reduction over previous series.

For more information, contact Microtune at (972) 673-1600 or on the Web at www.microtune.com.

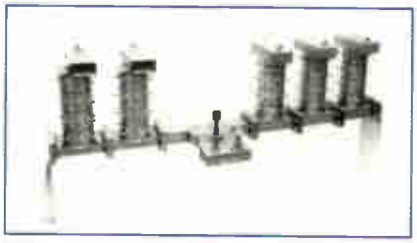
FASTENERS

Gardner Bender's specialty Data/Voice/Video (DVV) fasteners are designed to speed and simplify communication and data network installation. These fasteners feature a one-piece nail-in solution for cabling to concrete, roofing and wood studs; they accommodate common sizes of coaxial and other cable. More than two dozen different types are included in the line. All feature a clip-on cable holding design and staples with ultraviolet-resistant polyethylene saddles and zinc-plated nails. Different types meet specific application requirements. The roofing nails are designed for fastening coaxial cables directly to shingled roofs.

For more information, contact Gardner Bender at (414) 352-4160 or on the Web at www.gardnerbender.com.

CHANNEL COMBINER

Communications and Energy Corp.'s 2300 series combiners support multipoint multichannel distribution service (MMDS). They can combine up to 16 nonadjacent channels in series or 31 adjacent channels with 1008 3 dB quad hybrid. Digital performance specifications across 6 MHz bandwidth are as follows: group delay ripple, <+/-15 ns; insertion loss, for one combiner is <1.0 dB with additional maximum loss of 0.025 dB per channel voltage standing



wave ratio (VSWR), >20 dB; and semi adjacent isolation, >45 dB. The unit measures 8.5 in. x 8.5 in. by 36 in.

For more information, contact Communications and Energy at (315) 452-0709 or on the Web at www.cefilter.com.

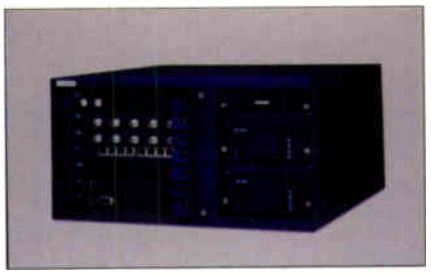
EDFA MODULES

Ditech Communications has launched the Quasar, the first in a series of Erbium-doped fiber amplifier (EDFA) modules. This module offers network equipment vendors one of the building blocks required to build advanced dense wavelength division multiplexing (DWDM) systems. Quasar is intended for use in optical switching, optical add/drop, and optical restoration applications. A customized gain flattening filter ensures that peak-to-peak power differences between DWDM channels is typically 1.0 dB across a 1,530-1,563 nm range.

For more information, contact Ditech at (800) 234-0884 or on the Web at www.ditechcom.com.

CABLE MODEM AND CMTS

Com21's DOXport 101 cable modem allows home cable subscribers to get fast Internet access. DOXport is compatible with every Data Over Cable Service Interface Specification (DOCSIS) 1.0- and 1.1-based cable modem termination system (CMTS). It incorporates 56-bit data encryption standard (DES) encryption, takes up 1.5 x 7.5 inches of space, and supports up to 16 personal computers (PCs).



Com21's DOXcontroller CMTS scales to support 4,000 cable modems, handles data and management packets in parallel, minimizes upstream traffic latency, and enables toll-quality voice with minimal voice jitter.

For more information, contact Com21 at (408) 953-9100 or on the Web at www.com21.com.

NONSTANDBY POWER

> Alpha Technologies' APC2 pole-mount, nonstandby power supply allows application-specific custom configuration. Alpha's ferroresonant design provides fully regulated output voltage, surge and short-circuit protection, and complete line conditioning under normal modes of operation and loading. The APC2 can be configured with a variety of performance options. It is available in both 60 V and 90 V versions.

For more information, contact Alpha at (360) 647-2360 or on the Web at www.alpha.com.

HOTEL INTERNET AND CMTS

Netgame's NetHotel system uses existing hotel cable TV infrastructure to provide hotel guests with continuous connection to the Internet at speeds of up to 10 Mbps. Based on NetGame's cable modem technology, NetHotel enables guests to access the Internet using laptop computers or through in-room set-top boxes.

NetGame's Quarterback cable modem termination system (CMTS) transforms cable TV networks into high performance local area networks. The Quarterback CMTS is Data Over Cable Service Interface Specification (DOCSIS) 1.0/1.1-compliant and supports both cable- and telco-return with a single management system.

For more information, contact NetGame at (650) 324-0818 or on the Web at www.ngcable.com.

DWDM SOURCE LASER

Ortel's Inferno laser enables original equipment manufacturers (OEMs) to add functions to their products by overcoming high signal loss. The component is an 80 mW continuous wavelength (CW) 1,550 nm distributed feedback (DFB) source laser for dense wavelength division multiplexing (DWDM) applications. Inferno is designed for lithium niobate and discrete electroabsorption transmitters. It delivers a minimum of 80 mW CW output power over an operating case temperature range of –40° C to +65° C. Initially, Inferno will support C-band applications, but both C- and L-bands will be populated early next year.

For more information, contact Ortel at (800) 362-3891 or on the Web at www.ortel.com.

TRANSFORMER FAMILY

Pulse's surface-mount, wideband RF transformers are designed for cable upstream interface applications. The C2020 and C2022 have 1:1 and 1:4 impedance ratios respectively, operate at upstream frequencies from 5-80 MHz and have less than 1 dB of insertion loss.

These six-pin surface-mount transformers require 0.30 x 0.39 inches (7.62 mm x 9.9 mm) of board space. Both are designed for –40° C to + 85° C extended temperature operation and can withstand the 235° C peak solder reflow requirement.

For more information, contact Pulse at (858) 674-8100 or on the Web at www.pulseeng.com.

PCI CHASSIS

Advantech Technologies' protocol control information (PCI) chassis supports various computer telephony integration (CTI) applications. The MIC-3032/8 eight-slot CompactPCI chassis is compliant with PCI Industrial Computer Manufacturers Group 2.5 computer telephony, H.110 cordless telephone, bus and rear panel input/output, and hot-swap specifications. Its modular design supports many CTI applications, including automatic call distributors (ACDs), voice over Internet protocol (VoIP) servers, and video-on-demand (VOD).

For more information, contact Advantech at (858) 623-0838 or on the Web at www.advantech.com/ic.

GROUND RESISTANCE TESTER

LEM Instrument's GEO Model 15 is a battery-operated, auto-ranging, ground-resistance tester with a beeper that allows one-handed checking of ground grid connections without the need for stakes or disconnections. Model 15 measures from 0.025 ohms to 1,500 ohms at 1.667 kHz and can measure leakage currents down to 1 µA resolution. The tester comes with battery, heavy-duty case and calibration loop.

For more information, contact LEM at (310) 373-0966 or on the Web at www.leminstruments.com.

LIGHTNING WARNING

The SAFe system for advance warning of potential lightning strikes from the French company Dimensions is available in North America. The system identifies three hazard levels: a pre-warning level to indicate thunderstorms; a warning level that detects lightning hazards two to three miles from the station; and an alert level signaling imminent risk of a lightning strike. The SAFe system can detect active thunderstorms as far as 15 miles away and identify incipient thunderstorms from six to nine miles away.

For more information, contact the French technology press office at (312) 222-1235 or visit Dimensions on the Web at www.eurostorm.com.

SEISMIC-PROOF POWER

Yuasa's Zone 4-certified rack for its PowerLock batteries has been subjected to stringent shaker table testing, enabling the batteries to be used in seismically active areas. The industrial front termination PowerLock batteries are intended for distributed power, wireless, private branch exchange (PBX), cable TV and other telecom applications where space is limited and high power is essential. The Independence PL-110 and PL-150 PowerLock batteries are designed to provide a 48 V system on a single shelf of the Zone 4 rack.

For more information, contact Yuasa at (800) 538-3627 or on the Web at www.yuasainc.com.

TIMELY SOLUTIONS

Datum's TimePieces chipset family provides original equipment manufacturers (OEMs) with powerful embedded synchronization solutions. Timepieces will synchronize the transmission of data, voice and video to deliver carrier-class performance for core, edge and access products, including voice over Internet protocol (VoIP) applications. The TimePieces' plug-and-play architecture consists of a set of smart chips that configure themselves automatically, enabling designers to integrate scalable synchronization architecture with rapid time-to-market and low-risk design.

For more information, contact Datum at (949) 598-7500 or on the Web at www.datum.com/timepieces.

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MPS-12 Mini-Headend w/45dB Output (54MHz - 752MHz) with 10 MPSM45 Modulators and 1 MPSD Demodulator

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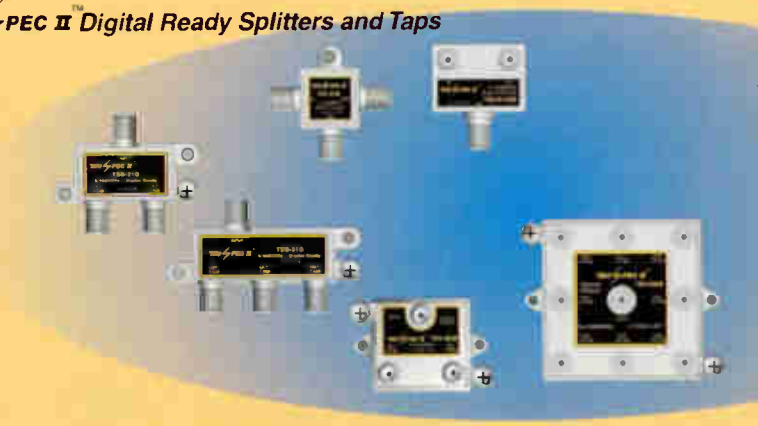

In addition to the complete line of quality headend components offered by ***Pico Macom*** a complete line of installation hardware, DBS components and *digital ready* passives are also available. The ***Tru-Spec II*** series represents a new generation of passive products designed for higher frequency operation and compatibility in two-way systems. They are designed to assure a minimum of intermodulation products that can occur with passives used in systems with high signal levels.

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BACKBONE CABLE SOLUTIONS

NetClear, a structured cable solution from Berk-Tek and Ortronics, is designed to optimize signal-to-noise (S/N) ratio, enabling networks to operate at peak digital data transmission levels. Every NetClear solution is guaranteed to exceed the bit error rate (BER) requirements of the most demanding applications such as Gigabit asynchronous transfer mode (ATM) and Gigabit Ethernet. NetClear says all components are matched to provide clear, balanced transmission signals. NetClear patch cords use a traditional round cable construction and feature impedance-matched components.

For more information, contact Ortonics at (877) 962-5327 or visit www.NetClear-channel.com.

OPTICAL TEST SET

The OTS9000 Optical Test Set from Tektronix tests dense wavelength division multiplexing (DWDM) systems at 10 Gbps. Geared for manufacturers of optical carrier (OC)-192/synchronous transfer mode (STM)-64 networking equipment, the system provides users with pattern generation and analysis for verification of multiple signals through bit error rate (BER) analysis. The OTS9000 has a scalable, flexible platform and has three card configurations: transceiver, transmitter only and receiver only. The system's variable receiver threshold allows manufacturers to perform accelerated BER testing.

For more information, contact Tektronix at (800) 426-2200 or on the Web at www.tektronix.com.

CONNECTOR

Bomar Interconnect Products has announced the Shadow, a 75 ohm bayonet nut coupling (BNC) connector. It is designed to terminate commonly used coaxial cables and the RF requirements of high definition TV (HDTV). Providing 3 GHz return loss, the Shadow features machined brass with Teflon insulators and gold-plated, semi-captive contacts.

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

AVANTRON AT-2000R CATV SPECTRUM ANALYZER

- ***Lightweight, and easy to use, only 19 lbs/8.6 Kg***
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- ***Meets specifications with 60 second warm up***
- ***High Sensitivity C/N, >60 dB at +5 dBmV***
- ***Fast 3 ms sweep time to catch transient ingress***
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- ***In-service CATV Measurements***
- ***Color LCD screen***
- ***Digital power measurements***
- ***... for the field***

Peter,
you can actually try this unit online! Go to their website at www.avantron.com It's really something to see!
Mike

The instrument of choice for analyzing ingress problems is a spectrum analyzer because of its broad input, excellent resolution, wide dynamic range and high sensitivity.

Today's advanced HFC networks demand more advanced testing out in the field. Tests such as finding fast transient ingress, measuring C/N ratios in excess of 60 dB, accurately measuring digital carriers, and doing complex proof of performance testing, all point to using an advanced CATV Spectrum Analyzer.

While spectrum analyzers with this capability have been available for many years, the Avantron AT-2000R sets a new standard in portability and ruggedness. At only 19 lbs/8.6 Kg (including battery with 2.5 hour operating time), the AT-2000R is by far the most lightweight, full featured CATV Spectrum Analyzer on the market.

Being comprehensive instruments, spectrum analyzers can be difficult to use, however, the AT-2000R features a simple, easy to learn user-interface.

All CATV Tests

Comprehensive CATV tests are performed quickly, accurately and in-service:

- RF Carrier Levels
- Carrier Frequency
- C/N, CSO and CTB
- HUM Modulation
- In-Channel Response
- Depth-of-Modulation
- Digital Channel Power

Fastest Scan Speed

Finding ingress on the reverse path can be a challenge, especially since much of the ingress are fast transients. Having the fastest scan speed of any CATV Spectrum Analyzer, the AT-2000R can scan a 100 MHz span in only 3 ms, ensures that you will catch all of the transient ingress. A built-in AM/FM demodulator allows you to listen to the interfering signals to help you determine its source.

With its high sensitivity, the AT-2000R can measure C/N ratios of greater than 60 dB with only a +5 dBmV signal, eliminating the need for an external amplifier even at test points or low level drops.

Most Accurate

With ±0.75 dB level accuracy, the AT-2000R signal measurement functions are much more accurate than any spectrum analyzer on the market. The AT-2000R assures instant accuracy and repeatability with the AutoCal feature which automatically calibrates itself within seconds of power-up

PC Technology

The AT-2000R is designed with PC technology in mind. Measurement traces and instrument settings are stored as records in non-volatile memory for later printing, or transferring to a PC. Up to 100 measurements and traces, as well as 64 instrument settings can be stored in memory for later download. Traces stored on a PC can also be transferred back to the instrument so they can be superimposed on a live trace.

Avantron

Avantron Technologies Inc.
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CALENDAR

May

3-4: West Virginia Mountaineer SCTE Chapter technical seminar, Ramada Inn, S. Charleston, W.Va. Contact Charles Bradley, (304) 247-6231.
4: Delaware Valley SCTE Chapter Vendor Show, Horsham, Pa. Contact Chuck Tolton, (215) 961-3882 or chuck_tolton@cable.comcast.com.
4-8: SuperComm 2000, Atlanta, Ga. Call (800) 559-3327.
7-10: C2K, NCTA National Show, New Orleans. Call (202) 755-3669.
9: Cascade Range SCTE Chapter technical seminar, Holiday Inn, Wilsonville, Ore. Contact Chris Johnson, (503) 245-0603 or johnson.chris@tci.com.
11: Penn-Ohio SCTE Chapter Vendor Show, Warrendale, Pa. Contact Linda Strobert (717) 263-7571.
17-18: Alaska SCTE Chapter Vendor Show, Anchorage, Alaska. Contact Gary Haynes at ghaynes@gci.com.
25: Central California SCTE Chapter Introduction to Fiber Optics, MediaOne L & D Center, Fresno, Calif. Contact Roger Paul, (559) 253-4685.

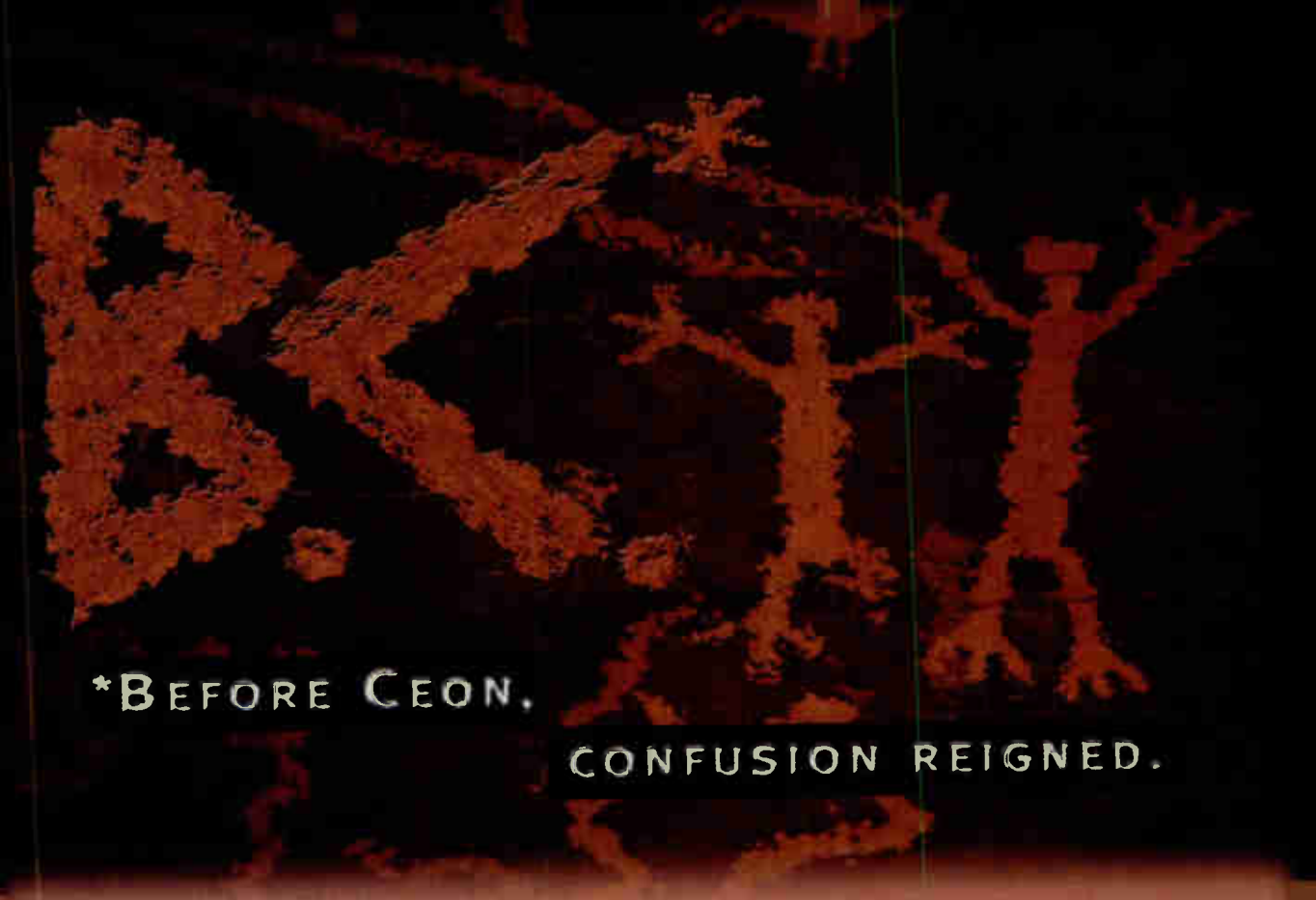
SCTE Seminars

17-18: Broadband Technology for Technicians, Sheraton Nashville Downtown, Nashville, Tenn.
23-25: Fiber Technology for Technicians, Holiday Inn Select, Little Rock, Ark.
25-26: Data Communications, Holiday Inn Boston-Somerville, Mass.

For more information on SCTE seminars, contact Jessica Dattis, (800) 542-5040, ext. 239.

PLANNING AHEAD

- *June 5-8:* SCTE Cable-Tec Expo 2000, Las Vegas. Call (610) 363-3822 or go to www.scte.org.
- *July 12-15,* New England Cable Show, Newport, R.I. Call (781) 843-3418.
- *July 31-August 2:* National Cable Television Cooperative (NCTC) 16th Annual Meeting, Newport, R.I. Call (913) 599-5900.
- *Sept. 12-14:* East Coast Cable 2000/Atlantic Show, Baltimore. (609) 848-1000.
- *Sept. 27-29:* Great Lakes Show, Chicago. Call (317) 845-8100.



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"Why can't I call one number to receive all my services?"

"Why do I get multiple bills each month from a single provider?"

"Why do I have to wait a week to get the services I ordered – if I get them at all?"

"Why can't I review my bill, pay it, and order new services online?"

"If I'm such a good customer, why can't I get a discount or better service?"

Facing questions like these, Multiple System Operators looking to expand their offerings often find themselves between a rock and a hard place. Provisioning, bundling, activation, self-service, pricing – what's an operator to do, without going back to the beginning and starting over?

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Introducing Cable Modems, Part 1

This month's installment begins a series on cable modem installation. The material is adapted from a lesson in NCTI's new Digital Installer Course. © NCTI.

Determining locations of the computer, cable modem and the telephone jack (when required) precedes connecting RF and network cables to the modem and computer. Certifying the reliability of the customer's drop system is also important in ensuring high-speed cable Internet access.

Determine gear locations

Prior to connecting the RF and network cables to the modem and computer, locate the computer and determine the desired location for the modem. If using a telephony return, locate the nearest telephone jack and determine if the existing telephone outlet is adequate for optimal performance and minimal service problems.

Like a cable TV outlet installation, review and discuss the computer location with the customer. Have the customer show you the present or desired location. You must determine with the customer if the location is permanent or if the equipment will be moved to another location. If your customer makes seasonal changes in the computer's location, recommend installing another outlet when it's time to move the computer. However, if the customer plans to move the computer only a few feet from its current location, install the cabling to accommodate that.

At this time, have the customer turn on the computer and verify it operates properly. Always have the customer turn on the computer first. Then, if a problem exists with the computer, there will be no question of responsibility. While at the computer, ask if the customer prefers Internet Explorer or Netscape Navigator as a browser. If the customer has no preference or has never used an Internet browser before, install or use what your company recommends.

Certify drop reliability

Before adding a broadband cable outlet or connecting a drop splitter or a directional coupler to an existing cable outlet, check the condition and integrity of the customer's drop. The accompanying table provides a recommended checklist for certifying reliability of a customer drop system.

Visually check that the installation and connections meet requirements. Correct or replace any drop components that are damaged, extremely old, or in any way not in compliance with your company's specifications before connecting a cable modem. Remove any old traps that may impede modem operation and tag the service drop at the tap, if required.

Ask the customer if any picture quality problems exist on any cable-installed TV sets. Ask permission to check the picture quality on those sets. Check the analog channels for obvious ingress, beats or any apparent problems. Digital video channels often will hide small problems in the drop. Visual impairments show up more readily in analog video channels and can indicate possible problems.

Always measure the signal levels at several channels throughout the system's bandwidth. Monitoring, detecting and eliminating signal leakage helps prevent ingress from interfering with the data signals. Signal ingress into the customer drop system is difficult to control when the customer's drop cable can be connected to a multitude of consumer premises equipment. Poor consumer equipment shielding, loose connections or damaged cable may cause signal ingress. You can combat these problems by using high-pass filters and directional couplers, and by eliminating drop system integrity problems.

Installing high-pass filters on each outlet not using the return path reduces ingress problems. Installing a directional coupler to split the signal to the modem adds port-to-port isolation across the bandwidth from the other equipment on the drop. Finally, installing and configuring the drop cable so it is less susceptible to damage by normal activities adds to long-term reliability. To accomplish this, consider pets, children, furniture movement and consumer equipment moves when placing any drop. CT

Next month's installment will continue with connecting cables to the cable modem and computer.

> Checklist for certifying reliability of a drop system

- Visually check condition and integrity of drop system
- View picture quality of several analog channels
- Measure signal levels of several channels
- Monitor, detect and eliminate signal leakage
- Install high-pass filters and directional couplers, if needed
- Replace defective drop components

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Molex Fiber Optics	www.molex.com
Motorola Broadband Communications Sector	www.motorola.com/broadband
Multicom	www.multicominc.com
Multilink	www.multilinkinc.com
NCTI	www.ncti.com
nCube	www.ncube.com
Noise/Com	www.noisecom.com
Passive Devices	www.pdi-eft.com
PBI Customer Service	www.cabletoday.com
PBI List Sales	www.cabletoday.com
PCI Technologies	www.pcitech.org
Pico Macom	www.piconet.com
Pioneer	www.pioneercatv.com
Power & Telephone Supply	www.ptsupply.com
Preformed Line Products	www.preformed.com
Quality RF Services	www.qrf.com
Quintech	www.qecinc.com
Readers Choice Awards	www.cabletoday.com
Rifocs Corporation	www.rifocs.com
Riser Bond Instruments	www.riserbond.com
Sadelco	www.sadelco.com
Scientific Atlanta	www.sciatl.com
SCTE	www.scte.org
Sprint North Supply	www.sprintnorthsupply.com
Standard Communications	www.standardcomm.com/satcom
StreamPort Technologies	www.streamport.com
Synchronous	www.syngroup.com
Telecrafter Products	www.telecrafterproducts.com
Tellabs	www.tellabs.com
Terayon Communication Systems	www.terayon.com
Times Fiber Communications	www.timesfiber.com
Tollgrade	www.tollgrade.com
Toner Cable Equipment	www.tonercable.com
Toshiba	www.internet.toshiba.com
Total Site Solutions	www.totalsitesolutions.com
Trilithic	www.trilithic.com
Trilogy Communications	www.trilogycoax.com
Tulsat	www.tulsat.net
TVC	www.tvcinc.com
Viewsonics	www.viewsonics.com
Watkins-Johnson	www.wj.com
Wavetek Wandel Goltermann	www.wwgsolutions.com

INTRODUCING

Communications Technology's Readers' Choice Awards 2000

Communications Technology's Readers' Choice is an annual awards program that honors the industry's most exceptional new products. *CT* readers will select the winners during the SCTE Cable-Tec Expo held June 5–8 in Las Vegas, NV.

Entries from companies who will be exhibitors at this year's SCTE Cable-Tec Expo are being accepted in the following categories:

- **Best New Headend Product**
- **Best New Distribution/Line and Transmission Product**
- **Best New Customer Premise Product**
- **Best New Network Diagnosis Product**

Nomination criteria will include the product's technological innovation, feature set, interoperability and adherence to recognized industry standards, and contribution to broadband telecommunications' growth and advancement.

Qualifications

To be considered for a ***Readers' Choice*** award, the product must be on display at the SCTE Cable-Tec Expo. The product must have been announced no earlier than May 1, 2000 with a product release/ship date no later than September 1, 2000. SCTE Cable-Tec Expo exhibitors must fill out and submit the entry form (provided on next page) and product press release via Certified Mail to *CT* by May 15, 2000.

Communications Technology's Readers' Choice Awards 2000

Entry Form

To nominate your product, send the following information via Certified Mail to:
Jennifer Whalen, Editor, *Communications Technology*, 1201 Seven Locks Road, Potomac, MD 20854.

Contact Information

Entries due May 15, 2000

Vendor contact person

Phone #

Mobile/Show Phone #

Email

Booth # at Expo

Award Category *(check only one)*

- ❑ Headend
- ❑ Distribution/Line and Transmission
- ❑ Customer Premise
- ❑ Network Diagnosis

Product Information *(Attach responses on additional sheets)*

- Name of product:
- Announcement date:
- Name of company:
- Availability date:
- Description of product (200 words or less)
- What is the key distinguishing feature that makes this product stand out in its category?
- How does the product advance the state of the art of broadband telecommunications?
- What is the business and technology case for this product?
- What makes this product a significant improvement on your existing offering?
- List two or three competing products and indicate what makes this product significantly better.

Readers' Choice Award Categories

Headend: Processors, modulators, satellite receivers, lasers, receivers, RF grooming, combiners, antennas, towers, microwave equipment, lightning protection, headend cables, racks, surge suppression equipment, video and audio equipment, monitors, commercial insertion gear, cable modem termination system (CMTS), routers, Ethernet switchers, servers, caching engines, backup generators, air conditioners, HVAC (heating, ventilating and cooling gear), servers, firewalls, routers, local area networks (LANs), telephony gear, uninterruptible power supplies (UPSs), backup generators.

Distribution/Line and Transmission: Coaxial cable, fiber, nodes, passives, actives, amplifiers, strand, hardware, taps, addressable taps, line splitters, directional couplers, power inserters, connectors, utility enclosures, power supplies, standby power supplies, batteries, pedestals, vaults, controlled environmental vaults (CEVs), duct, pipe, conduit, tools.

Customer Premises: drop cable, drop passives, drop hardware, converter, set-tops, cable modems, network interface units (NIUs), network interface devices (NIDs), interdiction units, TV sets, VCRs, traps, filters, tools.

Network Diagnosis: test equipment. OTDRs, TDRs, fault locators, status monitoring equipment, network management systems, transponders, operations support systems (OSSs).

MARKETING

Title: Account Executive

SCTE, a professional, non-profit organization serving 16,000 members in the cable telecommunications industry, seeks a motivated, experienced sales person with excellent communications skills and a proven success record. Prefer broadband hardware or exhibitor sales experience. Primary product is exhibit space at annual convention supplemented with print and website advertising, training courses & sponsorships. Compensation is salary plus commission and comprehensive benefits package. 35-45% travel. Send resume, cover letter and compensation history to SCTE Human Resources, 140 Philips Road, Exton, PA 19341. No phone calls.

Let's Get Connected!

Your state-of-the-art career connection begins at Seren Innovations, Inc. as a subsidiary of Northern States Power Company, we're a rapidly growing provider of cable TV, high-speed cable Internet, wireless and local/long-distance telephone services. Through our new advanced fiber optic network, homes and businesses benefit with one convenient bill as well as advanced picture clarity, increased speed and proven reliability. Give your career a boost when you join our Contra Costa, CA location as:

HEADEND SUPERVISOR

In this position, you'll monitor head end, microwave, satellite, data & phone equipment installation/ repair/ documentation. You'll supervise 7-8 technicians; perform equipment maintenance; utilize spacialized test equipment; perform FCC proof of performance tests; document compliance, maintenance and repair; handle on-call duty rotation; and help plan/implement long-term maintenance schedules.

HEADEND TECHNICIAN

You'll monitor headend, microwave, satellite, data & phone equipment installation/repair/documentation. You'll perform equipment maintenance; utilize specialized test equipment; balance & sweep headend data system using a sweep generator & system analyzer; per-form FCC proof of performance tests; document compli-ance, maintenance and repair; handle on-call duty rotation; and help plan/implement long-term maintenance schedules.

In return for your expertise, we offer a competitive salary and comprehensive benefits package within a progressive work environment. To apply, please send your resume, referencing position of interest, to:

SEREN INNOVATIONS, Attn: Human Resources, 15 South 5th St. , Suite 500, Minneapolis, MN 55402, Fax:(612) 395-3501,E-Mail:webmaster@seren. com . An Equal Opportunity Employer M/ F/ D/ V.

SEREN INNOVATIONS

Charter Communications, the nation's fourth largest multiple-system cable television operator with 6.2 million subscribers, (and ranked as the 8th fastest growing company in the U.S. by Inc. Magazine) is currently seeking qualified professionals for the following technical positions:

Various Locations Throughout North Carolina

PLANT MANAGER

The successful applicant will be responsible for managing the work of the technical manager and supervisor and chief technician, as well as for the management of plant operation processes and systems including preventative maintenance; demand maintenance; demand service and installation, including subcontractor labor.

CHIEF TECHNICIAN

Reporting to the Plant Manager, the successful applicant will be responsible for supervising the work of Installers, Service, and System Technicians as assigned, as well as for the technical training of supervised personnel and all activities contributing to customer satisfaction.

SERVICE TECHNICIAN I

Reporting to the Technical Supervisor, the successful applicant will be responsible for performing field technical work and servicing customer problems, troubleshooting, repair and maintenance of the Cable Television system.

SYSTEM TECHNICIAN I

Reporting to the Technical Supervisor, the successful applicant will be responsible for preventive maintenance and repair of the plant including the trunk and distribution system, as well as for performing routine maintenance and repairs while providing technical support for the resolution of service related problems.

REVERSE SPECIALIST

Reporting to the Technical Supervisor, the successful applicant will be responsible for maintaining the integrity and improving the performance of the 5 to 40 MHz portion of all two-way system plant, as well as for supporting the Preventative Maintenance group, and assisting the supervisor with various system and headend return issues.

Salary commensurate with experience. Benefits include group health and dental insurance, a vision plan and company matched 401(k).

Interested candidates should send their resume, with salary requirements, to:

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Att: Engineering - RR
2414 East Main Street
Lincolnton, NC 28092
Fax: (704) 735-8784
e-mail: rrudd@chartercom.com

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CONTEC

CONTEC is the largest converter Repair Company in the cable television industry, and the only one with a nationwide service network. Our corporate offices are located in Schenectady, New York and we have several convenient repair locations throughout the United States. Thousands of independent cable operators and leading multiple system operators rely on CONTEC for expertly remanufactured converters and CATV equipment. We are actively recruiting for the following position:

Engineer - Digital Video Services

Contec is seeking experienced engineers with experience in digital video services and cable modem services. Qualified candidates will be directly involved in the development, support and growth of our digital repair service offerings. A minimum of 2 years of progressive cable television engineering experience is required with familiarity of cable, satellite and MPEG transmissions and DOCSIS requirements. A working knowledge of computers, commercial test equipment, signal generation and signal transmission is required. Hands on knowledge of Unix, Windows 9x, Windows NT is preferred; knowledge of Visual Basic, C++, networking, IP, IP telephony and test equipment automation interfaces is a plus. Excellent written and verbal skills will be required in this highly visible position. Some travel will be required. BS/EE or equivalent experience is required (MS preferred) with knowledge in communications technology and/or digital signal processing.

CONTEC offers a competitive compensation & benefit package featuring health, dental, 401K w/match, life insurance, and tuition reimbursement. If you are qualified for the above position please mail, email, fax (no phone calls please) your resume to:

CONTEC

ATTN: Director, Human Resources
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Schenectady, New York 12307
Fax: 518-372-5051
Email: www.jobs@gocontec.com
Web Site: www.gocontec.com
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Knowledge Is Power At Cable-Tec Expo 2000

We've all heard the saying "knowledge is power." This expression rings true for those of us in the broadband community. Knowing what new technologies are coming down the pike and how to use them is what gives us the inside track. We cannot afford to let opportunities to gain new knowledge pass us by.

"We cannot afford to let opportunities to gain new knowledge pass us by."

That's why I encourage you to attend Cable-Tec Expo 2000 next month in Las Vegas. The theme for this year's show is "Touch the Technology." It's rather fitting, too, considering that Expo is the one place where you can literally get your hands on the latest and greatest in technology from the product manufacturers themselves. You can see why this is a prime occasion for each of us to expand our knowledge.

What you'll find

The SCTE Cable-Tec Expo 2000 Exhibitor Subcommittee has worked diligently over the past few months to provide you with a wide-ranging, technology-filled exhibit floor. That's why you'll find more than 300 exhibitors and more than 120,000 square feet of innovative, product-specific displays. This also is where you will make contact with the industry's leading product manufacturers, learn what's new, understand how to use new tools, address troubleshooting issues and look at the broader implications for our ever-growing industry.

Another way to get up close and personal with the industry leaders is through the Technical Training Centers on the exhibit floor. At these centers, vendors can showcase products, demonstrate equipment, offer technical presentations or provide you with the technological solution that you have been looking for.

What the experts say

Don't just take my word for it. Hear what others are saying about the valuable knowledge to be gained in attending Cable-Tec Expo 2000, both on and off the exhibit floor.

"You'll be hard-pressed to find a more comprehensive environment for learning than Cable-Tec Expo, whether it's the Annual Engineering Conference, workshops, or the opportunity to interact one-on-one with the exhibit floor vendors," said Ron Hranac, consulting systems engineer in Cisco Systems' Service Provider Engineering group.

"Sharing information with colleagues in technical sessions, on the exhibit floor and at the many related activities provides unparalleled opportunities to strengthen our industry through the advancement of SCTE members' skills and knowledge," said Rex Bullinger, hybrid fiber/coax (HFC) engineering manager for Excite@Home.

"I attend the SCTE's Cable-Tec Expo every year," said Paul Gemme, vice president of engineering for Time Warner Cable. "It is the one conference in our industry that is totally aimed at the folks who have to actually make it all work."

Leslie Ellis, senior technology analyst for Paul Kagan and Associates, gave this endorsement: "Everyone seeking a single, uncluttered forum for the products and players in cable technology should definitely put the Expo on their 'don't miss' list."

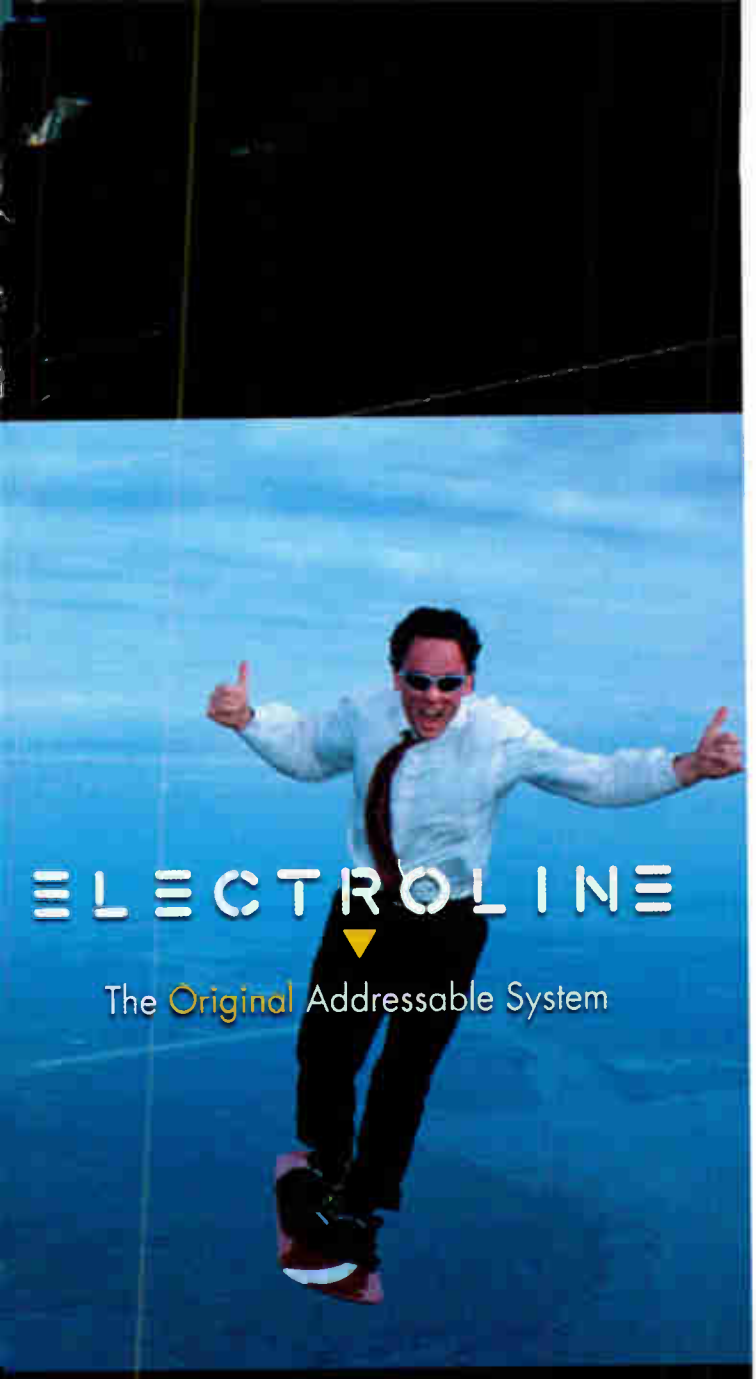
See ya there

As each of us involved in this industry strives to achieve greater heights in the services that we provide, it is important to pool our resources and work together. This is a valuable forum for you to exchange ideas with your peers.

The Exhibit Hall hours will be Monday, June 5, from 2-6 p.m.; Tuesday, June 6, from 11 a.m. to 6 p.m.; and Wednesday, June 7, from 9 a.m. to 1 p.m. On-site registration will be available at the event. More information can be obtained from the SCTE Web site at www.scte.org or by calling the Cable-Tec Expo 2000 hotline at (610) 363-3822.

See you in Vegas! CT

Scott Meek is the manager of marketing services for Channell Corp. and is the chairman of SCTE's Cable-Tec Expo 2000 Exhibitor Subcommittee. He can be reached at (909) 694-9160.



Money Talks!

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- Money from dramatic reductions in truck rolls, overdue accounts, non-pay disconnects and cable piracy
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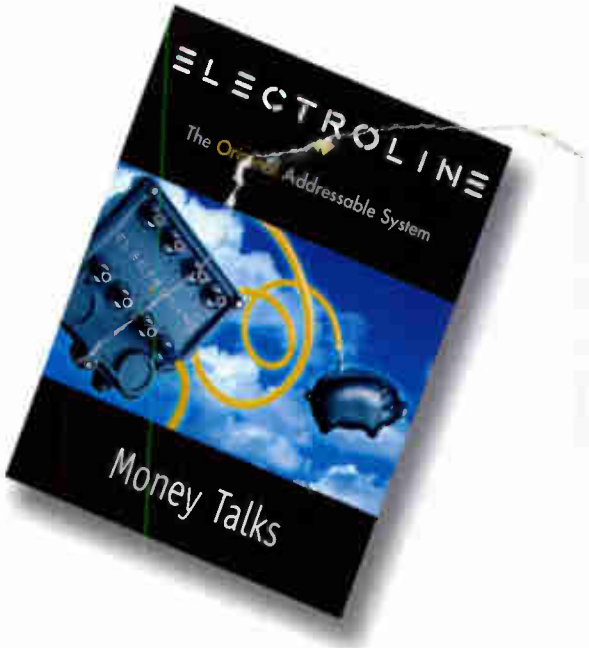
work for you.



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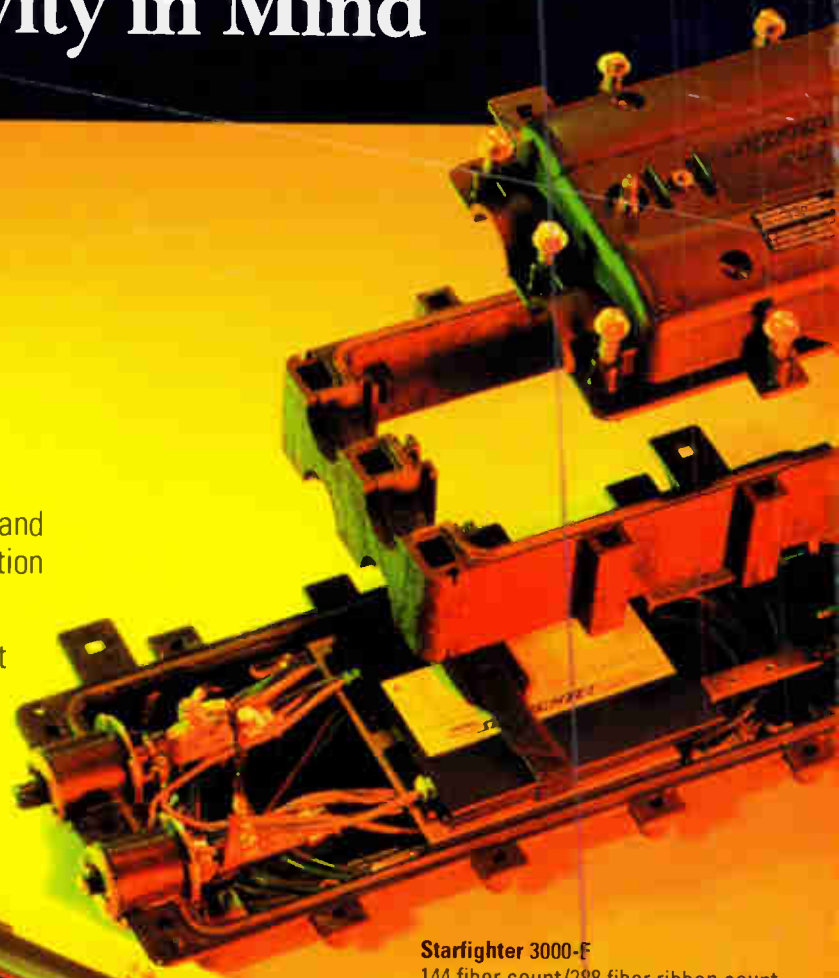

Starfighter 3000-F
144 fiber count/288 fiber ribbon count
Starfighter 3000-CAK
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Starfighter 2000-F
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Starfighter 1120-F Minibutt™
24 fiber count/48 fiber ribbon count

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