Communications Technology

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OFFICIAL TRADE JOURNAL OF THE SOCIETY OF CABLE TELECOMMUNICATIONS ENGINEERS

AUGUST 1997

SCTE Cable-Tec Expo '97

- *Engineering Sessions*
- *Technical Workshops*
- *Exhibits*

A good time was had by all...

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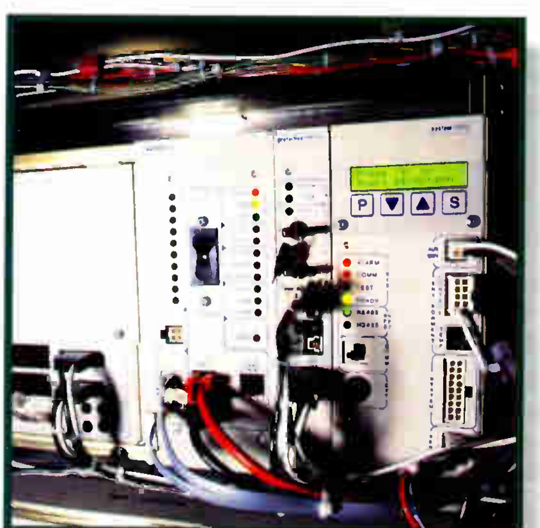

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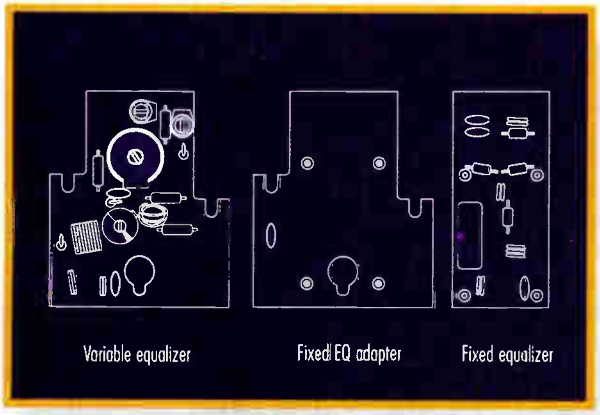

"Our relationship with our customers is the most important factor in our success in offering new services in a competitive marketplace."

—Alex B. Best

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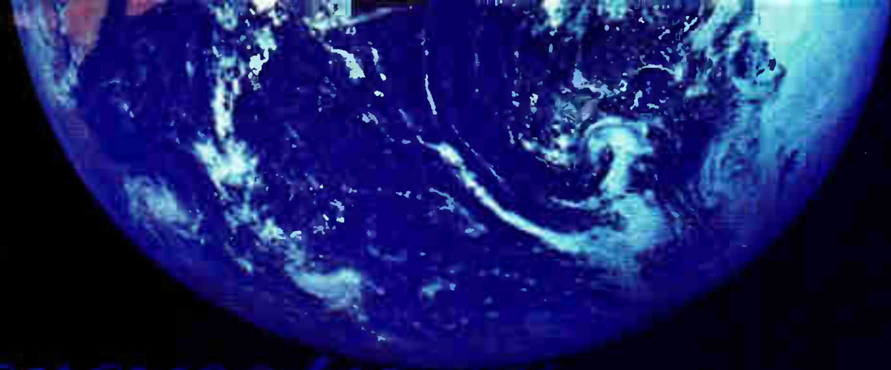

DVSR9000 DigiCipher IRD

Agile IRDII Video Cipher

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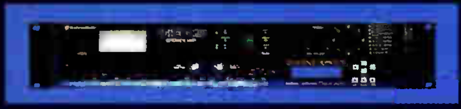


Agile Omni Global Vu

By Rex Porter

"This Is Not Your Basic Cable System"

Been reading about a lot of changes this past two months.

Brian Roberts gets together with Bill Gates and that's good news. But not for the reasons that are being touted in the national press. In a commentary for the *New York Times*, a writer compared Bill Gates to Thomas Edison ("—rich and renowned but finally irrelevant") and implied that Gates was perhaps wasting his money with this deal. He says, "Microsoft will have to move from providing interfaces, operating systems and programs for business and education, all of which have a limited market, to entertainment, whose market is limitless. To be one of the major players in the media world to come, Microsoft will have to become an entertainment conglomerate like Disney, Fox, Viacom, Time Warner and Sony—making movies, producing television shows and records, publishing magazines and books, running theme parks."

Really?

Here is *the* major player in the media world, headed by *the* major player in the media world, with a personal wealth reported to be in the range of $44 billion dollars and a commentator for the *New York Times* is telling him how to plan his future and the future of Microsoft?

I don't believe, for one second, that Bill Gates purchased 11.5% interest in Comcast because he wanted to be directly involved in the operation of cable telecommunications. Bill Gates is a visionary who knows the infrastructure transporting data along the Internet is archaic. The telephone system was never planned to serve the Internet. His master plan is to develop a new infrastructure whereby, in the major cities at least, "high-speed" cable modems would interface with fiber-optic networks (cable's full service networks), transport the signals from the cable customers homes to the cable system's headend, then be up linked to Gate's Teledesic low-orbit satellite system, to then be transported world wide.

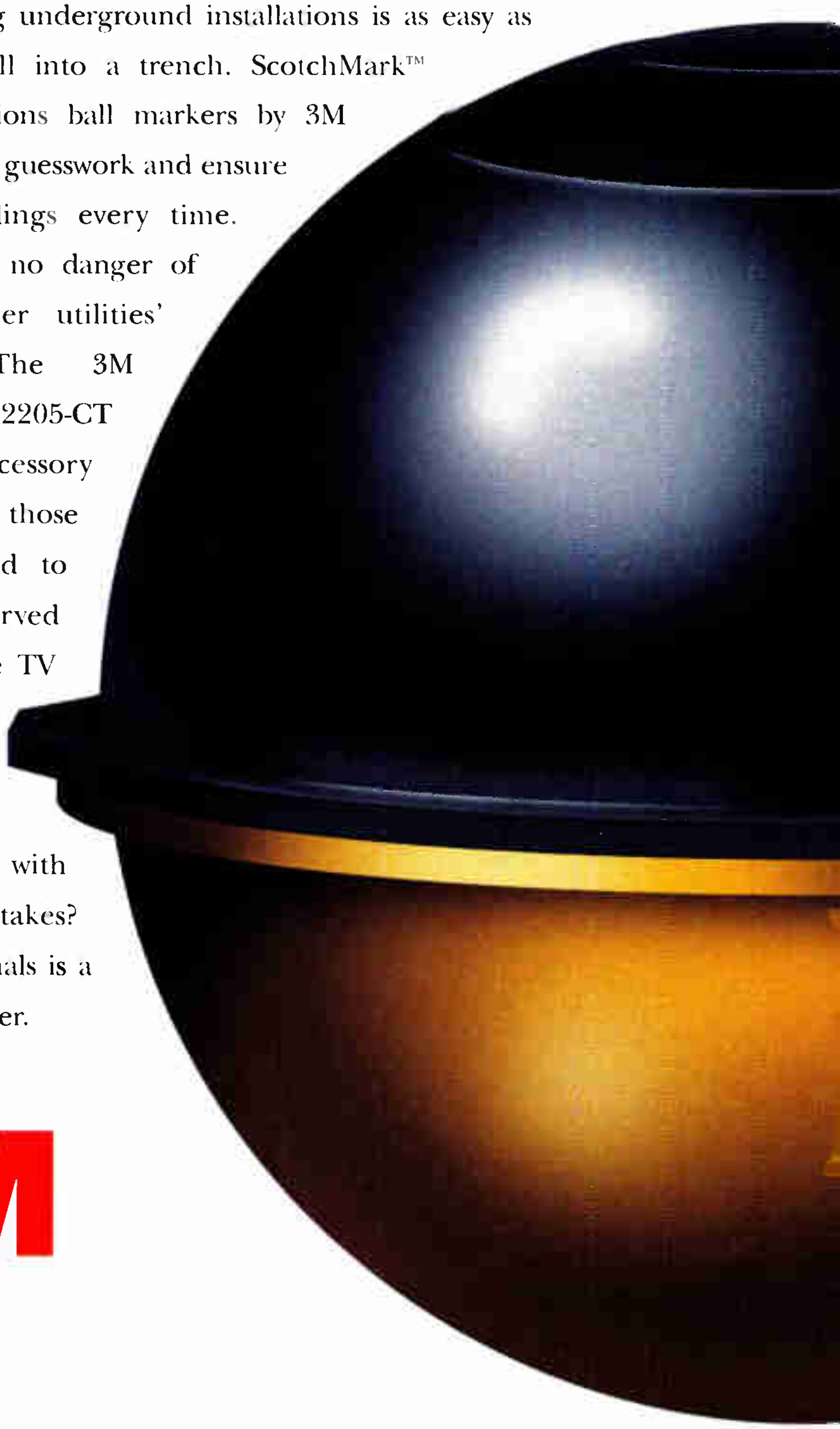
Sorry, *New York Times*, but I have to disagree with your statement that "right now computers aren't very entertaining." Every survey I've read says that, if they had to make the choice, Americans would give up many appliances, including their TV sets, before they would give up their computers.

I expect vested interests within the communications industry to use their resources to fight this new service for the public. Even the newspaper industry has to worry about the day when a computer's printer will print the news right off the computer with the same, or better, layout and graphics of the paper stock daily thrown onto our driveways, porches and hedges.

Is that really *all* the news that's fit to print?

Rex Porter,
Editor

The official *Communications Technology* Web site will be debuting this month—come check it out at www.ctinfosite.com



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SCTE Board Elects Society's '97-'98 Officers

The Board of Directors of the Society of Cable Telecommunications Engineers elected the Society's officers for the coming year at its meeting held June 3 in conjunction with Cable-Tec Expo '97 at the Orange County Convention Center in Orlando, FL.

The Society's officers for the 1997-1998 term are:

- Chairman: Steven Johnson
- Eastern Vice Chairman: James Kuhns
- Western Vice Chairman: Robert Schaeffer
- Secretary: Norrie Bush
- Treasurer: Larry Stiffelman
- Additional member of the executive committee: Andy Scott

The current SCTE Board of Directors consists of: Region 1 Director Ralph Patterson, Patterson Communications, serving California, Hawaii and Nevada; Region 2 Director Steve Johnson, Time Warner Cable, serving Arizona, Colorado, New Mexico, Utah and Wyoming; Region 3 Director Norrie Bush, TCI of Southern Washington, serving Alaska, Idaho, Montana, Oregon and Washington; Region 4 Director M.J. Jackson, Gilbert Engineering, serving Oklahoma and Texas; Region 5 Director Larry Stiffelman, CommScope, serving Illinois, Iowa, Kansas, Missouri and Nebraska; Region 6 Director Robert Schaeffer, Technology Planners, serving Minnesota, North Dakota, South Dakota and Wisconsin; Region 7 Director James Kuhns, Comcast Cablevision, serving Indiana, Michigan and Ohio; Region 8 Director Steve Christopher, Thomas & Betts, serving Alabama, Arkansas, Louisiana, Mississippi and Tennessee; Region 9 Director Hugh McCarley, Cox Cable, serving Florida, Georgia, Puerto Rico and South Carolina; Region 10 Director Maggie Fitzgerald, DAVI Communications, serving Kentucky, North Carolina, Virginia, West Virginia and District of Columbia; Region 11 Director Dennis Quinter, Time Warner Cable, serving Delaware, Maryland, New Jersey and Pennsylvania; Region 12 Director John Vartanian, Viewer's Choice, serving Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island and Vermont; and At-Large Directors (representing the entire U.S.) Ron Hranac of Coaxial International, Andy Scott of NCTA and Wendell Woody of Sprint/North Supply.

Call for Papers for '98 Emerging Technologies Conference

SCTE is now seeking proposals for technical papers to be presented at its 1998 Conference on Emerging Technologies to be held Jan. 28 to 30 in San Antonio, TX.

The annual conference, which attracted more than 1,300 attendees last year in Nashville, TN, is an extension of the Society's annual Fiber Optics seminar, first held in 1988. The tenth anniversary edition, ET '98, will offer industry professionals an exclusive forum to interact on key issues facing broadband telecommunications.

Submission topics should address critical technical decisions that will affect the future of this business and

cutting-edge research and development, including digital television transmission, as well as other technologies of value to the future of cable telecommunications. The deadline for submitting proposals is August 15, 1997.

Submissions should include a title, author's name, presenter's name, affiliation, full address, telephone/fax numbers, e-mail address and a one-to-two-page abstract detailing the technology or issue and its significance to the industry.

Proposals may be sent via mail, fax or e-mail to: Roberta Dainton, SCTE, 140 Philips Road, Exton, PA 19341-1318; Fax: (610) 363-5898; E-mail: rdainton@scte.org.

The SCTE Emerging Technologies Program Committee will announce the selected presentations in October. Accepted authors must be prepared to submit a camera-ready manuscript to SCTE by Dec. 15, 1997, for publication, as well as present a 15-20 minute oratory based on their chosen conference paper.

Safety Legislation Input Saves Industry Thousands

The Society has done the cable telecommunications industry a great service by cutting through the regulatory red tape surrounding fall arrest systems. This accomplishment culminated SCTE's efforts to clarify federal safety ordinances placed on the broadband industry.

SCTE Director of Regional Training Ralph Haimowitz wrapped up a two-year discussion with the Occupational Safety and Health Administration n May that resulted in a clearer understanding of that agency's CFR 29, Part 1926.500-.503 rule, which concerns fall protection for building construction.

This law affects all cable industry personnel working in the field.

"A lot of erroneous information has been passed around regarding OSHA regulations," commented Haimowitz. "Some of these rules were confusing. This issue is of great concern to cable systems throughout the industry."

Barbara Bielaski, the OSHA Project Officer overseeing the revision of this regulation, outlined the requirements of Subpart "M" of CFR 29, "Fall Protection in the Construction Industry," set to take effect on Jan. 1, 1998. This section bans the use of body belts as part of a personal fall arrest system, but does not contain specific guidelines for work on poles, towers or ladders.

The requirements that do apply to these areas are written in Subparts "V" and "X", as well as Part 1926.105(a). These sections define an employer's responsibility to protect employees from falls by using cages, wells or ladder safety devices.

OSHA intends to issue a notice of proposed revisions for Subpart "M" later this year. This notice will include new requirements for work on telecommunications towers and antennas installed on towers. CT

MediaOne Awards Contract To Superior Electronics

MediaOne, the broadband services arm of US West Media Group has awarded a contract to Superior Electronics Group to provide its CheetahNet Monitoring software to MediaOne systems in the United States. Financial terms of the agreement were not disclosed. The three-year contract also provides for software services including maintenance, training and installation, as well as preferred vendor status for Cheetah monitoring hardware including transponders and line monitors.

CheetahNet software will be used for performance and status monitoring of the entire broadband network. It measures signal quality and provides virtually instantaneous warning in the event of signal degradation of network failures.

CT Goes Online

Where's the hottest place to be on the Web? *Communications Technology's* site located at www.ctinfosite.com

49th ARFTG Conference Held in Denver

One week after the SCTE's Cable-Tec Expo, the Automatic RF Techniques Group held its 49th Conference at the Brown Palace Hotel in Denver, CO. This was a joint session with the IEEE Microwave Theory and Technique Society (MTTS) and the theme was "Characterization of Broadband Telecommunications Components and Systems." The Automatic RF Techniques Group is an unincorporated organization whose purposes are limited to education, scientific research, and publication of member research, in the field of automated radio frequency network design and measurement. The conference's technical program chair was Dr. Gary D. Alley of Lucent Technologies.

The areas of involvement are obtaining and distributing information on how automatic RF measurement systems are being used, the types of measurements being performed, and the types of items tested; providing a forum for discussion and education on the interfacing of test equipment and on computer-aided design techniques; and the establishment of a mechanism to encourage sharing of software programs, ideas, and techniques. Chaired by Dr. Roger Marks, National Institute of Standards and Technology, this conference was attended by many engineers from cable telecommunications.

Session A (Cable TV1) presented a keynote address from Syd Fluck—"RF Measurements for Broadband networks," Tom Williams' paper—"Proofing and Maintaining Upstream Cable Plant with Digital Signal Analysis Techniques," and others' presentations such as "Procedures for Measurement and Characterization of Upstream Channel Noise in CATV Networks," and "Performance of QAM on a Hybrid Fiber/Coax CATV System. Session B (Cable TV2) covered such topics as "CATV Tap and Splitter Linearity Improvement for Broadband Information Networks," "Characterization of Cable Amplifiers for Broadband Network," "Optimal Control of Intermodulation Distortion in Hybrid Fiber/Coaxial" and "Alignment and Maintenance Issues for Upstream Cable Plant." Session C: (LMDS & MMDS), Session D: (Component Characterization) and an Interactive Forum rounded out the conference. Copies of the Conference Digest are available from: ARFTG, 1008 East Baseline Road, #955, Tempe, AZ 85283-1314. Mr. Henry A. Burger is the Executive Secretary and be reached by phone at (602) 839-6933, by fax at (602) 968-3542 or e-mailed at h.burger@ieee.org.

Elliot Joins CableLabs

Tom Elliot, formerly senior vice president, technical projects for TCI, has joined CableLabs to focus on projects dealing with digital, high definition TV and consumer electronics. Elliot previously was a visiting executive at CableLabs in 1989 and left in 1991 to return to TCI.

S-A's Cable Modems To be Sold In Canada

Scientific-Atlanta announced that its dataXcellerator cable modems will be sold by Fundy Communications, a provider of telecommunications services and Atlantic Canada's largest cable operator. The modems will be sold directly to consumers for the delivery of high-speed Internet services and will retail for $279 to $299 (Canadian).

Fundy's decision to deploy S-A cable modems follows a recent investment of more than $80 million to build an extensive fiber-optic network. S-A will provide headend equipment, installation and support, as well as one-way dataXcellerator cable modems for the launch in Moncton. CT

Cable Industry Founder Dies

Martin F. Malarkey, founder of the National Cable Television Association, passed away June 27, 1997 due to cardiac arrest. Malarkey was a pioneer and widely recognized authority in the cable TV industry—an expert in cable TV system economics, syndication organization and development, financial planning and negotiations.

In 1949, he built and developed one of the first commercial cable TV systems in the nation and wrote extensively throughout his career on cable system marketing and financing. He founded Malarkey-Taylor Associates in 1964, a cable TV consulting organization and developed a network of clients around the globe. In 1992 Malarkey-Taylor was sold to its senior partners and was renamed MTA-EMCI and renamed again in 1997 as the Strategis Group.

A Building Mix-Up

I enjoyed your interview with Jim Farmer in the June issue of *Communications Technology*. Just a note: the picture on page 30 is of the ANTEC Technology Center located in Norcross, GA., not Chicago.

Jeff Seebeck, VP, software/ESP
ANTEC
E-mail: jeff.seebeck@antec.com

Editor's response: Sorry for the mix-up. I asked for a photo of the headquarters building in Illinois and just thought it really was that building.—Rex Porter

Another Cable Modem User

After reading the letters to the editor in the June 1997 issue of *Communications Technology*, I am also prompted to write to you about my experiences using a cable modem. I am connected to Suburban Cable TV Inc., in Delaware County, PA (suburban Philadelphia). I am running Windows NT, using a Zenith Homeworks Universal cable modem (Full two-way RF, no hybrid systems here!) This configuration has been up and running for over a year. I was originally connected as part of their "technical trials," although it appears as if these trials are continuing.

Strengths—the system runs great! I have had very little down time; probably less than 10 minutes over the 15 months I have been using it. (Compare this to busy signals, or plain old slow data, on a dial-up provider.) The throughput is tremendous. FTP file transfers have reached as high as 70 k bytes per second of usable data! Although this is not typical, the average data rate for data transfer is still 10 times faster than any 28.8 bps dial-up service, and that is worst-case.

Remember, cable modems are still limited by how fast the other end can send the data, and apparently there are many sites that keep me waiting for data. Also, the dedicated IP connection, when I boot up my computer, allows me to easily run as an FTP server, which is difficult if not impossible on a dial-up provider.

Weaknesses—I have many friends in the area who are waiting to sign up for this service when it becomes available. That is my concern. Cable MSOs had better roll out some commercial service for cable modems *soon*. They do not know what they have! MSOs had better realize that this rollout *demands* a different and dedicated team of installers, technical support, etc.

Bottom line—There is no comparison between cable modems and dial-up service, EM service—ISDN ("It Still Does Nothing") included! ➤

David H. McDowell, senior engineer
General Instrument Corp.

Editor's response: MSOs and system owners have a real future with full-service networks.—RP

Deregulation of Another Kind

Daniel Boone is buried in Frankfort, KY. Frankfort is the state capital of Kentucky. Frankfort operates the largest municipally-owned, two-way active, cable system in the United States. Using our unique "hardware/software" system, Frankfort is ready for deregulated electricity. Frankfort citizens will be able to purchase electricity from multiple sources because usage data is now available in real time. This network can read meters, manage energy, monitor home security, do service connect and status monitoring of all cable signals and other utilities. This system can read all 22,000 meter sites in Frankfort, every 10 minutes.

The proliferation of two-way hybrid fiber/coax (HFC) and deregulation of electric and natural gas is driving more interest in products such as these. Our exhibit booth was swamped at the Society of Cable Telecommunications Engineers Cable-Tec Expo in Orlando, FL —all of a sudden, cable guys are being contacted by utility guys to see if their networks will perform these functions and it is easy! It's just a matter of filling the need! In the interactive world of 2005, citizens will *not* be visited by meter readers and you *will* shop for electricity much like you shop for long distance telephone service. Utility planners believe they will need to read meters constantly to plan production and marketing strategy. Dan Boone's resting place is ready for that day and 58 other companies and communities are planning ahead too. Thank you.

Mark S. Stuhlreyer, dir., sales & marketing,
Moore Diversified Products Inc.
E-mail: mark@mooredp.com

Editor's response: "This is not your basic cable system anymore!"—RP

Clarification

Due to an editorial oversight, a reference was omitted from the article "Mirror, Mirror: Simple Steps to Reduce Backreflections" in the June 1997 issue of *Communications Technology*.

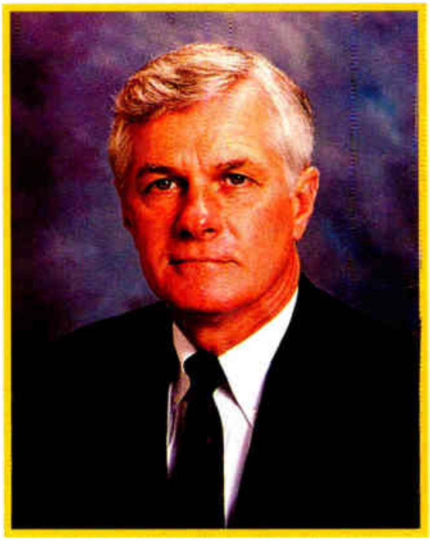
This piece, written by Photonic Components, should have referred to an earlier article, "New Advances in Fiber-Optic Connectors and Attenuators," by Mike Thaw of Radiant Communications, which appeared in the March 1994 edition of *CT*.

We apologize for any confusion caused by this oversight, and recommend the fine Radiant article for readers looking for authoritative information on backreflection and its remedies. For a reprint of the article, call Radiant Communications at (800) 969-3427. CT

By Rex Porter

Engineering at its *Best*

Cox Cable Communications' Alex Best



Alex B. Best

Alex B. Best, senior vice president of engineering, joined Cox Cable Communications in April 1986 as vice president of engineering. He was promoted to his present position in January 1989. Best joined Cox following 20 years with Scientific-Atlanta, where he was involved in nearly every aspect of that company's CATV product development and business application. His last position prior to his appointment at Cox was that of principal engineer.

Best received B.S. and M.S. degrees in electrical engineering from the Georgia Institute of Technology, and completed the Program for Management Development (PMD) at Harvard Business School. He has been a member of the National Cable Television Association's Engineering Advisory Committee since 1978 and presently serves as its chairman. He has been a member of the Society for Cable Telecommunications Engineers since 1975. In addition, Best is a member of the board of directors of the Southern Cable Television Association.

Best was the 1977 recipient of the NCTA's Vanguard Award for Science and Technology and received the SCTA's Polly Dunn award in 1992 for his dedication to the cable industry. In 1994, he was inducted into the SCTE's Hall of Fame. He talks here with *Communications Technology* Editor Rex Porter.

Communications Technology: *One of the highlights of your past year is probably Cox Communications winning the 1996 J.D. Power Award for superiority in cable system operation. Could you describe some of the programs and engineering projects that helped Cox win?*

Alex Best: It is common knowledge that two of the most important attributes of cable service from our customers' perspective are picture quality and reliability. I believe one of the reasons we won this award was our early and widespread deployment of fiber-optic technology. We started this effort in 1988 and, as a result, our picture quality and reliability have improved dramatically. As an example, in 1988, our average outage hours per basic customer was more than five hours a year. At the end of 1996, this number was slightly more than one hour per customer per year, a five-fold improvement, due primarily to the deployment of fiber technology. In addition, also beginning in 1988, we instituted stringent customer service standards throughout all of our systems. These standards, which measure operational performance in six categories, are reported back to Atlanta on a monthly basis. They include such parameters as average speed of answer of our telephones and average wait time at our front counters and are still in place today. These standards, coupled with our advanced technology deployment, are instrumental in providing the type of value proposition that led our customers to respond positively about their association with Cox Communications.

CT: *Will you be eligible for that award again in 1997?*

Best: Yes. As I understand the award, J.D. Power will now conduct the cable industry survey on an annual basis and, regardless of the previous year's results, the company with the most favorable customer ratings will win the award. We are very proud of this honor and remain convinced that our relationship with our customers is the most important factor in our success in offering new services in a competitive marketplace.

CT: *As long as I can remember, when we needed an engineer to teach analog video, either in a formal presentation or from a videotape, we always called on you. What's your impression of the changing technology with digital video and high definition TV (HDTV)?*

Best: In the history of cable, there have been two technology developments that were monumental in affecting the future of the industry. The first was the use of geostationary satellites in 1975 to distribute new programming services and the second was the use of linear lasers and fiber optics to improve picture quality and reliability beginning in 1988. I believe, in a few years, we will look back on the deployment of digital TV as the third key

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technology deployment in terms of the impact it will have on our industry. Only time will tell the magnitude of this impact. Today, we are using digital TV to improve the quantity/quality of what we deliver. Tomorrow, it may be the vehicle that allows worldwide access to video-on-demand.

HDTV is also, of course, digital TV. Its long-term impact, however, is more difficult to predict. The technology of digital TV allows one to trade off the issues of quantity of channels versus quality of channels. The question remains, however, whether consumers are willing to pay

> "Cox is unique in the cable industry due to our highly clustered properties."

the price for a picture that has two to three times the resolution of an NTSC analog picture. Other attributes include a 9 x 16 aspect ratio and compact disc quality sound. As a sample of one consumer, I am a proponent of HDTV. On the other hand, no one has put in front of me a product line of receivers showing every combination of 4:3-1/2 resolution to 9:16 HDTV resolution and asked me to vote with my wallet.

As a cable operator, I have mixed emotions about HDTV. No industry can better support HDTV than the cable industry! Not satellite, not multichannel multipoint distribution service (MMDS), and certainly not the regional Bell operating companies (RBOCs). We have the capability of more capacity than any of our competitors. This is due both to our bandwidth and our ability to support advanced modulation schemes such a 64-QAM (quadrature amplitude modulation) and 256-QAM. Full resolution HDTV requires about 20 Mbps per channel, however, which means, at best, we can carry two HDTV channels per 6 MHz.

CT: *Two years ago, the SCTE inducted you into the SCTE Hall of Fame. A handful of members belong to this club and they are selected because of their lifetime service to the SCTE. As an MSO, Cox Communications has always supported grassroots efforts such as meeting groups and chapters. My local chapter, the Cactus Chapter, exists today due to Cox Communications in Phoenix, AZ. How do you think we could get the other MSOs to recognize the importance of SCTE training and require their installers and technicians to belong to the local chapters and attend their meetings?*
Best: I don't think there's any question within the cable industry's technical ranks of the value of the training programs offered by the SCTE. The primary problem stems from time demands placed on technicians and installers by their supervisors to complete their job-related tasks in a 40-hour week. Indeed, many work overtime to satisfy the job requirements. I believe the approach to deal with this issue is to make the system's general manager aware of the long-term value of technical training. I admit this is not an easy task but unless you can show general managers the "payback," they aren't likely to offer their technical employees the time required to attend SCTE-related functions. I think the good news is the general managers now recognize that, due to the rapid pace of technological change, the decision to not offer time for additional technical training is a one-way street to obsolescence. The SCTE should take advantage of this opportunity and heavily promote its programs, both to the technical ranks and upper management.

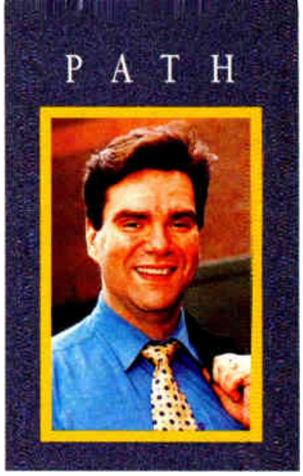
CT: *With hybrid fiber/coax (HFC), data transmission and digital TV becoming the present and the future of telecommunications, could you elaborate a little on what Cox engineering is doing and is planning to do in the near future with these services?*
Best: Cox is unique in the cable industry due to our highly clustered properties. Today, 83% of our customers reside in nine large systems. We like to say that with respect to new businesses we have a 9 x 3 opportunity. This implies that we will offer three new services: digital video, high-speed data, and telephony to all of our customers in these nine systems. This effort is well underway and is scheduled to be essentially complete by the end of 1998. In parallel with this effort is our ongoing upgrade efforts to take all of these systems to 750 MHz, two-way capable, including fiber route diversity down to the 1,000-home node level. Once again, our plans call for us to be essentially complete by the end of 1998.

CT: *Are there any other new technologies you see lurking over the horizon as we move toward the year 2000?*
Best: I won't call it a new technology but I'm intrigued by the implications to our industry of streaming video over the Internet. This technology is certainly in its infancy but, as we remove the bandwidth restraints due both to the deployment of high-speed modems plus our investment in @Home and their high-speed backbone network, this streaming video capability is likely to follow. The challenge for us is to turn this into an opportunity. The good news is that our broadband pipe is an essential ingredient to this capability. No other delivery system in widespread deployment today can match our ability to target high bit rate data down to the individual customer level.

CT: *What advice do you have for technicians or system engineers, especially those entering cable telecommunications from other related fields?*
Best: Work hard to integrate the skills and knowledge you bring from your related field into the cable industry. If we put the best of what you have to offer with the best that we have to offer, no one can beat us. One way to do this is to learn about our industry from a technical perspective. Ask questions, read books and get involved with the SCTE. The next five years will be quite a ride. Let's have fun together. CT

Rex Porter is Editor of "Communications Technology." He can be reached in Mesa, AZ, at (602) 807-8299 or via e-mail at tvrex@earthlink.net.

By Alex Zavistovich



Selling Your Upgrade, Or Goodbye, Ol' Blue

I've had the same stereo system for 17 years. I called it Ol' Blue for its colored backlit display (plus I always kind of wanted a dog.)

Ol' Blue got me through who knows how many all-night college parties — plus the entire fuzzy decade of the '80s. It had to. See, I'm lazy about electronics. I bought Ol' Blue because I wanted to set up a system right the first time, and not have to worry about it again.

This past week, tragedy struck Ol' Blue. First I fried one receiver channel. Then I blew out a hole in a speaker horn you could drive a Volvo through. When my cassette player (a veritable baby at 15 years) gave up the ghost, I surveyed the tattered remains of my trusty sidekick and came to a painful but inevitable conclusion.

Time to upgrade.

I'm glad I did, because digital technology is pretty cool. It's the same story in the cable industry. Plenty of engineers have decided that it's time to put their own Ol' Blue out to pasture. Charter Communications is upgrading to hybrid fiber/coax HFC, Shaw Communications is adding digital interactivity, Massillon Cable is shelling out $9 million to redesign and rebuild its Ohio plant. Practically every week I hear about a new system that's upgrading to HFC, adding digital video storage, interactivity, whatever. Systems that were state-of-the-art when they went up 15 or 20 years ago are now, like Ol' Blue, long overdue for a rebuild.

The story is always the same: System operators want to offer expanded channel capacity and high-speed data capability. Digital technology, after all, is pretty cool.

When I was the editor of a newspaper for the radio engineering industry, I wrote a story about an FM station down in Florida that was among the first to buy a digital signal processor for the transmission chain. Station management actually promoted their switch to digital technology on the air, and their listeners responded favorably. Granted, listeners probably didn't know a digital signal processor from a food processor. They knew it had the word "digital" in it, though, and by gosh, they knew digital technology was pretty cool. That's all they needed to know.

> "Market technology. These are important times. Make people aware of the changes."

It seems to me that cable operators can take a hint from this. Don't hide your light under a bushel. If you're planning an upgrade or a rebuild, be vocal about it. Don't just slip a form letter in with the bill. You are creating the future of cable TV. Run an ad on your system trumpeting these changes — heck, run a whole ad *campaign*.

Never mind if you think your audience may not understand what upgrading means. My dad retired before PCs became common, and consequently, is computer illiterate. An electric typewriter can have him against the ropes. His idea of a hard drive is from Baltimore to Richmond in three hours. Still, he's heard enough to know that digital technology is pretty cool, and that's good enough for him.

You need to sell your reasons for upgrading to your subscribers. Let them know that occasional lapses in service, a little inconvenience now, is just part of getting ready for the promise of digital technology. Right now, the public's perception is that using compression on video means inferior signal quality. They don't realize that compressing signals means more programming choices and more available bandwidth for applications like high-speed Internet access. You have to tell your subs these things; they honestly won't be able to figure it out by themselves.

The same also may be true for your fellow station employees. Outside of the engineering department, many people look at upgrades as capital expenditures, and not much else. They may not get the necessary connection between enhanced services and system upgrades. If you're serious about your career, it's your responsibility to educate them. Take time out to work with your company's marketing staff. Help them understand that you're not just spending money, you're laying the foundation for the services they're charged with promoting.

Sell your upgrade. Market technology. These are important times. Make people aware of the changes.

Good-bye, Ol' Blue. CT

Alex Zavistovich is executive editor of "Communications Technology." He can be reached in Potomac, MD, at (301) 340-7788, ext. 2134.

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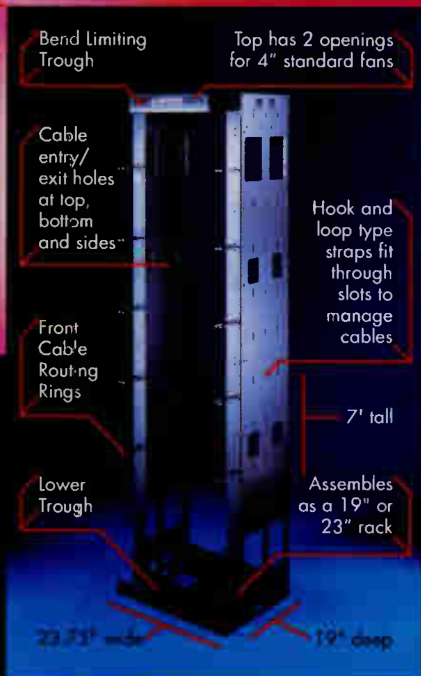

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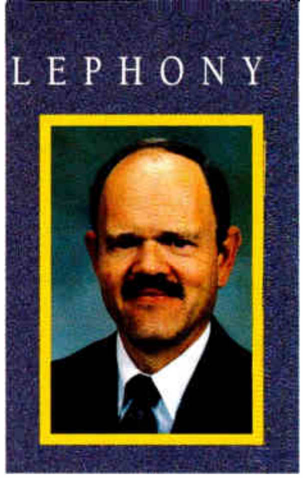
Reader Service Number 130

By Justin J. Junkus



Telecommunications Plumbing Problems

About a year ago, I had the unfortunate experience of coming home to a flooded town where the municipal systems couldn't handle 14 inches of rain in one day. Water kept coming, and basements under the storm flooded because the distribution system could only move a fraction of it. Replace the water with information, and the drainage system with the public switched telephone network, and you can visualize the effects of increased voice and data traffic on our networks today.

Causes

Networks are engineered, or planned, for predetermined amounts of usage by subscribers. This fact of life began with the introduction of switches in early telephony. It didn't take a genius to figure out that it was unlikely that everyone served by a telephone company would be on the phone at the same time. While we all need a permanent, hardwired connection to the service provider to alert the provider of our need to "talk," most of the time, we are not connected to anything beyond the service provider's office.

This means that local service providers and the carriers that interconnect local switches can save lots of money by equipping their offices with just enough paths to connect the most likely volume of active, talking, subscribers to each other. The science of this provisioning is known as "traffic theory." The type of switching that is built by applying traffic engineering principles is called circuit switching.

Traffic theory works great for voice traffic (unless you live in a community of teenagers!). Introduce data onto the lines, however, and you have a whole new arena in which to play. Data has lots of properties that make it unpredictable. It is spurious by nature, meaning that users transmit in bursts, when their terminals are ready to send, and then remain quiet until the next burst. It also can demand that an analog line that was specified at an average three minutes of use per hour become a permanent connection, even when no data is being sent. This is not inconsistent with the spurious nature of data. It's explained by the way that data interfaces with an analog telephone line through dial-up modems.

With dial-up data, if a user decides to set up the connection and leave it there all day, the modem will oblige by keeping supervision on the line, even when no data is being sent. In plain English, that means the service provider's equipment never sees the line "hang up." It doesn't matter if the cause is slow typing, a coffee break, or a two-week vacation. When this happens, the hardwired path from the user to the telephone office gets extended through the entire network, tying up what should have been shared equipment for the duration of the connection.

The same effect can occur, albeit to a lesser degree, when subscribers use dial-up connections to an Internet provider, for e-mail or Net surfing. Although no real information is moving along the connection for much of the time, the path from the subscriber to the Internet provider is dedicated to the one subscriber during the entire time the computer is on-line. This phenomenon has resulted in some telephone companies having a real problem delivering dial-tone and a voice connection to their nondata customers, since the same switching equipment provides the path for all their subscribers, voice or data.

Ah, you say, that's tough for the telephone company, but my cable telecommunications company's broadband access will solve all those problems, and it will get the data business to boot! Your thinking is that data, voice and video each have their own frequency allocations. Even better, data service over a cable modem is packet switched, so data only ties up a connection when it is actually being sent. Therefore, you maintain that even with heavy traffic, your company can provide dialtone and data connections to its customers. That's not necessarily true.

Let's assume that you are providing data service via a cable modem. Essentially, you have set up the subscriber as a user on a local area network (LAN). The way you did this is to interface the cable modem to the user's PC with an Ethernet network interface card (NIC). The cable modem converts digital information from a modulated RF carrier to the Ethernet protocol recognized by the NIC.

At the headend, you have an Ethernet router that provides access to the subscriber's Internet service provider (ISP). On the network side of the router, you have a port that is connected in some way to that ISP. This connection is the critical point, and a choice made here can make the difference between you and the phone company. ➤

Connections to the ISP can be via T-1 and T-3 lines, or through a higher speed optical network. If your company is beginning to offer service, it might be tempted to use one or more T-1 lines, as the most economical choice.

Typically, data will be moved between your headend and the ISP using some type of packet-switched service. Unlike the case for circuit switching, packet switching only uses the paths between users when data is actually being sent. This solves part of the problem by making more efficient use of the connections, but if the volume of data is high, packets will be dropped, and data will be lost. Since you are providing high-speed broadband access to the end user, you let more data into your network per unit of time than your telephone company counterpart. The odds of you having a problem are therefore actually greater than the telephone company's in a similar situation.

> "To avoid dropped packets, you may need higher speed lines from your router to the packet network."

Good error detection and correction protocols will facilitate recovery, but too many requests for recovery will choke the network the same as too much circuit switched voice traffic. To avoid dropped packets, you may need higher speed lines from your router to the packet network, or a data service provider who has a packet network with switches that can store a large quantity of data packets until paths are available. Your decisions on the choice of line speeds and the access network to the ISP will require you to have knowledge of the volume of data traffic you can expect. Once you are offering service, you must continually monitor data traffic to avoid degradation as user activity increases.

What about your voice traffic? Let's say you split the voice telephony from the data traffic at a switch digital interface unit and then route the voice calls into the public switched telephone network via T-1 or T-3 trunks to an interexchange carrier. Your switch is just another entity bidding for the interexchange carrier's limited resources, and if you are in an area where facilities are underengineered, your own subscribers will have the same problem getting a voice connection as they did with the underengineered phone company.

Solutions

Fortunately, there are ways to minimize the problems. We've already mentioned preventing lost data packets by increasing the bandwidth of the facilities from the router to the packet-switched network. Increased bandwidth solves other problems as well. For telephony services, it pays to be sure that the interexchange carrier that will be carrying your long distance traffic has sufficient network capacity to handle your traffic as well as any traffic from other sources. Try to find out the grade of service they use when engineering their network, and verify that your traffic will pass through their network with at least the same blocking probabilities that you use in your own network.

It helps to have multiple carriers and multiple routing through the public switched telephone network. Consider trunking that provides service via alternate carriers, both for reliability and for excess capacity.

When you evaluate your telephony partners, look at the technology they use. For example, several carriers are planning to increase network call handling by applying dense wavelength division multiplexing in their fiber-optic systems. This is one way carriers can modify their plants to handle increased traffic. Does your telephony partner have this ability?

What about that data call with the long holding time? This is one example of the usefulness of operations systems. A good operations system includes the ability to monitor and report on traffic per line, especially for lines with abnormally high traffic. What you do once the high usage line is identified depends on company policy, and possibly even local regulations, but once you know which users are involved, at least you can formulate a strategy.

One more caveat

Before we leave this subject, you need to be aware of another potential bottleneck with data service over a cable modem. By design, Ethernet only allows one user on a network to send data at any given time. If you are serving a large number of homes from one node, all of these users must bid for the connection to the headend. If 10 users are attempting to use a 10 Mbps Ethernet connection, the effective rate of data transfer drops. It may not go to 1 Mbps, but it will decrease. The effect is compounded as more users are added.

At least one vendor is offering a solution to this problem by allowing a service provider to offer grades of data service. With this option, subscribers could elect the maximum data rate throughput they require, and pay accordingly. Users with a higher rate would have precedence, and get better service when they need it. Other vendors suggest ways to subdivide data traffic by either adding optical transmitter/receiver blocks at nodes or implementing block conversion

Once again, new services are a combination of opportunity and challenge. New revenue and more jobs can belong to cable, but only if the cable company understands the traffic demands of its subscribers better than the traditional phone company, and meets their needs accordingly. For technical personnel, the situation again points to the need for a strong skills foundation based on continuing education in telephony and data, as well as in core cable technology. CT

Justin Junkus is president of KnowledgeLink, a training and consulting firm specializing in the cable telecommunications industry. He may be reached for comments or to arrange for consulting services via e-mail (jjunkus@aol.com).

By Ron Hranac

Subscriber Drop Wiring For Interactive Services—Part 2

As I mentioned at the conclusion of last month's column, the use of good quality materials alone won't guarantee trouble-free drops. Good installation practices must be used, too.

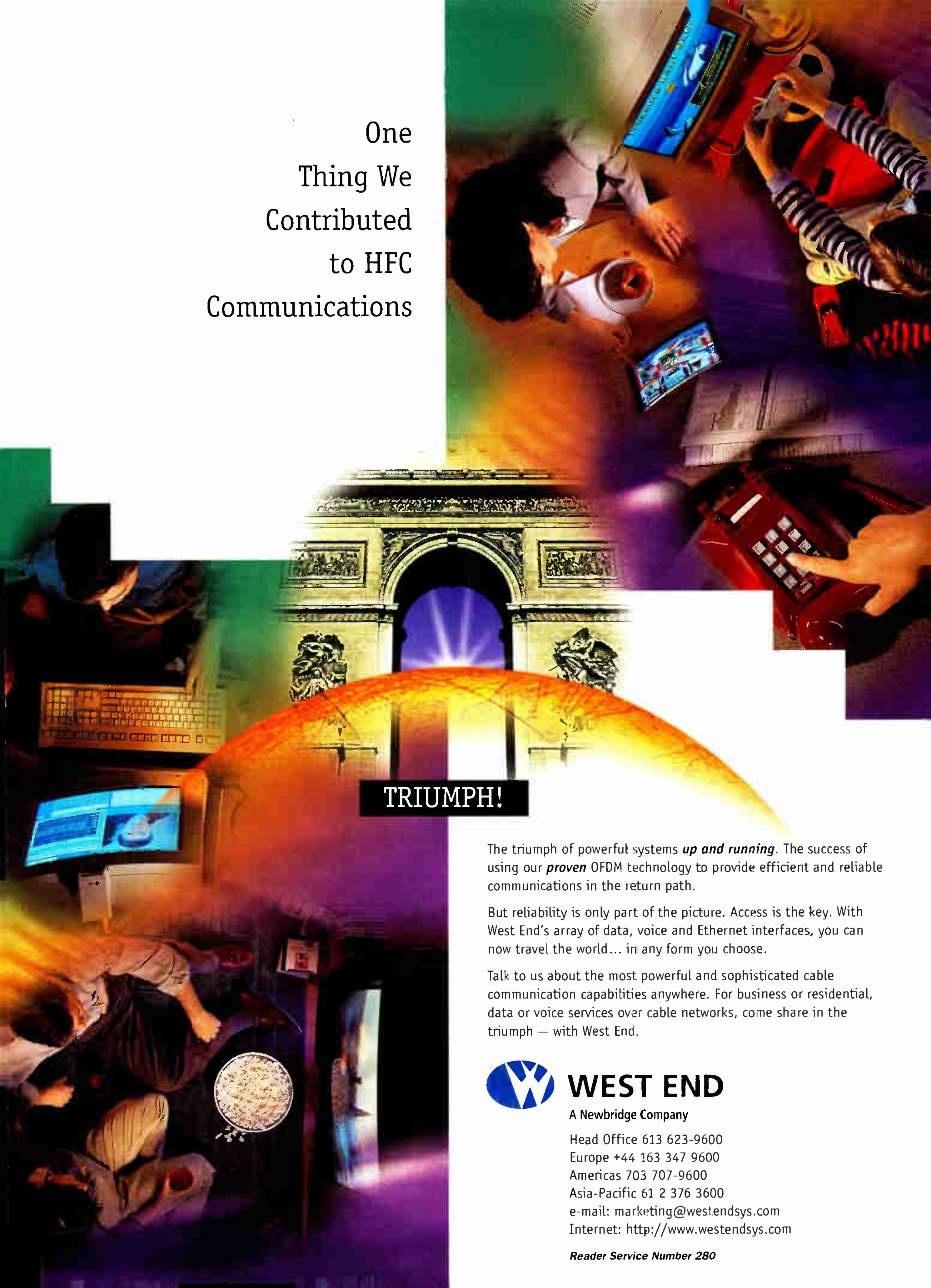
All systems should have written installation procedures and guidelines, whether they were provided by the corporate office or developed locally.

Ongoing training programs are essential to ensure that good installation practices are followed and that all personnel know proper procedures. You should consider implementing some sort of installer certification program. The Society of Cable Telecommunications Engineers has such a program.

Installation practices include apparently simple things like routing of the cable. Where possible, overhead cables should avoid routing that will result in abrasion by tree branches, signs, or corners of buildings. Overhead routing also must take into consideration requirements of any applicable codes.

Underground drop routing can be more difficult, but cables must be buried deep enough so that they will not be easily dug up or damaged by someone working in a garden, digging holes for fence posts, or installing or maintaining a sprinkler system.

Cable installed on the outside of a house or building should be routed so that it is not susceptible to damage by pets, vandalism, etc. When cable must be routed around a corner, care must be taken to ensure that the cable's minimum bend radius is observed. If the cable is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bent or kinked too sharply, it may be damaged. At the very least, a sharp bend may create an undesirable point impedance discontinuity. That's engineer-ese for an impedance mismatch, which can cause unwanted signal reflections.

When cable is attached to the side of a building, staples must never be used, because of the likelihood of puncturing the cable's jacket. Cable attachment clips should be used instead. Always space the clips unevenly. I know it's nice to make the installation look neat, but evenly spaced clips may cause repetitive impedance discontinuities that can degrade the structural return loss of the cable. Even the best-designed clips have the potential to cause a very slight "dent" in the cable, which will change the cable's impedance at that point. If you get enough of these regularly spaced dents—and if they're severe enough—the result could be a frequency-dependent suckout.

Because so many subscriber drop problems are related to improperly installed connectors, it's important that the connector manufacturer's installation procedures be followed carefully. This includes using the correct connector for the cable; proper cable preparation; use of the right crimp tool (and one that is not worn out); and properly tightening the connector on the mating interface. Twenty to 30 inch-pounds of torque is recommended. The exception is on consumer equipment such as TV sets and VCRs, which may be damaged by tightening this much.

All outdoor connectors must be properly weatherproofed, even if they're located in pedestals or lockboxes. For premium sealed connectors, follow the manufacturer's guidelines. Standard connectors can be effectively weatherproofed by covering the connector with a weather boot that has been filled with silicone grease (Don't use silicone adhesive or RTV.) *A word of caution: Do not attempt to weatherproof connectors using boots that are not filled with silicone grease!* If the boots are not filled with silicone grease, water can get into the boot and damage the connector and cable. Nonfilled boots make dandy little terrariums.

Loop wiring is not recommended for two-way operation. Frankly, I don't recommend loop wiring for any situation. All installations should use home run wiring, including multiple dwelling units (MDUs).

One way to ensure installation practices and guidelines are being followed is to implement a subscriber drop quality control (QC) program. You should develop a QC checklist, and perform random inspections of 5% to 10% of all drops. The QC inspection program should be structured so that all installation personnel will have a sample of their work inspected on a regular basis.

When problems are found during the random QC inspections, it may be a good idea to inspect additional work done by that particular installer. If the same problems are occurring repeatedly, then the installer may need additional

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training. Installers that do good work should be recognized, too. This pro-vides positive reinforcement.

Each new installation must be tested r signal leakage prior to connecting it the subscriber's TV set or other in-me equipment. Leakage should be sted in the lower portion of the VHF dband spectrum (108 to about 150 Hz), preferably using a channel car-d on the system in that range. The akage can be checked using a reso-nt half-wave dipole in conjunction th a cable TV signal leakage detector. Alternatively, a portable VHF scanner 2-meter ham radio can be used. anners and ham transceivers usually ve excellent sensitivity, sometimes as w as 1 or 2 microvolts per meter, and n be programmed to tune most fre-encies in the VHF spectrum.

Near-field probe antennas are useful r identifying the exact location of a ik. Most cable TV leak detector manu-cturers sell near-field probe antennas as itional accessories for their equipment.

When testing the drop for signal kage, the objective should be *no mea-rable leakage* from a terminated drop. ie drop should be connected at the o, but instead of connecting the other d(s) of the drop to the subscriber's in-me equipment, first terminate the bscriber end(s) of the cable with a 75 m terminator. This will eliminate the ssibility of leakage from a subscriber's set, VCR, or FM tuner during the easurement. Once the entire drop has en verified to have no measurable kage, then it can be connected to the bscriber's equipment.

All leaks represent potential ingress ints. If cable TV signals can leak out of system, then over-the-air signals can ik into the system. In some cases, it has en found that downstream leakage can low, but ingress can still be severe. is is because RF signal levels inside the le are relatively low level (the output a line extender, at around +40 dBmV, is ly about 0.00013 watt), but over-the-interfering signals can be relatively gh level. For example, a ham operator e me can legally transmit with up to ,500 watts—and my antenna might be rly a few yards from a loose connector n your feeder. If I did my math right, that 1,500 watts is roughly the equivalent of +108.75 dBmV at the transmitter's 50 ohm output. Let's see...subtract a dB of feedline loss and add, say, 7 dBi of antenna gain, and my effective radiated power pointing at your cable is almost +115 dBmV. What do you think will happen if a loose connector gets blasted with that much over-the-air RF?

Next month I'll conclude this discussion with some comments about grounding and bonding, the use of high pass filters, and common mode chokes. CT

Ron Hranac is senior vice president, engineering for Denver-based consulting firm Coaxial International. He also is senior technical editor for "Communications Technology."

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SCTE Cable-Tec Expo '97

Getting Serious in America's Playland

By Laura K. Hamilton

Orlando, FL—Home of Cable-Tec Expo '97.

Photo courtesy of Orlando Visitor's Bureau.

While Orlando, FL, may conjure up visions of palm trees, Disney World, and overheated/overjoyed kids, the cable technical community descended on that city in early June for something a bit more serious. Serious cable technology. Serious discussions about hybrid fiber/coax (HFC) networks, digital and data. Serious engineering discussions that often came back to one serious topic: Cleaning up the return path.

As we said in the first part of this wrap-up of the Society of Cable Telecommunications Engineers Cable-Tec Expo '97 (*Communications Technology*, July 1997, page 12), there was no Mickey-Mousing around here. And really, if you're on the technology side of our industry, that's the real reason to attend this 100% technical confab. There's none like it anywhere else.

Perhaps that's why SCTE's big show just keeps getting bigger and bigger. This year boasted 4,600 attendees and 3,600 exhibitor personnel.

Turn the page for a wrap of this year's Engineering Conference. It featured industry leaders tackling the topics of digital deployment and cable modem technology and product strategy.

The Annual Awards Luncheon gave the Society best a chance to take a bow. So see page 48 for the accolades.

On page 53 you can read about pre-conference tutorials and technical workshops, and the expanded exhibit floor hours are highlighted on page 60.

With all that serious technology going on during the day, a cable engineer or technician needs some relaxation in the evening. Expo always offers up plenty of ways to socialize and this year was no exception. (See page 62.)

Expo photos were taken by Al Covington of ALBJ Images.

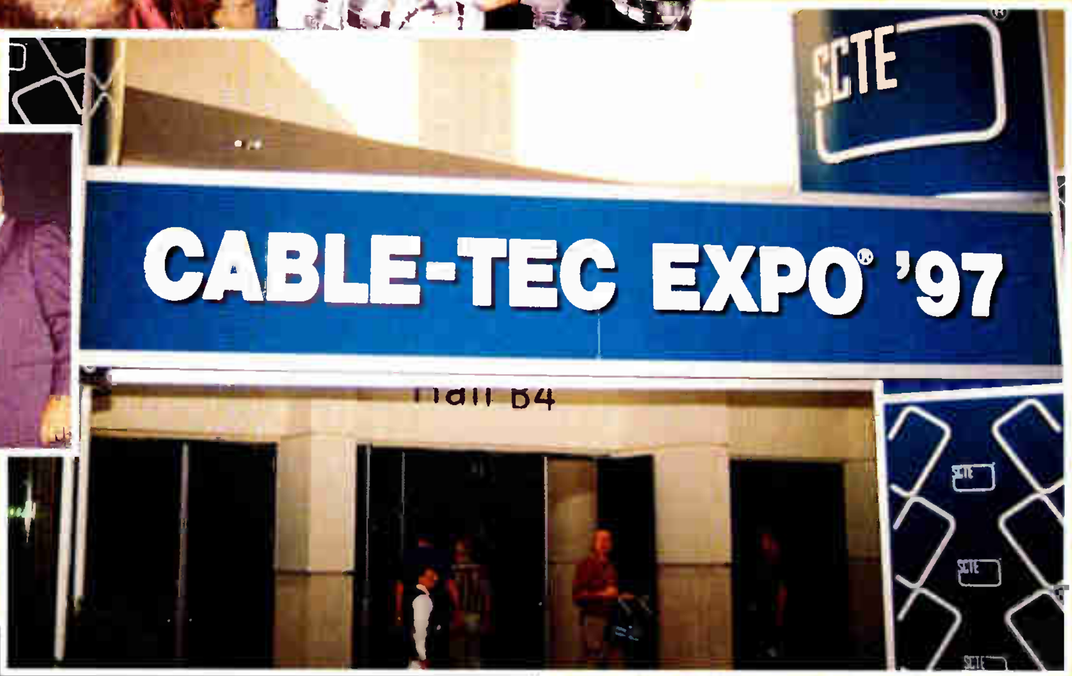
This wrap-up was written with assistance from following members of the "Communications Technology" editorial staff: Coaxial International's Ron Hranac (senior technical editor), Justin Junkus (columnist), Rex Porter (editor), and Alex Zavistovich (executive editor). Also contributing were Convergence System's Terry Wright and Phillips Business Information's Scott Chase (group publisher). Further assistance was provided by PBI's Paul Levine, Allan Rubin, Sylvia Sierra and Nancy Umberger.

Laura Hamilton is senior editor at Communications Technology. She can be reached via e-mail: lhamilton@phillips.com.

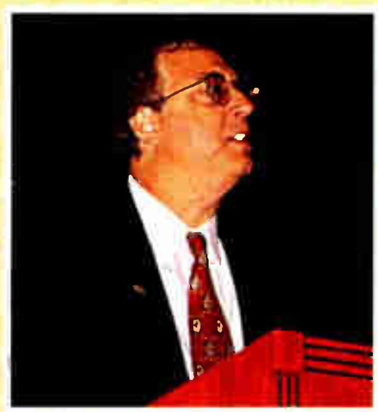
Expo Evening revelers enjoyed The Rainforest Cafe.

Steve Johnson of Time Warner accepts the chairman's gavel from Viewer's Choice's John Vartanian.

The University of Wisconsin's David Devereaux Weber is honored as Member of the Year by the SCTE's Alan Babcock.



A highlight at every Expo, here Cable-Tec Games competitors show off their technical know-how during "Cable Jeopardy."



SCTE President Bill Riker welcomes Expo attendees to the Engineering Conference.

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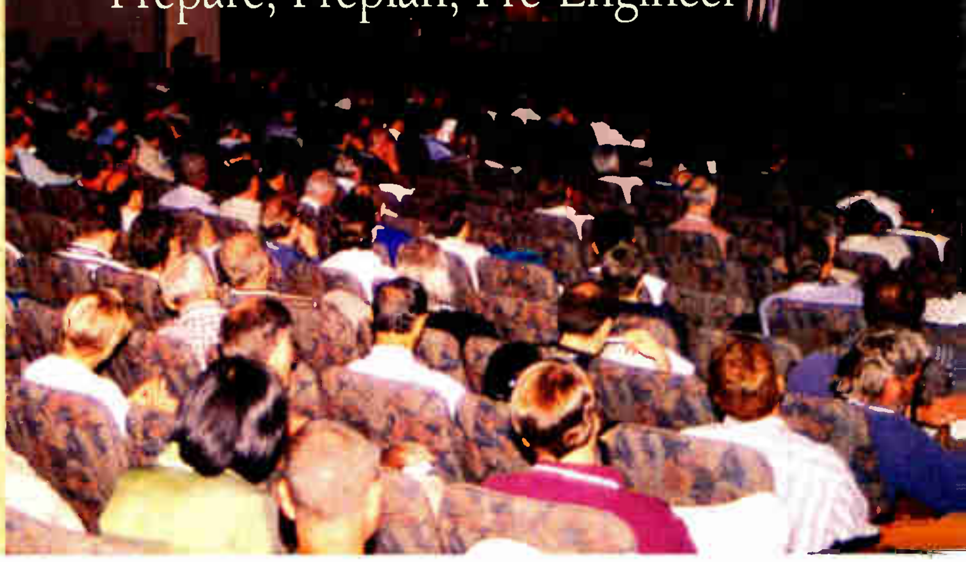


Rate hikes, unresponsive or rude customer service reps, late installs, and not-so-great picture quality. You've heard all those old cable customer complaints before, and despite jumps in sub satisfaction and an undeniable commitment by the industry to do ever more, cable must continue to meet and beat its customer service goals.

A packed house for the Engineering Conference, which featured two sessions: "Preparing for Digital Deployment" and "Cable Modem Technology and Product Strategy."

Society of Cable Telecommunications Engineers President Bill Riker kicked off Expo '97's Engineering Conference pointing out many of the positive moves MSOs have made in not only serving Mr. and Mrs. Subscriber better, but changing any lingering negative perceptions they may have.

Riker highlighted SCTE's involvement in "The Future is on Cable" effort, the "On-Time Customer Service Guarantee," and how these programs can help please your ultimate bosses, who are of course, Mr. and Mrs. Sub.

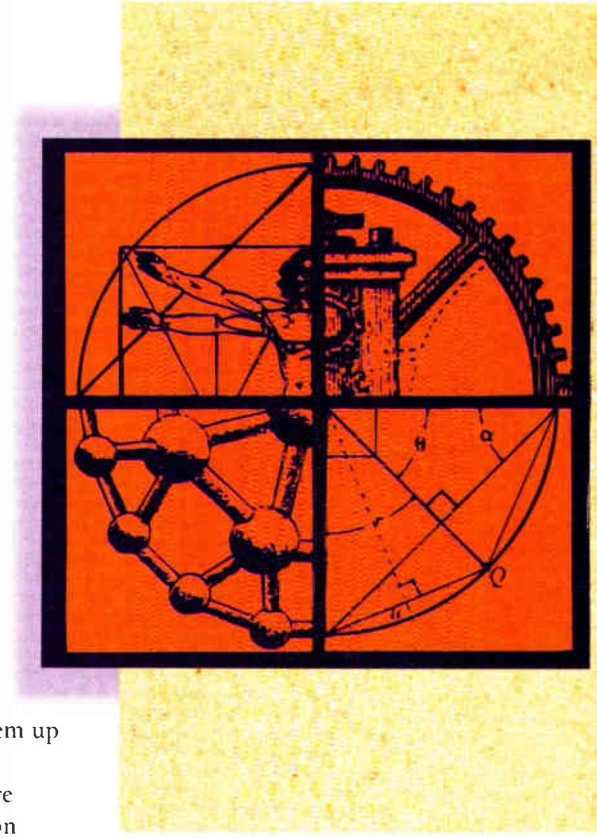
Riker also detailed the changes in this year's Expo, including the expanded exhibit hours, which were requested after last year's show by vendors and attendees alike.

Digital: Prepare now

If you're getting into digital technology, you must preplan and pre-engineer virtually every move now, or you could very well be extremely sorry later. So went the underlying sentiment at the first Engineering Conference session, "Preparing for Digital Deployment."

Moderator Jim Ludington of INT2 pointed out that the technical arena is moving from being "hardware-centric" to "software-centric." That paradigm shift, which includes network management software systems, is changing the very way engineers collect, store and ultimately use technical data coming in from their systems. If you're not organizing that data in a smart way, you're losing an extremely valuable tool for getting a digital system up and keeping it up.

As for the ever-present spectre of noise in the system, Ludington



emphasized the noise battle should be "a day-to-day procedure, not a nightmare project."

James Ludington, president of INT2, was conference co-chairman.

ANTEC's Keith Kraeger took the podium next and offered digital "pre-engineering" tips including the issues of grounding, racking, powering and heat dissipation. Interfacing new digital equipment with your existing equipment is key, he emphasized.

Antec's Keith Kreager

Some "best-case scenario what-iff-ing" came from Todd Ortberg of ADC Telecommunications. "Keep in mind that there are killer applications that are yet to emerge," he said. Check out his paper in the proceedings manual for a digital data demand "explosion" scenario. The manual was part of every Expo attendee's registration pack and is available from the SCTE at (610) 363-6888.

"The one true enemy is wild, unexpected growth," said Van Macatee of TCI Communications Inc. What if your digital customer base, whether it be for video, data or possibly telephony, doubled in a month? Would you be ready? (And if you don't think customer demand can go through the roof, remember what happened to America OnLine when demand exceeded its expectations and capacity.)

Macatee said mind-boggling growth in customer demand for services over digital networks is a very real possibility and said a "reactive to proactive" network management shift was necessary for cable systems serious about digital.

Yvette Gordon of Time Warner shared some real-world engineering experience she's gained as director of interactive technologies at the company's Full Service Network. Her bottom line? "Pay attention to system integration. It's the most important piece and it's the most overlooked piece."

Timing cable modem technology

"A couple years ago, we all voted to change the 'T' in SCTE from 'TV' to 'Telecommunications'. Now it's payback time."

Douglas Jones of US West Advanced Technologies was referring to media access control (MAC) protocols for cable modems, but the statement is true for all aspects of data delivery. To offer bidirectional communications services over cable, engineers have to make a commitment to absorbing new technology and devising product strategies that work together with network development.

In the second engineering session, "Cable Modem Technology and Product Strategy," Mark Coblitz of Comcast Cable Communications presented a paper titled, "New Product Models." Growth and new products should leverage skills, assets and relationships, Coblitz said. Infrastructure required to deliver new products involves an assessment of available technology, skill sets and capital.

In a typical example, an operator planning to offer cable modem-based data service needs to consider whether the plant for such service should be the same as the consumer on-line service, whether to use pass through network monitoring, and whether network reliability needs to be improved. Staff may need new skills to sell or service business customers, in addition to new data skills. A system operator also must consider whether to work on the service by itself or with adjacent MSOs.

Operations considerations, Coblitz said, must include marketing, pricing, sales, accounting, purchasing/inventory control, legal, network monitoring and operations, training, installation, customer service and billing.

Finally, an operator must balance the return on investment against the effort required to deliver the service. In commercial cable modem applications, return on investment may be high, but implementation also is somewhat complicated.

Jamie Howard of @Home Network talked about the "chicken and egg dilemma": Which comes first, cable modem technology or the product strategy? Service providers need to develop a product plan that takes advantage of broadband opportunity and consumer demand, he said.

When offering data service, Howard said, the network must work smarter; a system can't be scaled simply by adding capacity. "You can't have a Ferrari going 120 miles per hour down an on-ramp just to be bogged down by bumper-to-bumper traffic," he commented.

Doug Jones of US West Advanced Technologies

Time Warner's Yvette Gordon

According to Howard, @Home uses asynchronous transfer mode (ATM) technology because it is less expensive than leased lines. Caching via a local server in the headend means less traffic beyond the headend, which

ADC Telecommunications' Todd Ortberg

TCI Communications' Van Macatee

Jamie Howard of @Home

reduces the network load, enabling faster access and greater network management capability.

US West's Jones compared three MAC protocols for cable modems: random access, polling and reservation.

A MAC protocol controls access to the return path of a cable TV network where multiple cable modems transmit on a single frequency channel. The MAC protocol controls how bandwidth is used among modems sharing the carrier, directly affecting data throughput for users.

> "Ludington emphasized the noise battle should be a day-to-day procedure, not a nightmare project."

Random access systems allow a modem to transmit whenever it has data. This system may lead to data collisions between simultaneous users, leading to retries and impaired data throughput. On a busy system throughput could drop to 30%.

In a polling-based MAC protocol, a cable modem termination system (CMTS) can poll individual units or modem groups when it wants the modems to transmit. Until it is polled, a modem cannot transmit. While this reduces collisions, polling can lead to perceived throughput slowdown because a modem that does not send all its data during the polling period must wait to be polled again before sending more data.

In reservation MAC protocol, a CMTS receives requests from modems for a slot to transmit a certain amount of data. The CMTS reserves time on the return path and signals the modems for the intervals available for each modem to individually transmit.

Both the Multimedia Cable Network System partners and the Institute of Electrical and Electronics Engineers are developing reservation-based MAC protocols. The MCNS protocol offers return bandwidth efficiency and guaranteed Quality of Service for individual users. Trials for these modems are slated for late 1997, for service in early 1998.

Michelle Kuska, on behalf of MCNS representative TCI, explained the Data Over Cable Interface Specification (DOCSIS). The DOCSIS working group is comprised of MCNS partners Comcast Cable, Cox Communications, TCI and Time Warner Cable; with Continental, Rogers and CableLabs.

Kuska said DOCSIS recommends an Internet Protocol network layer. The data link layer has three sublayers: Ethernet Logical Link Control; a link-security sublayer for privacy, authorization and authentication; and a MAC sublayer with a CMTS-controlled mix of contention and reservation transmission opportunities. The MAC sublayer also supports variable-length packets for bandwidth efficiency and provides for future support of ATM or similar transport schemes.

The physical layer includes a transmission convergence downstream sublayer that conforms to MPEG-2, and a physical media dependent sublayer based on North American digital video transmission specifications. —*Laura Hamilton, Alex Zavistovich* CT

Michelle Kuska of TCI

Mark Coblitz of Comcast

CableLabs Senior Vice President Richard Prodan moderated the second session.

Awards Luncheon

Devereaux-Weber Takes Member of the Year

SCTE's Alan Babcock (right) presents the Member of the Year Award to David Devereaux-Weber.

David Devereaux-Weber of the University of Wisconsin won the coveted Society of Cable Telecommunications Engineers Member of the Year Award at the annual awards luncheon, hosted by SCTE President Bill Riker and HBO Vice President Les Reed.

The program began with the introduction of the new board of directors and at-large directors. Riker then presented a Special Recognition Award to Wendell Bailey for his part in facilitating "the most cooperative period" in the history of the SCTE and the National Cable Television Association.

SCTE President Bill Riker honors NCTA's Wendell Bailey with a Special Recognition Award.

John Vartanian, immediate past chairman, presented the 1997 Chairman's Award to MediaOne (the company formed by the merger of US West and Continental Cablevision). Dave Fellows, MediaOne's senior vice president of technology and engineering, accepted the award.

Dave Fellows (on behalf of MediaOne) accepts the Chairman's Award from John Vartanian.

Passing the gavel

After passing the gavel to new Chairman Steve Johnson, and recognizing the subcommittees for the Cable-Tec Expo program and the Emerging Technologies '97 program, the ceremony turned to scholarship. *Communications Technology* magazine's Senior Publisher Paul Levine presented CableLabs and the SCTE with the Service in Technology Award, along with a check for $2,500 contributed to the Society's scholarship program. The winner of the Milton Jerrold Schapp Memorial Scholarship

Diana Riley (far left) and Bill Riker (far right) congratulate new Society Hall of Famers Jim Farmer and William F. Karnes.

Recognized as Fellow Members were Wendell Bailey, Walt Ciciora and Robert Dickinson.

The Terra Nova group was elevated to Chapter status.

Richard Green and Richard Prodan of CableLabs and Ted Woo and Bill Riker of SCTE accept a $2,500 check for the SCTE's scholarship program from Communications Technology's Paul Levine. CableLabs and SCTE were honored with this year's Service in Technology Award.

Expo '97

AWARDS LUNCHEON

Joseph Lanza won this year's Field Operations Award, which was presented by Victor Gates.

New SCTE Senior Members included: Paul Gemme, Keith Hayes, Ray Fournier and Victor Gates.

HBO Vice President Les Reed helped host this year's Awards Luncheon.

Fund was Erin Sandifer, who will receive $5,000 a year for four years.

The SCTE's Field Operations Award was won by Joseph Lanza for his volt meter design. James Stewart and Wayne Szetela snapped up second and third place honors, respectively.

Members and chapters

New senior members were Jack Terry, Ray Fournier, Keith Hayes, Ray Rendoff, Victor Gates and Paul Gemme.

Fellow members, nominated by the Society's executive committee, were Robert Dickinson, Wendell Bailey and Walt Ciciora.

Two meeting groups were elevated to chapter status: The Bonneville and Terra Nova chapters.

William F. Karnes and James Farmer were inducted into the SCTE Hall of Fame.—*Alex Zavistovich* CT

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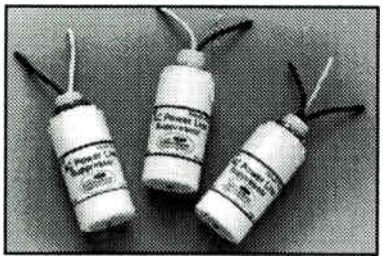

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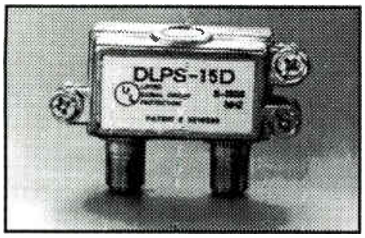

DLPS-15D™ Drop Line Power Suppressor

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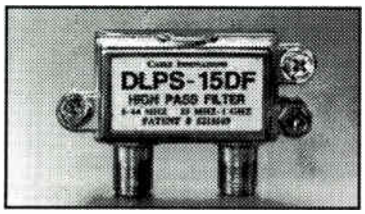

DLPS-15DF™ High Pass Filter/Drop Line Power Suppressor

The DLPS-15DF is an essential ingredient in achieving the reliability and subscriber satisfaction necessary in those systems that need to eliminate return path noise and protect both their equipment and the subscriber's electronics.

The DLPS-15DF offers the same suppression as the DLPS-15D, taking any overvoltage directly off the center conductor and zapping it to ground instantaneously before any damage can occur to cable line electronics or the subscriber's electronics.

The DLPS-15DF offers a wider and deeper filter, longer life, greater current handling capacity and faster response than any other type of protection/filter.

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Expo '97

Expo Workshops

Beyond the Expected

For the technical hungry with specific questions on their minds, Cable-Tec Expo workshops and pre-conference tutorials are the best part of the show. After pouring themselves a cup of morning coffee courtesy of the National Cable Television Institute, all levels of engineers and technicians pack into the workshops. Even though they start with a formal classroom feel, many times a question from the audience or a "this-happened-in-my-system" anecdote spurs real-world conversations.

Tech-hungry attendees packed what is the heart of Expo.

Preconference tutorials

As the cable industry moves from providing entertainment services to full-service telecommunications, technicians in the industry must be prepared for these new opportunities.

That's the rationale behind the Society of Cable Telecommunications Engineers new certification programs, described in the opening presentation of Expo '97's preconference sessions held for early birds to the show. The programs were described in "Preparing for Technical Certification at the Service Technician and Telephony Levels," a paper authored by Alan Babcock, SCTE; Andy Scott, NCTA; and Gary Selwitz of Raystay Co.

The SCTE Training Committee, one of five standing committees reporting to the board of directors, has introduced two certification programs: The Service Technician Certification and Telephony Certification.

The Service Technician program is designed for installers who are required by their companies to service and repair the "last mile" of coaxial plant. This level of certification is targeted at personnel dealing with equipment and coaxial cable plant between the output of a bridger amplifier and the customer terminal device.

The Telephony program has been created to address data and voice issues as cable's evolving fiber-based platform takes on more personal communications, competitive access to long distance companies, Internet access, low- and high-speed data transfer, and local residential voice communications.

Rules for the new certification programs have not been finalized. Feedback from the Expo will enable full introduction of the programs in the Fall 1997.

"Training, Certification and Standards." These three pillars are the cornerstones of the SCTE's motto, so it's fitting that one of the preconference sessions should address the organization's efforts in technical standards development.

In a paper by Ted Woo, titled "SCTE Technical Standards Development," some

EXPO WORKSHOPS

of the society's latest achievements were detailed. SCTE is now a member of the Electrical & Electronics Standards Board of the American National Standards Institute. The ANSI/SCTE SP 400-1996 "F Port (Female Outdoor) Physical Dimensions is now an American national standard. SCTE DVS 031, "Digital Video Transmission Standards for Cable Television," has passed the 60-day public review at ANSI. SCTE IPS SP 406, "F Port (Female Indoor) Physical Dimensions," is being submitted to ANSI for approval.

Jointly with the Electronic Industries Association, the SCTE has created standards for electrical test procedures regarding insertion gain and loss, return loss, isolation, noise figure, composite triple beat distortion, composite second order distortion, power consumption and group delay.

James Haag with Integration Technologies authored a paper detailing the work of the Interface Practices and In-Home Cabling Subcommittee. This subcommittee was formed in 1988 to develop dimensional, electrical and mechanical standards on components in the drop network. Starting with interface standards between the F male connector and F female port, the subcommittee has since expanded its scope to include 82 specification and test procedure standards to improve drop-related performance.

A progress report from the SCTE's Digital Video Subcommittee was prepared by Paul Hearty of General Instrument. Thus far, six SCTE standards have been completed: 64/256-QAM cable downstream modulation and forward error correction, audio system specification (ATSC/Dolby AC-3), base system information specification, subtitling methodology and syntax specification, asynchronous data services specification, and video formats specification.

One proposed SCTE standard on system information extensions for cable and satellite applications has been completed. These others will be submitted to the ANSI review and approval process. The 64/256-QAM standard already is close to adoption by the International Telecommunications Union.

Are you ready for the Emergency Alert System (EAS)? That was the question raised in a paper written by Time Warner Cable's Steve Johnson. EAS has advantages over the previous EBS in that it is digital, star-configured (as opposed to daisy-chaining, where a failed link can undermine the entire system), geographically regionalized, prioritized, addressable and automated.

Workshop presentations

Bar coding and material management practices were explained in a paper from Comcast Cable's Richard Pulley. In March 1995, the SCTE Material Management/Inventory Subcommittee recommended to the SCTE adoption of the Universal Product Code (UPC) as the bar code technology for the cable industry. The recommendation was standardized in May 1995. UPC implementation began in December of 1995.

Bruce Weintraub of SBC-Media Ventures and Exide's Larry Ross wrote a paper highlighting the work of the SCTE Maintenance Practices Subcommittee. The Damages Working Group of the subcommittee sent a questionnaire to 75 systems across the country to assess capabilities for damage prevention and control. The survey findings indicate a need to improve these capabilities to reduce downtime and increase plant reliability. The working group expects to issue recommended practices shortly.

You can't tell the players without a scorecard, they say. In the world of telephony, that's especially true, as acronyms and new technologies are introduced on a seemingly daily basis.

"Telephony Acronyms and Data Network Protocols," a preconference paper written by William Winslow and Mark Mayer of Sprint North Supply, tackled explanations of various transmission schemes and network architectures, including ISDN, SONET and HDSL.

The paper first addressed the digital hierarchy, from the DS-0 (64 kbps) to DS-3 (44.736 Mbps) level. Customer needs drive the use of the higher bit-rate schemes: high-speed data and voice requirements and the need for dedicated transmission types or for connection of multiple LANs, including PBXs are typical examples.

Fractional T-1 service is a digital transmission rate between DS-0 and 1.544 Mbps (full DS-1 or T-1). It is typically used for LAN interconnections, videoconferencing, computer imaging and dedicated voice applications such as PBXs or key systems. DS-1 and DS-3 enables voice and data to be combined, and Fractional T-1 customers get dedicated bandwidth without the cost of full DS-1 service, but that dependence on a dedicated path can also be a limitation.

High bit-rate digital subscriber line (HDSL), a dedicated nonswitched service, can provide DS-1 service over two copper pairs. However, there is a distance limit between the central office and the customer. Also, most HDSL systems are stand-alone and not integrated into central office or customer premises equipment.

DDS (digital data service) is a low-to-medium speed dedicated data service available in speeds up to full DS-0 to carry slow scan video, voice and data. It is good for the small data user market, eliminates the need for modems and is widely available. On the down side, it is more expensive than analog, requires a new diagnostic system, and has limited capacity.

Synchronous optical network (SONET) is a family of fiber-optic transmission rates that can carry many signals and allows internetworking of products from multiple manufacturers. Its levels range from OC-1, with the capacity of 28 DS-1s (52 Mbps) to OC-48 (2.5 Gbps) with the impressive carrying capacity of 1,433 DS-1s. Although the advantages of such architecture are obvious, SONET can be expensive and is meant only for high-capacity app ications.

For low- to medium-speed LAN networking, videoconferencing, Internet access and telecommuting, ISDN (integrated services digital network) is one option. Simultaneously handling voice, data, video and graphics, its speed is determined by the interface: basic rate (BRI) or primary rate (PRI). More economical than dedicated lines, ISDN still requires terminal adapters and is not available everywhere.

Frame relay, a high-speed switched service that moves data in units or "frames," operates at access speeds up to 1.544 Mbps. It requires only one access line from each site to the frame relay network. However, while it efficiently transmits large data bursts, it is intended for data only, and is prone to network congestion.

ATM (asynchronous transfer mode) is a high-speed, high-volume packet switching transmission protocol. It can link large LANs through a WAN, and capacity may be purchased in increments into the gigabit range. Although it is not always available in all areas, and standards are not totally established, ATM costs are rapidly declining, which is a decided advantage of the scheme.

Data-ready plants

Bay Networks' Gene O'Neil, principal field engineer/trainer, leveraged the many lessons learned in deploying all generations of the former LanCity cable modem solutions to deliver a quality workshop on what it takes to ensure "data-ready" cable plants. Coming from a company currently shipping approximately 3,000 units per month, with more than 100,000 units shipped to date, Bay Networks/LanCity certainly has the credibility lacked by many in this space. A cable operator considering entering the data services space would do well taking O'Neil's advice to heart as his basic message applies to the underlying infrastructure necessary to support any cable modem solution.

O'Neil focused on three key areas critical to the successful deployment of data services over cable modems. These areas are:

1) *Reasonable* Cable Plant Operating Characteristics
2) Properly Installed Headend Equipment, and
3) Properly Configured Cable Modem Provisioning Server

The second and third areas O'Neil covered are primarily vendor-specific, but do call attention to the importance of properly installing headend equipment, and especially of properly configuring equipment like cable modem provisioning servers (i.e., the server that actually enables cable modem operation on a cable plant). However, O'Neil spent the majorit of his time and focus discussing issues associated with the return path.

In the area of reasonable cable plant operating characteristics, O'Neil stressed the value of good engineering practices and meeting FCC requirements on the forward plant. Good engineering practices topics ranged from common sense issues (e.g., don't use rusty or other sub-quality parts in connections) to more informative (and lesser known) areas such as the importance of having total power on the data channel be at parity with the total power seen on traditional video channels. However, the challenges associated with the return path was easily the primary thrust of O'Neils message.

Even though recent advances in digital signal technology enable automatic signal level adjustments and ranging by current generation cable modems, these functions depend on the unity gain inherent in the return path. And this represents a natural path into what are likely the most complex challenges cable operators need to address in the area of the return path.

According to O'Neil, cable operators will easily spend the majority of their time overcoming the unique challenges imposed by the return path. The "many to one" convergence of return path data streams into the headend complex creates a scenario where noise and ingress are funneled together. This funnel effect is further complicated by the fact that the combining of return paths (i.e., from various HFC segments) actually combines these funnels. For example, O'Neil mentioned that if a thousand cable modems are all combined onto a single return path, then the meaningful data signal would easily get lost within the rising noise floor accompanying the funneling of all these return paths. According to O'Neil, segmenting the cable network should be the primary method for solving noise and ingress problems, a method that also maximizes data service performance for end users by minimizing contention for bandwidth among those users.

Another critical area of the return path is the issue of excessive group delay. This fundamental issue is a characteristic of plant topology (e.g., amplifier cascade counts...even in HFC networks) and return spectrum frequency assignments. O'Neil sited an example from his experiences installing LanCity modems where a simple return path center frequency change from 11 MHz to 14 MHz reduced group delay enough to enable a previously nonfunctional cable modem to achieve correct operation. Generally, any return path frequency near T7 can introduce significant group delay issues. (Bay's modems, for example, can compensate for up to 800 ns of group delay. However, a few extra amp cascades near the T7 frequency, can exceed this value and prevent a cable modem from operating properly.)

O'Neil also discussed and compared the application of QPSK and QAM encoding techniques, both of which have been adopted by the MCNS Consortia specification and the IEEE 802.14 Working Group's standard definition effort, on the return path. In general, QPSK (well-proven in satellite communication applications) provides robust operation in a noisy environment. QAM, on the other hand, provides more

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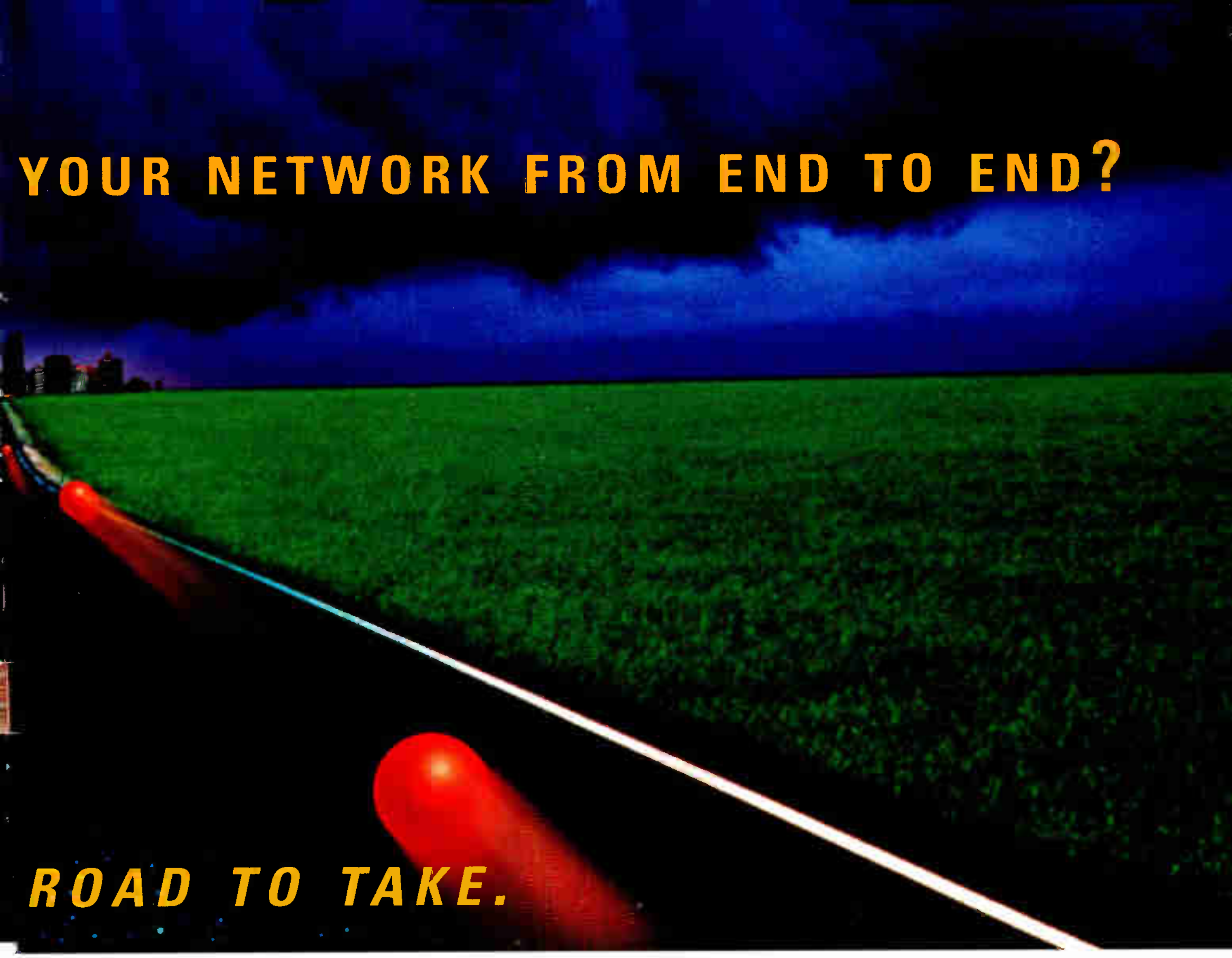

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EXPO WORKSHOPS

bits per hertz, has a larger constellation size (QAM 16 has four times the symbols size per 90 degree space as QPSK), but is not as robust in noisy environments. This is why forward error correction (FEC) is employed in most QAM implementations. The QAM approach, according to O'Neil, is ideally suited for downstream applications when the downstream path has been decoupled from the upstream return path. However, QAM can be used for the upstream return path when the quality of that return path can support it.

In summary, assuring data-ready cable plants is a function of:

- Good engineering practices (and quality parts)
- Proper equipment configuration and installation (at the headend as well as customer premises)
- Proper network segmentation (to minimize noise and ingress problems while maximizing performance through reduction in contention)
- Selection of return path frequency appropriate to the cable plant topology and group delay tolerances of the cable modem solution.

Digital deployment

Telecommunications is pushing cable networks toward digital technology. Because digital is still new to many cable engineers, learning how to measure levels and preparing for deployment of digital networks is more important than ever.

At the Expo workshop devoted to digital deployment, Zulfikar Ali of General Instrument discussed considerations for digital networks. According to Ali, two main digital headend architectures are national control (like the Headend In The Sky), or local control, in which services come from any source, but control is managed by a local access controller.

System considerations in digital deployment include a system readiness test, satellite downlink, signal processing and channel lineup, transmission system and customer premises. Ali recommended that digital signal level for the satellite downlink be kept in the range of -25 dBm to -65 dBm, with a minimum carrier-to-noise (C/N) ratio of 8 dB. For signal processing, digital signal level should be set at -10 dB relative to the adjacent analog carrier, and digital channels should not be located adjacent to trapped channels.

In implementing transmission systems, Ali said, FCC technical requirements for C/N, distortion and cumulative leakage index (CLI) are adequate for digital signals. At the customer premises, signal level at the end of the drop should be checked to ensure a C/N of 30 dB or better, with no other significant impairments.

Broadband Communications Technician/Engineer candidates tackled exams at Expo.

Wavetek's Rick Jaworski described tests to prepare the cable network for digital. Because ingress in the home can wreak havoc on the return, it must be continually monitored and eliminated. Testing for leakage helps find wiring damage or poor craftsmanship that can result in ingress, Jaworski maintained. Locating faults for repair can help eliminate reflections which can impact digital signals, he added.

To align the reverse path, Jaworski recommended choosing operating levels that maximize the distortion and C/N performance, while minimizing signal level differences at the headend. Level references can be established with any signal level meter for the video carrier; for the digital carrier, digital measurement capability is demanded.

Digital architectures and system capabilities were tackled by Bill Wall of Scientific-Atlanta. Wall focused on network management to coordinate the various applications made possible by digital technology. Standard data networking technologies and protocols allow modern network management tools to be used in the system. All devices—including the digital home terminal itself—can be monitored and provisioned using simple network management protocol (SNMP). The SNMP can monitor home terminals regularly for signal level, signal-to-noise ratio, bit error rate and channel passband shape.

With SNMP, all devices in the network can be monitored for alarm conditions, said Wall. Also, trouble reports can be diagnosed and standby equipment can be put on line remotely.

Inside wiring

Running the wiring to support new services in residential units and businesses requires more planning than just stringing cable to outlets. That was the message of the "Inside Wiring Options" workshop conducted by the panel representing Integration Technologies, KnowledgeLink and Ortronics.

New services require a structured wiring system, which J.R. Anderson of Integration Technologies introduced as a "combination of twisted-pair wiring and coax."

"You have two possibilities as a cable company for bringing in new services—use existing building wiring or install new wire," says Mike Sawyer, KnowledgeLink vice president. If you use existing wire, you are going to have to analyze the plant for both physical and electrical characteristics. Most residential telephone wiring was installed using a loop or ring structure, where telephone outlets are connected in a string starting at the demarcation point from the service provider and ending at the last outlet in the string. While this configuration worked well for

Reader Service Number 5

EXPO WORKSHOPS

low-bandwidth voice services, data suffers signal degradation that may make existing loop wired systems unusable for data services. In this case, the wiring needs to be replaced with "home run" segments, from the demarcation point to each outlet in the building.

Twisted-pair may be shielded or unshielded, and comes in cables that contain color coded pairs. There are multiple grades of twisted-pair, some of which may not be suitable for data transmission. To avoid problems and have maximum flexibility later, Al Feasting of Ortronics recommends running Category 5 twisted-pair in new and replacement installations.

Screw terminals worked well for voice and low-speed data, but new data services require data-friendly "punch down" blocks, such as a 110 connector. With these blocks, splices and taps are made by using a special tool to insert the conductor into the punch down terminal, which not only secures the wire, but penetrates the conductor insulation. Problems with loose connections and corrosion are virtually eliminated.

Sometimes new wiring is not feasible. Examples are residential and apartment or office buildings, where there is a high emphasis on use of existing vacant pairs. In this case, the pairs being used to provide new service must be tested before installation of the service for shorts, opens or crossed pairs. Most testing of this nature begins at the network interface unit at the demarcation point, and may continue up to the subscriber's outlet. Much of it is procedurally similar to the troubleshooting techniques used by the cable TV technician, but involves the use of new equipment looking at different signals.

Single family residence wiring is another application where complete rewiring is often not feasible or desirable. Mike Sawyer presented typical install situations, including locations where the wiring is a combination of loop and star due to extensions that were added by the homeowner. Although there are standards for wiring color codes, in the field, single family residences often do not follow the recommendations. When new services are added, such as telephone return on pay-per-view, the installer needs to be aware that colors and even wire gauges may not be those recommended by the standard. The connectors also will probably be screw-type blocks, in many cases purchased from a retail outlet by the homeowner. "A good policy is to make sure all phones are working before you begin installation, so you are sure that you have not affected service by anything you did when you made changes," noted Sawyer.

Making two-way work

Coaxial International's Ron Hranac and The Excalibur Group's Tom Staniec teamed up again this year in the Expo workshops. Continuing where the pair left off last year, Hranac started the session by providing a brief overview of the various impairments that can affect the reverse path. He then discussed data carrier levels, and the importance of understanding that some digital modulation schemes have high peak-to-average signal power ratios. Incorrect measurement of these types of signals can lead to reverse laser clipping.

Hranac showed how to set upstream levels by establishing the so-called X level. Examples of a typical amplifier signal flow diagram and an amplifier internal loss reference table were demonstrated. Hranac concluded his portion of the presentation with a review of how the reverse path can be characterized using CableLabs' CW Tester, and showed several real world examples of reverse path problems. "The key to successful two-way operation," commented Hranac, "is a commitment of time and resources."

Staniec emphasized what many in the industry have found: The reverse optical path is usually the weak link in two-way systems. He noted that not only can the laser be a weak point, but so can the reverse optical receiver. In particular, reverse transmitter-receiver pairs often are intended for larger link budgets than actual conditions, resulting in many receivers being overloaded. This condition will reduce operating headroom substantially, but can be overcome by using high quality optical attenuators at the receiver input. Staniec added that a Fabry-Perot laser's dynamic range can be improved by using an optical isolator.

Staniec also discussed the relationship between a system's cumulative leakage index and reverse path performance. While direct correlations don't always apply, Staniec showed examples of some systems that have very good leakage programs in place, keeping the entire network's leakage (including drops) below a 5 µV/m limit rather than the FCC's 20 µV/m threshold. In those systems, reverse path ingress was essentially nonexistent. "This can be done without hiring additional personnel," said Staniec, "but it requires what amounts to a lifestyle change."

HFC upgrades

Walter Colquitt of Optel and INT2's James Ludington's workshop on "Managing Your HFC Upgrade" broke down the components of the project in terms of its scope: the parameters of your present system, the parameters of the HFC system you're planning, your budget for the project, and the timetable.

You should know the number of plant miles in your existing system, the number of amplifiers, any geographical obstacles (highways, rivers, etc.), and the number of passings or subscribers it serves.

For your proposed HFC system, detail the miles per node, passings or subscribers per node, and how many nodes or passings you'll have per hub. Also plan the number of hubs per zone, and the number of zones per region of service.

Your capital budget should address issues such as buildings or land you'll need for your headend, hubs and network operations center. Fiber interconnects and your distribution plant are also capital expenditures.

When you're ready to set your timetable, you'll need to create project milestones that will help you meet your required completion date. Part of the timetable is a request for proposals, followed by vendor and contractor selection.

Revenue opportunities

Advancing technologies, lowered costs, a favorable regulatory environment and increased demand for consumer, corporate and industrial telecommunications applications will drive the development of new revenue opportunities over the next few years, presenters said at the workshop on revenue opportunities.

Broadband Networks' Tom Donahue noted in his paper, "Revenue Generation from Municipal Systems," that fiber deployment for everyday cable service could serve "as the backbone to reach high density, high need and high revenue locations such as major office centers, premium MDUs, medical centers, colleges and school systems."

Donahue's complete paper emphasized "the reality" of connecting business, medical and educational interactive customers in a profitable manner. The author further outlined ways that such projects are financed through reoccurring service fees, initial public grants to end users (such as the medical, academic and law enforcement communities), and creative partnership/lease agreements.

Following up on the same theme, Jay Kirchoff of Moore Diversified Products Inc. listed several key regulatory moves that have created conditions for the growth of ancillary revenue streams. The elimination of regulatory initiatives that could have served to create utility service monopolies, coupled with a reduced time to market for the impact of regulatory changes, has resulted in an expansion of "choice" for consumers of all stripes related to energy consumption, rate options and energy management, Kirchoff said.

Citing five competing technologies — telephone, fixed base radio, mobile radio, CATV and satellite — Kirchoff listed the cable industry's advantages as "network performance, in-place infrastructure, network performance, network availability/reliability" and the inherent two-way nature of cable-based communications architectures.

CATV, Kirchoff opined, "is in the best position to respond to opportunity" in the realization of new revenue streams derived from existing and planned infrastructure.

In a third paper titled "Broadband Based Traffic Signal Systems," Byron F. Smith of ISC Datacom Inc. stated, "The cable industry can realize incremental incomes with very little costs in bandwidth." Smith argued that the inclusion of public services over existing cable systems can, in effect, imbed the service within the community, leading to retention of business arrangements and franchise renewals.

Real powering

As anyone who has ever dealt with juicing up a cable telecommunications network knows, real-life powering goes way beyond Ohm's Law. Multiple return paths exist in the powering of coaxial plant. Return resistance is not equal to the coaxial shield resistance. It is lower. As resistance drops, voltage drops are lower, availability goes up, and current draw is reduced.

So said CommScope Director of Technical Services Mark Alrutz in his introductory powering paper.

Steve DuChene of Time Warner Communications (Tampa Bay Division) continued in the real-world vein with feedback on upgrading power and the safety issues inherent in doing so. He offered up observations culled from his division's deployment of the much-discussed 90 volt powering.

"90 volt powering is no longer a text book theory," Duchene pointed out, "Its deployment has not been problem-free, but it is getting better as equipment manufacturers get feedback from systems using it."

Network design and 90 volt powering was discussed in the David Johnson of Cox's paper. He explained that even though many cable ops have slowed down "lifeline" telephony launch schedules, you must continue to look at all available options to enhance other services that might not seem exactly "lifeline." Johnson detailed central network

Cost-Saving Fiber Optic CATV Control Systems Now Available On One Fiber

Why are you still using leased phone service for communication to remote headends? Radiant Communications has fiber optic systems compatible with all major OEM equipment...GI Omnistar, GI Set Top (TNA), GI Digital Headend, SA System Manager, SA Pegasus, Superior Cheetah, AM Communications. All systems are now available using only one fiber and will generally pay for themselves in a few months.

Reader Service Number 113

Low-Cost Fiber Optic 5 Channel Broadband System

A low-cost fiber optic 5 channel broadband system for applications that require more than one channel is available from Radiant Communications. The Series VL2500 transmits channels 2 through 6 via singlemode fiber for distances up to 40 Km. A multimode fiber version for college campus requirements is also available. A true plug and play system, no adjustments are required. Radiant supplies other low-cost AM fiber optic broadband systems for 24 and 80 channels as well as a 16 channel FM system.

Reader Service Number 222

Fiber Optic CATV Drop Cables

Radiant offers a full line of fiber optic cable plant products. The company guarantees drop cables with back reflections of –60dB for ultra polish terminations and –70dB for angle polish terminations. Available from 2 to 12 fibers with customer specified node connector. Also available are fiber optic assemblies, couplers, fiber management systems plus the industry's first and best low backreflection attenuators, both fixed and variable.

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Reader Service Number 180

EXPO WORKSHOPS

powering advantages and explored intermediate alternatives that could provide a logical migration path to full central powering in the long-term.

Getting to the down-and-dirty details of power distribution cables in HFC networks was Continental Cablevision's Daniel Kerr, midwest regional network design manager. His discussion centered on the resistive, mechanical and pole-loading properties of copper and aluminum conductors. For a very detailed look at these materials and structures powering issues, see Kerr's paper in the Expo proceedings manual, which includes extensive equations and samples to give readers a broader perspective for determining the best option for distributing power within an HFC network.

Audio dilemmas

Craig Cuttner of Home Box Office, Russell Murphy of The Family Channel and Linc Reed-Nickerson of Tektronix presented papers on audio. They didn't come up with the solutions some might hope to hear but they were able to point out areas of concern with the ongoing arguments about loudness. Loudness can't be controlled without introduction of problems some have never considered. Ever considered the use of limiters or compressors to solve this problem? Think it's simple? Then you should have attended this workshop. Or, as Russell Murphy said, "It would make a good topic for you to present to your SCTE chapter, to further their education." After all, this is a sore subject with your customers.

Return path problems

Ah, return path woes. The majority of members of the cable technical arena are dealing with them daily. And if you're not tackling them today, you surely aren't going to be ready for a two-way tomorrow.

Dean Stoneback of General Instrument overviewed the main return issues as:

- System dynamic range and component selection
- Determining system levels
- System alignment and long loop automatic gain control (AGC)
- Measuring digital signals
- Identifying common problems

The workshop's emphasis was on identifying and eliminating the problems including casting the spotlight on problem spots like plant alignment, power levels, laser and hybrid clipping and ingress mitigation.

Slugging

"Surge Termination, Fusing and Slugging" was presented by John J. Downey, Senior Field Engineer for C-COR Electronics; Dan McCreery, Manager of Customer Service for Atlantic Scientific; and Oleh Sniezko, Director of Transmission Engineering for TCI. Here are some questions you would be able to answer if you had attended: 1) What is Ground Flash Density? 2) What is Direct Coupling? 3) What is a method of effective protection against surges in a modern full-service network? 4) Which is more effective in improving network surge protection: fusing or circuit breakers? 5) Which is better: a Slo-Blo fuse or an Autofuse fuse? How do temperature and aging figure into planning for proper surge protection of an improved network?

Proceedings manual

You can get further information by contacting the SCTE to purchase a copy of the *1997 Expo Proceeding Manual: Collected Technical Papers, Volume II — Workshops*. Call the Society at (610) 363-6888. —*Scott Chase, Justin Junkus, Laura Hamilton, Ron Hranac, Rex Porter, Terry Wright, Alex Zavistovich* CT

Exhibit Floor

Scenes from the exhibit floor.

Cable-Tec Expo '97 packed the largest exhibit hall wallop than ever before thanks to a schedule change to provide additional show floor hours—more than any previous Expo.

For information on new products, watch *CT's* "Marketplace" department. (This month's starts on page 101.)

Making light work

An exercise in passive fiber-optic systems sponsored by AMP was offered in the exhibit hall. Participants studied and made hands-on measurements on a complete passive fiber-optic system similar to those used in the cable industry.

Conferees flocked to register for the most well attended Cable-Tec Expo ever.

SCTE Bookstore

New to the store was *T-1 Transmission Basics Computer-Based Training*, *Telecommunication Technologies Computer-Based Training*, and *Satellite Calculations Handbook* (by J. Kuhns).

Forgot to pick up something? Call the SCTE at (610) 363-6888 for details on ordering Society wares.

Drop and cable service

CommScope supplied drop hardware and Time Warner Cable installed cable service to exhibitors and videotaped Expo sessions.

Scenes from the exhibit floor.

Technical demos

Because Engineering Conference and workshop sessions steer clear of product-specific presentations, and because many attendees do want formal presentations on vendor's products, a Technical Training Center is provided in Cable-Tec Expo's exhibit hall.

A wide range of industry vendors demonstrated a vast array of technology including:

- and Reverse Path upgraded for existing equipment by **CableServ Electronics**
- Sweeping fiber reels made easy by **Photon Kinetics**
- Return path testing, implementation and installation by Trilithic
- Identifying and managing the challenges of return path by **ANTEC/Digital Video division of Arris Interactive**
- Cable modems by Bay Networks
- Reverse path training by Scientific-Atlanta
- Emergency Alert System by Trilithic
- Headend management systems (splitter combined networks) by **Channel Commercial Corp.**
- SCDMA cable modems by Terayon
- Fiber/coax cable installation into conduit by American Polywater
- Heatless connector protection by **Contech Systems**
- Premium F-connector by Gilbert **Engineering**
- Understanding TDRs by Riser-Bond
- Passive component network design by **Gould Fiber Optics Division**
- 1,310 DTX transmitter family by **IPITEK**
- Product training by **Diamond Communications Products**
- Enterprise solutions for hybrid fiber/coax design by GLA **International/Design Extender**
- Fiber-optic proactive preventive maintenance systems by Norscan
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- Baseband testing technique using demodulators and video test set by **Tektronix**
- Return testing with digital signal processing by Holtzman Engineering—*LH*

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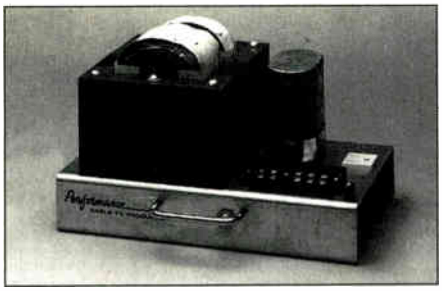

REPLACEMENT FERRO fits most manufacturers cabinets

The Performance Model FR2000 60V/16A Ferroresonant power supply is designed to replace or retrofit discontinued and obsolete power supplies. It fits most existing cabinet configurations and connects using existing wiring. Price is $299, call 800/279-6330.

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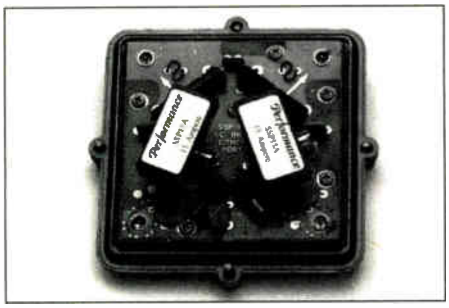

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The Performance Model BT 1200 universal battery tester checks gelled electrolyte and lead acid batteries in 10 seconds. Since batteries deteriorate gradually, regular testing with this unique device enables you to log changes in voltage levels as they occur. Having this history lets you know when to do preventive maintenance before a critical battery fails. Price is $250. Order today, call toll free 800/279-6330

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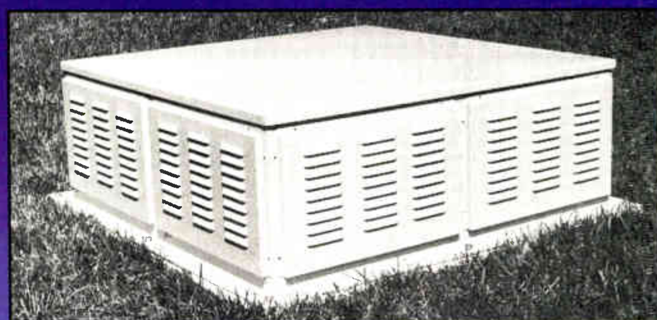

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Reader Service Number 140

Fun in Orlando

Plenty of social events offered attendees the chance to relax in the evenings after a full day of technology.

Wavetek sponsored its traditional Arrival Night Reception and this was followed the next evening by the Welcome Reception hosted by ADC, Ericsson, iCS, Sprint North Supply and Times Fiber Communications. A highlight of every year's Welcome Reception is the National Cable-Tec Games.

Cable techs compete for industry bragging rights

TCI sweeps Games

Teams from TCI, Paragon-Time Warner, MultiMedia, Hardline, Technology Services and others met to compete in the Sixth National Cable-Tec Games. When the dust cleared, TCI took home trophies for first, second and third places, in addition to bronze, silver and gold medals.

Each year, a larger audience comes to cheer on competitors in a variety of events. Following the award ceremony where competitors snapped up their medals and trophies, a special "celebrity" Jeopardy panel was selected to answer "answers in the form of a question." *Communications Technology* Editor Rex Porter, who was on that panel, commented, "I found out how easy it is to answer from the audience and how difficult it is when you're holding the buzzer!"

Splicing event winners went as follows: Bronze— Woody Cash, TCI-San Jose, 100 points/3:08 time; Silver —John "Chris" Price, Multimedia, 100 points/3:07 time; Gold— Doug Hamilton, Hardline Communications, 100 points/3:04 time.

Metering event winners included: Bronze—Doug Hamilton, 100/3:40 time; Silver—David Bumpurr, Multimedia, 100/2:26 time; Gold—Woody Cash, 100/2:37 time.

MTDR winners were: Bronze—David Bumpurr, 100/2:44 time; Silver—Bob Cherry, Paragon/TW, 100/2:41 time; Gold—Woody Cash, 100/2:37 time.

Cable Jeopardy winners were: Bronze—Doug Hamilton, 520 points; Silver—Woody Cash, 660 points; Gold—Tom Saylor, Technology Services, 1,060 points. (This is a record score.)

So who took home the overall bragging rights? Overall Bronze went to Paul Eisbrenner, TCI of Fort Collins, CO. The Silver was snagged by Frank Gadberry, TCI of Clarkston, MI. Woody Cash of TCI of San Jose, CA, took home the Gold.

Ham reception

If you're a ham employed in the cable industry and you didn't make it to the Expo's Amateur Radio Operators' Reception, you missed some tasty refreshments provided by Scientific-Atlanta and the chance at almost 60 doors prizes.

A wide range of industry vendors contributed valuable gift certificates, antennas, transceivers, multimeters, software and more. Familiar SCTE member, Society face and avid ham Ron Hranac raffled off the goodies. The lucky Dan Whelan (WB2WHD) won the grand prize: a Kenwood TS570S HF/6m rig sponsored by S-A, while first prize (a 100 MHz handheld digital scope contributed by Tektronix) went to Dennis Musser (N0UXA).

"SCTE-LIST" party

Bay Networks and General Instrument provided refreshments at the "SCTE LIST" gathering where group members matched e-mail addresses to faces.

Fun at Expo evening

Loyal Order of the 704

If you don't know what the 704 stands for, you're probably not ready to join this "secret society." The LO704 private reception was open only to cable pioneers with 20+ years in the industry.

Chapter board lounge

This lounge offered SCTE chapter officers and board members a place to meet at Expo. It was hosted by new SCTE Manager of Chapter Development Stephen Townsend.

Expo Evening

The biggest party is usually Expo Evening, and this year's Rainforest Cafe venue proved to be the place to be seen at the show. Located in the Disney Village Marketplace, attendees were surrounded by a recreated rainforest comprised of both live and animated wildlife and special effects. Lush vegetation, live tropical birds, simulated thunder and lightning, rain ions added to Expo Eve's ambiance.

Sponsors for the party included ANTEC, CommScope, General Instrument, Philips Broadband and Scientific-Atlanta.

And more ...

Other social events at Expo included a Christians in Cable Breakfast as well as the Sixth Annual SCTE Golf Tournament, which has come to traditionally mark the end of Expo.

Mark your calendars for June 10-13, 1998, for Cable-Tec Expo in the Mile High City, the Cable Capital—Denver. See you there.—*LH, RP* CT

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Space Savers

Three Ways to Increase Bandwidth without Rebuilding

By Jerry K. Thorne

In the past 26 years I have seen cable go from 12-channel single-ended 220 MHz systems to the 550/750 MHz power-doubled and feedforward systems of today, through the rebuild or upgrade process. Each jump in bandwidth was based on the condition of cable and type of equipment in use. This article identifies three methods to upgrade (not rebuild) CATV distribution to the next higher bandwidth needed for more channels or Internet services—assuming your original trunk amplifier housings will remain in their current locations and the cable is in good physical condition.

Equalizer upgrades

The least expensive upgrade is to exchange equalizers (EQs) and utilize any extra bandwidth of the existing modules when possible. One major city now has 630 MHz EQs in their 550 MHz modules, and I am told the bandwidth achieved was just over 600 MHz. Again, not all types of 550 MHz equipment will have this kind of success. This scenario was attempted in Canada with a different brand of cable TV amplifier and was not pursued after initial tests.

More than one system has re-equalized trunk locations to 500 MHz and squeaked 500 MHz plus from negative voltage 450 MHz trunk modules. A lot of systems have tweaked their variable EQs to 475 or 480 MHz with these same modules. In two systems that have reached the 500 MHz plateau, the variable EQs were replaced with 500 MHz fixed EQs.

The biggest advantage of fixed EQ besides bandwidth is that fixed EQs have lower loss than variable EQs, plus the carrier-to-noise (C/N) performance may be improved. Insertion losses for variables range from 1.8 to 2.6 dB at 450 MHz depending on the dB range of the EQ. Given the 1 dB insertion loss at the rated frequency of fixed EQs and their linear (cable) response nature, fixed EQs sound like a win-win proposition. Even the cost is lower on fixed EQs.

The 450 MHz modules mentioned previously, modified for 500 MHz, required new interstage response networks and removal or replacement of a few other components to attain the 500 MHz goal. In this particular design, the output hybrid was already a 550 MHz power-doubled hybrid, while the input push-pull hybrid was rated only to 450 MHz. Not all 450 MHz hybrids are created equal. This area of operation is beyond the published specifications. If the input hybrid were changed from an 18 dB unit to a hybrid with 22 dB of gain, the extra bandwidth to 500 MHz may not be available. Bandwidths of hybrids have varied over the years. The date code on the hybrid and some bench tests will provide the bandwidth answers for particular modules.

> **BOTTOM LINE**
>
> **Bandwidth: The Final Frontier**
>
> There's more than one way to skin a cat. The answer to increased bandwidth is not always rebuilding. Sometimes simple upgrades can work just as well. There are three ways to go, without having to move your original trunk amp housings (and assuming your cable is in good shape):
>
> - **Upgrade your equalizers.** This approach can win you 30 to 50 MHz more bandwidth without replacing the RF amplifier hybrid integrated circuits (hybrids). Because this option is module- and hybrid-specific, you'll need to do bench sweep tests for verification.
> - **Upgrade your modules.** New parts and hybrid changes or new circuit board kits installed in existing modules may earn you more space. To be doubly sure, consider modifying the RF connector chassis, too.
> - **Replace your modules.** Sometimes upgrading may not be enough. Although you may need to modify or replace your connector chassis as well, new modules can increase your capacity from 300/330 to 450 MHz, or from 450 MHz to 550 MHz.

In many 300 MHz hybrid amps it is possible to change to 330 MHz or 350 MHz equalizers and reach the higher bandwidth. Some popular line extenders rated to 300 MHz will reach 330 MHz or 350 MHz by setting the slope control to "flat" and installing the new EQ as the only tilt circuit. The resonant frequency of the slope control creates the roll-off, which limits the line extender to 300 MHz when the slope control is adjusted away from the "flat" setting.

Module upgrades

Many systems have been upgraded from 300 MHz to 450 MHz by upgrading existing modules with hybrid changes and circuit modifications. Several third party amplifier vendors offer new 450 MHz and 550 MHz circuit boards and hybrids to fit original amplifier modules.

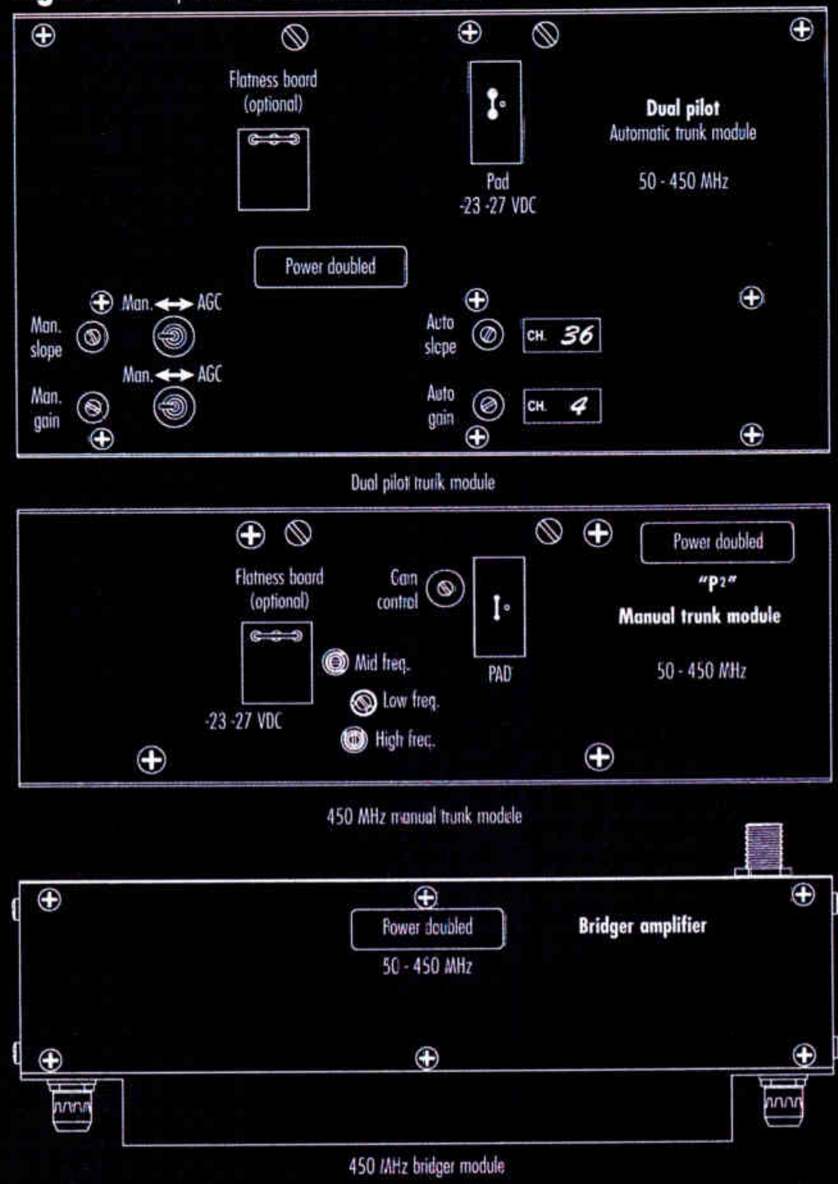
Kits are available for Jerrold SJ-301 and SJ-400 and 300 MHz Pathmaker modules. The SJ and Pathmaker modules use the same type of negative voltage hybrids which allow up to 450 MHz push-pull or power-doubled output conversions. Push-pull and power-doubled output kits are also available for Magnavox 5-series trunk and line extender modules to 550 MHz, as well as Scientific-Atlanta two-way distribution amplifier modules to 550 MHz with a 5 MHz-40 MHz return path. The hybrids used in these kits use positive voltage (+24 volts) and are not bandwidth restricted by hybrid availability as in the Jerrold and Pathmaker upgrades.

Module replacements

The typical 20 dB at 300 MHz systems can be upgraded with similar drop-in modules to operate at 25 dB spacing to 450 MHz. This is probably the most common system upgrade to have occurred in the past 15 years. Several of these systems have upgraded to 450 MHz every year over the past few years.

The complete module change-out is quick. The lower cost idea may be to rework existing modules as described previously or locate similar higher bandwidth modules on the used market (buyer beware). There may still be 450 MHz modules available in various equipment brands for an upgrade to 450 MHz. Some systems have found the necessary modules to make 450 MHz to 550 MHz upgrades. Remember, for P3-750 cable, 22 dB at 450 MHz is approximately 24.5 dB spacing at 550 MHz, while 25 dB at 450 MHz is about 27.8 dB at 550 MHz. Be certain the modules acquired or upgraded will have reserve gain for proper automatic gain control (AGC) action.

Figure 1: Replacement modules for 450 MHz



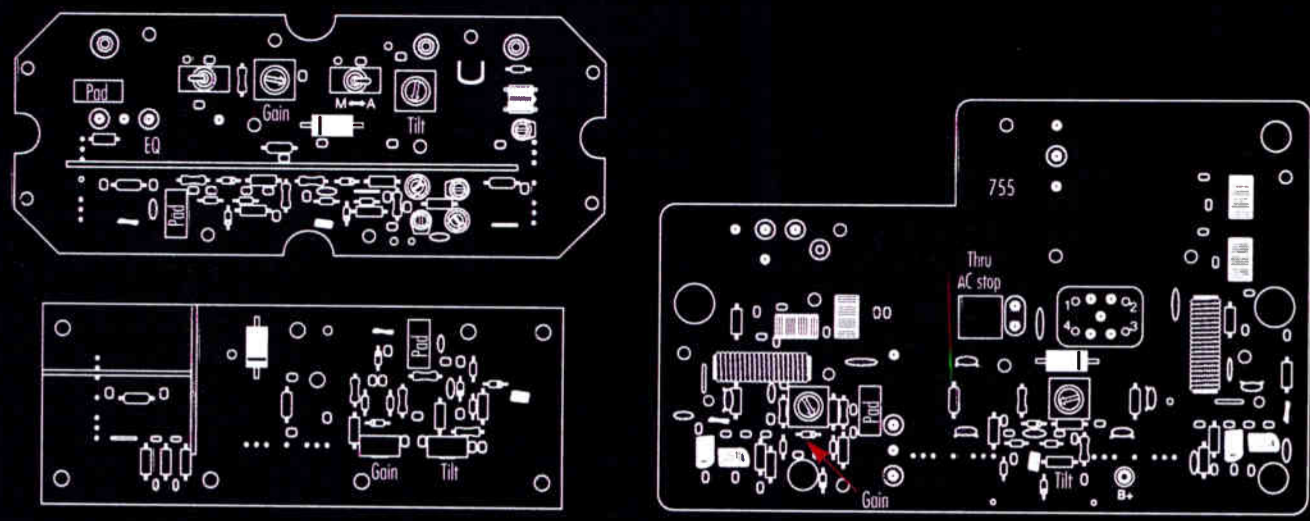
Other considerations

Anyone still out there with 220 MHz? If so, there was a round of upgrades missed in the mid-seventies. The first 300 MHz hybrids and Jerrold's SJ "quad amplifiers" replaced the transistors in the earliest 220, 260 and 270 MHz push-pull systems. During this time, the improved composite triple beat (CTB) and cross modulation specifications of these new devices allowed 20 dB spaced plants to reach 300 MHz at 25 dB spacing.

There are still many 300 MHz systems operating in rural America. Systems in this group with some amount of .412-inch and .500-inch cable still in service face big challenges. The jump from 300 to 350 MHz in P1-500 cable is from 25 dB to just over 27 dB. With an EQ swap from 300 to 330 or 350 MHz, the reserve trunk module gain for AGC action would be used up overcoming the additional cable loss.

Some systems with the older small cable sizes may have used high-gain feedforward amplifiers to get beyond 300 MHz,

Figure 2: 550 MHz Upgrade kits for Magnavox 5-series trunk, bridger and line extender



but the current drain of these or power-doubled modules makes the higher loop resistance of the smaller cables very undesirable due to power losses.

For these systems, the next upgrade could require cable de-lashing or re-lashing if the old housings with new modules are to remain in their current locations. This choice might only make sense if a system does its own cable construction and repairs. A friendly, inexpensive cable contractor may also make this option viable. At this point many systems, like this one, will choose a full rebuild (but not always).

With loss and gain addressed, consider the CTB requirement and the use of power-doubled hybrids with its higher current demand. The present RF operating levels for trunk, bridger and line extenders must be addressed. With 300 MHz bridgers operating at 47 dBmV on Ch. 36 and 40 dBmV on Ch. 2, I hope tap levels are high. If not, plan on the bridger output reaching 49/40 or 49/39 dBmV and hybrids changing to power-doubled in the bridger modules to accommodate 60 analog channels. There is a good chance power-doubled line extenders could be required.

With trunk operating levels at 32 dBmV flat, expect to go to 34 dBmV at 450 MHz and 30 dBmV at Ch. 2 (34/30) or 35/30 trunk levels to cover some of the extra loss from 300 MHz to 450 MHz. The noise figure on the newer hybrid amplifiers is better than earlier vintage modules. The lower loss of fixed EQs and the lower noise figure will allow lower input levels to aid in overcoming the cable loss differential at the higher frequency. The 4 or 5 dB trunk slope will help hold down CTB. If the amplifier cascade is greater than 15, power-doubled trunk becomes a very real possibility to meet CTB requirements.

> "The least expensive upgrade is to exchange equalizers (EQs) and utilize any extra bandwidth of the existing modules when possible."

Many systems have a few over-spaced trunk spans in the system plant. For those few locations, rather than use a trunk module with higher gain, and therefore higher output levels, it would be better on CTB and C/N to use a low-gain intermediate amplifier about two-thirds of the way through the span. This low-gain amplifier operating at +25 dBmV flat output will have CTB ratings in the -90 to -95 dBc range. Setup is easy with fixed pad and equalization in this amplifier. The same module also can be used in feeder lines operating around 10 dB below normal line extenders. Over the last three years, a major MSO used these methods in mid-sized cities for 300 MHz to 450 MHz system upgrades. Minimum continuous wave (CW) measurements for CTB of 52 dB and minimum C/N of 46 dB for 60 analog channels were achieved.

Trunk cascades of 35 to 40 amplifiers are common in older 36-channel systems. With 60 channels and all power-doubled modules and line extenders, the cascade from the headend can still reach 26 trunks and two line extenders in the "typical" system upgrade. With a typical fiber node, up to 15 power-doubled trunks and LEs usually can meet the CTB and C/N minimums. In a 550 MHz system with 77 analog channels, the cascade numbers may allow 10 to 12 trunks from the headend and only six trunks and two line extenders from a node, depending on RF signal levels. More conservative RF levels will allow a slightly longer cascade from each node. Feedforward technology could offer up to 15 amplifiers from the node. All these amplifier scenarios consider forward signal parameters only. Reverse path C/N considerations may reduce node size if two-way is part of the upgrade plan.

One more level of technology has presented itself for power-doubled

Figure 3: 550 MHz replacement modules, connector chassis

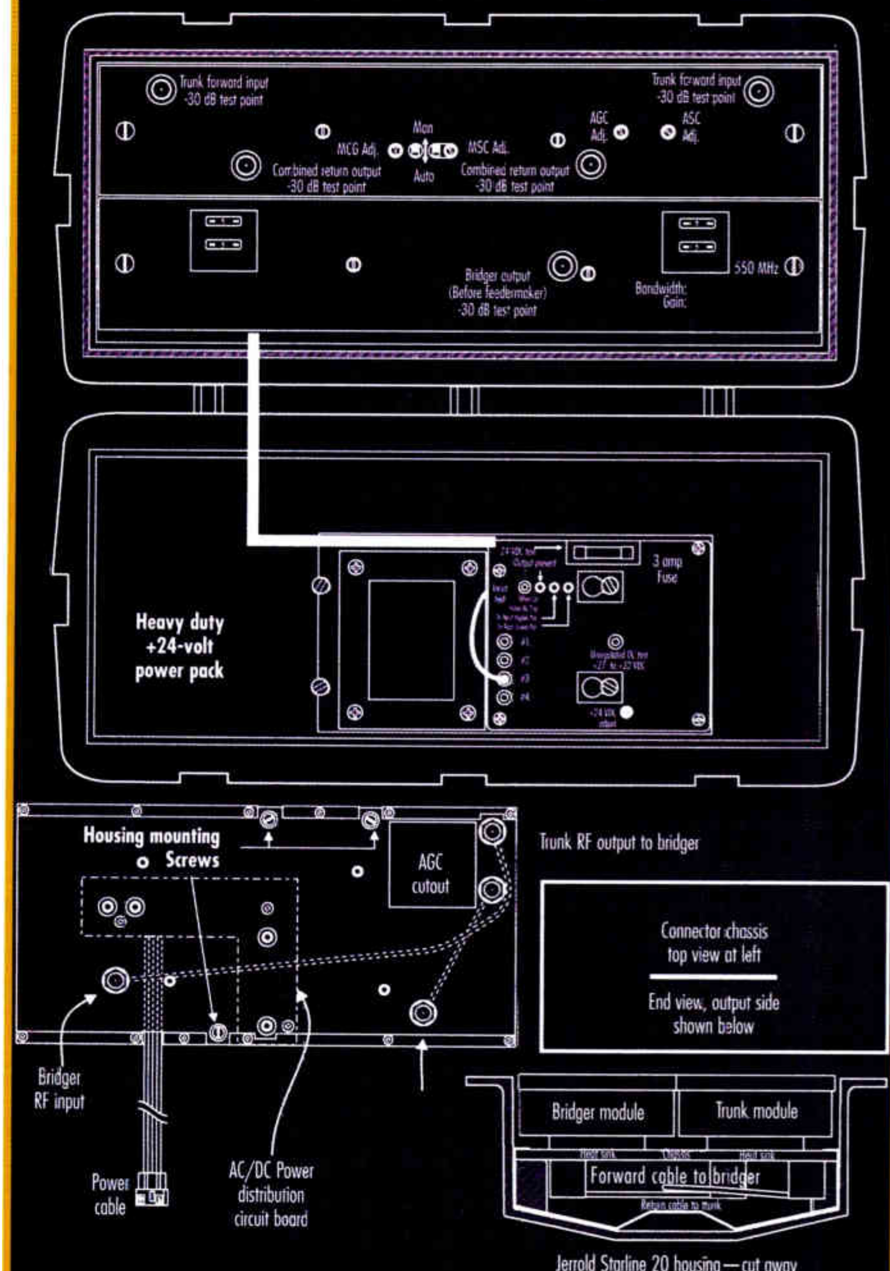
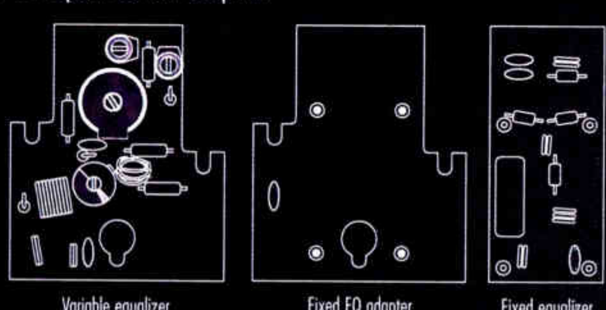


Figure 4: Equalizers and adapters



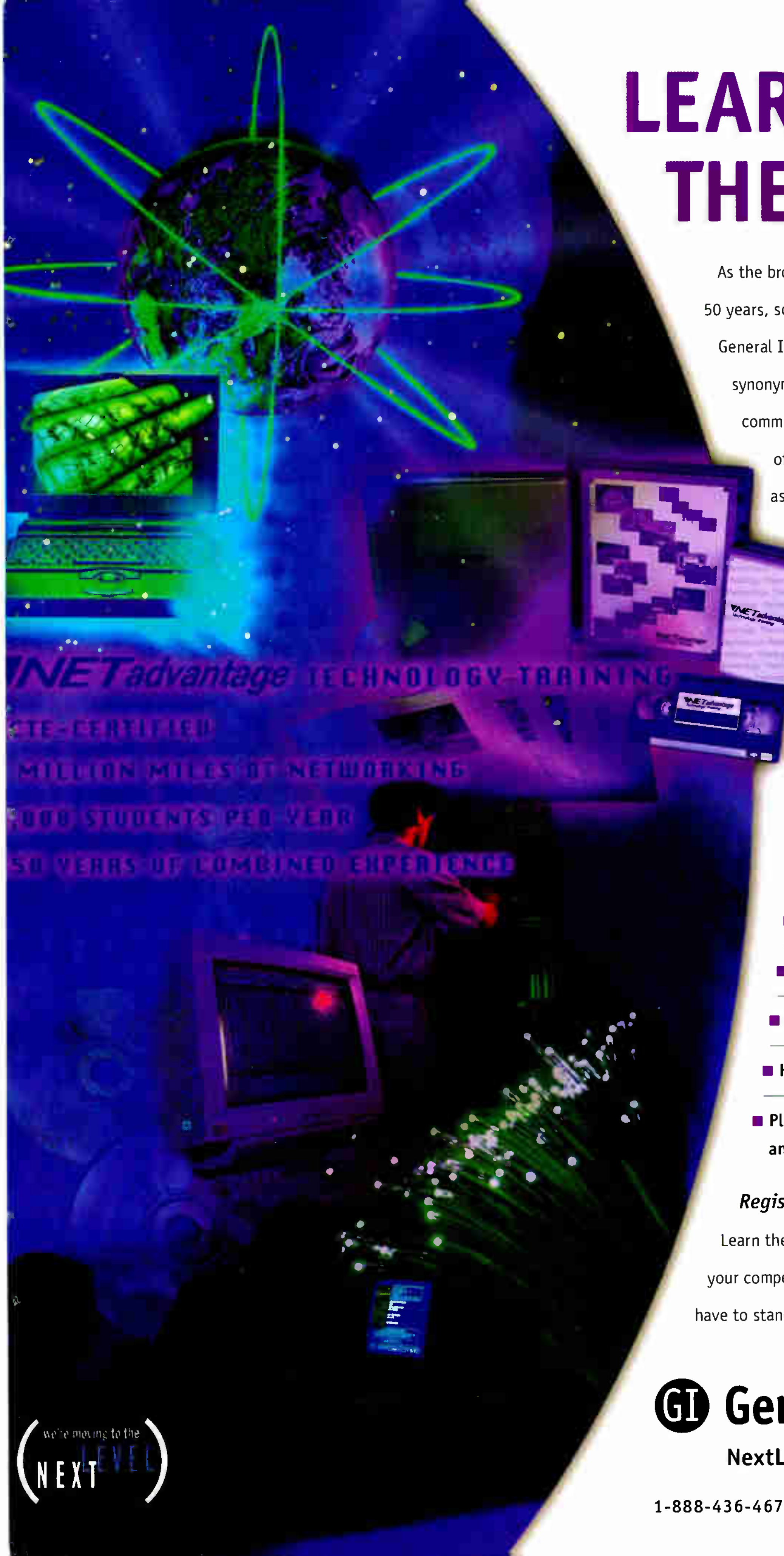
systems that cannot afford feedforward technology. In a 450 to 550 MHz upgrade, an option exists that can work in some cases for a modest cost increase. One hybrid vendor has a power-doubler hybrid using Darlington transistor configurations on the substrate. This type of hybrid can offer 6 dB improvement of CTB only for the frequency range from 450 to 550 MHz. It does not improve the performance at all over a standard 550 MHz hybrid with only 60 analog channels. However, the lower CTB in the top 100 MHz can be of benefit with all 77 channels analog.

Depending on original operating levels, spacing and cable conditions (age, damage, etc.), 20 dB 330 MHz systems previously upgraded to 450 MHz might still be upgraded to 550 MHz with fiber nodes to reduce the trunk cascades. In one such system, Darlington power-doubled hybrids made the difference. Field trials were completed at a fiber node with 550 MHz drop-in modules using a six-amp cascade and two line extenders (LEs). With 77 channels loaded, the C/N of 46 dB and CTB of 52 dB were achieved with feeder levels at 49/38 at the bridger and both LEs.

The Darlington hybrid was used only in the bridger for this test. When management raised the performance bar to 48 dB C/N and 54 dB CTB, the line extenders would require Darlingtons to reach the CTB requirement, while raising trunk levels met the higher C/N level. The trunk modules used standard 550 MHz power-doubled output hybrids.

All of the carrier operating levels, distortion levels and power-doubled scenarios can be modeled before making an upgrade strategy decision. I saw my first cable TV system distortion analysis spread sheet in 1990. The spread sheet has been translated into popular spread sheet program formats and is used by many corporate engineers and vendor applications engineers. It is the first step in making the upgrade vs. rebuild decision. If the performance is not there, low cost does not matter. CT

Jerry Thorne has been in the cable industry since 1971. He is currently an applications engineer with Quality RF Services.



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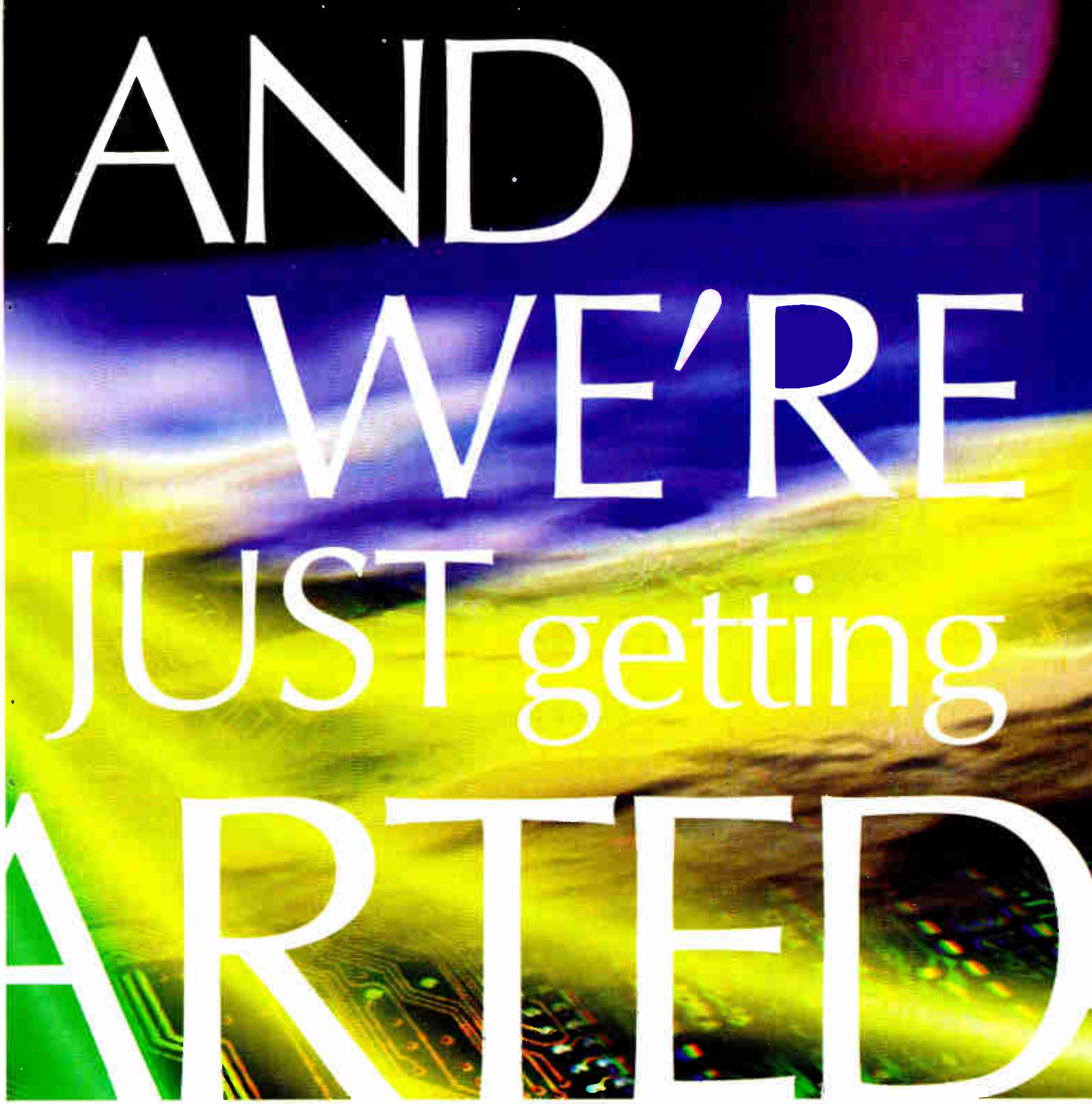
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Tips on Upgrading for Data and Digital

By Robb Balsdon

The question of whether to upgrade or rebuild existing cable plant is one of the key decisions that currently faces most cable operators. This decision is dependent on a number of factors: 1) quality of the cable, 2) portion of the plant that is overhead or buried, 3) bandwidth of the existing equipment, actives and passives, and 4) services that need to be supported on the plant. What follows is Rogers Cablesystems' plant upgrade strategy.

The quality of the cable is more dependent on the construction methods that were used to build the plant than the age of the cable. If more of the plant is buried, the addition of actives to compensate for high-loss cable can be more cost-effective that a wide-scale replacement of cable. If the existing equipment is less than 450 MHz, and the operator desires more bandwidth to support high-speed data service (HSDS) and digital television (DTV), it is likely the equipment must be replaced. Usually, older amplifiers do not have two-way capability or the return amplification is discrete transistors and the dynamic range is not sufficient to support new services with the additional loading of interfering signals. If telephony services must be offered, and the plant is older, a fiber-to-the-feeder (FTF) architecture is a must. If the plan is to offer HSDS and DTV only, then conventional cable plant can be upgraded by:

1) Reducing trunk cascades through the addition of fiber nodes,
2) Replacing or upgrading amplifiers for extended bandwidth and two-way,
3) Installing standby power supplies to meet HSDS availability requirements,
4) Installing status monitoring at the trunk amplifier and node level for network visibility and reverse path segment switching, and
5) Installing reverse path segment switching to isolate and troubleshoot reverse plant interference.

Rogers Cablesystems considered the requirement to support 60 channels of analog service and 100 MHz of digital services (128 DTV signals at 8:1 compression with 256-QAM (quadrature amplitude modulation), more with statistical multiplexing). Financially,

BOTTOM LINE

Upgrade Tactics

When Rogers Engineering set to upgrade its plant for more forward bandwidth and return capability, the mission was to increase plant performance to support high-speed data and digital TV. **How did they do it?** Instead of choosing to rebuild its system, the Rogers team planned a less expensive upgrade that entailed constructing a 600 MHz two-way plant with 10 trunk amps and three line extender cascaded with reverse bridger switching.

Tool check

Doing your own system upgrade? Then remember that systematic system balancing and network hardening requires the following tools: bidirectional sweep equipment (with signal level meter built-in), signal leakage detector and TDR (time domain reflectometer).

Don't blame the sub

Rogers found that, in its system, the majority of the problems in the reverse path originated from the distribution/feeder network and not from the subscriber's home. Some causes of these noise impairments were: corroded connectors, splices, tap plates, broken sheath, poor grounding and poor termination.

the objective was to conserve capital and ensure the upgrade maximized the reuse of existing assets to reduce total upgrade costs.

Similar to many cable operators, Rogers implemented a plant upgrade rather than a full rebuild because of the high cost of placing new buried cable in system rebuilds. The decision was to construct 600 MHz two-way plant with a maximum of 10 trunk amplifiers and three line extender cascades with reverse bridger switching to isolate the reverse path in each 50- to 100-home feeder area.

Only certain models and vintage of amplifiers were selected to be upgraded to 600 MHz. In many cases, the passives installed in the last 550 MHz upgrade were adequate at 600 MHz. There was a wide variation in the quality and bandwidth of the cable plant in

Performance matrix example

	Video	HSDS	DTV
Service definition	Analog channel	64-QAM D/S 16-QAM U/S	256-QAM
Architecture *recommendations*			
Passband (downstream)	550/450 MHz	550/600 MHz	600 MHz Passband
Passband (upstream)	N/A	33/42 MHz	30/33/42 MHz
Segmentation (downstream)	Note 1	Note 1	Note 1
Segmentation (upstream)	Note 1	Note 1	Note 1
Cascade limit: trunk/distribution	Note 1	Note 1	Note 1
Status monitoring			
Fiber hub	No	Yes	Yes
Trunk/bridger	No	Yes	Yes
Downstream performance *requirements*			
C/N @ 4.2 MHz BW	≥43 dB	≥43 dB	≥45 dB
CSO/CTB	-55/-51 dBc	-55 /-51 dBc	-55/-51 dBc
Frequency response and signal levels	Note 1	Note 1	Note 1
Upstream performance *requirements*			
System thermal noise @ 100 kHz BW	N/A	≤-39 dBmV	≤-36 dBmV
Spurious	N/A	≤-40 dBc	≤-40 dBc
Frequency response and signal levels	Note 1	Note 1	Note 1
Dynamic (Slow-varying)			
Interference @ 90th percentile			
Common path noise	N/A	≤-23 dBmV	≤-23 dBmV
Ingress @ 99th percentile	N/A	≤15 dBmV	≤20 dBmV
Upstream total power @ 99% confidence	N/A	≤30 dBmV	≤30 dBmV
Dynamic (Fast-Varying)	Note 2	Note 2	Note 2
Bit error rate (BER)	N/A	≤1E-6	≤5E-5
% errored seconds	N/A	≤5.0%	≤7.5%
% severely errored seconds	N/A	≤0.50%	≤0.50%
% G.821 channel availability	N/A	≥99.50%	≥99.00%
Signal losses (SIG, based on T-1 carrier)	N/A	≤3	≤5
Network availability	99.4%	99.4%	99.4%

Note 1: The required frequency response and signal levels are based on cable operators design and operational guidelines.
Note 2: Based on bit error rate (BER) measurements.

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cable systems originally constructed by Rogers or purchased by Rogers. In several cases, the quality of the plant was such that a high percentage of cable replacement was required and an FTF design was used because of the low (less than 10%) incremental cost over a comparable 600 MHz rebuild.

Plant performance

Performance objectives can be divided into static—or relatively static such as composite triple beat (CTB), composite second order (CSO), frequency response and signal level—and dynamic parameters. Dynamic parameters can be separated into slow-varying (ingress, common path noise, system thermal noise) and fast-varying (impulse noise). The static and some slow-varying dynamic parameters were important for analog video and DTV, but with HSDS other slow varying dynamic parameters are important. The table on page 78 provides an example of some of the parameters that an operator should consider when delivering analog video, HSDS and DTV services.

Performance objectives

The main requirements in meeting the desired performance objectives are to follow industry established construction practices in a methodical and thorough manner, and to attain accurate system balancing (gain and frequency response) for both downstream and upstream networks.

In order to accomplish systematic system balancing and network hardening, the essential tools required are bidirectional sweep equipment (with signal level meter built-in), signal leakage detector and TDR (time domain reflectometer). HSDS requires bi-directional sweeping for activation and maintenance.

Systems such as the Rogers' ingress/impulse noise test platform (INTP) and similar systems offered by cable TV vendors are a necessity. The INTP is essentially a spectrum analyzer, matrix switch and a control PC. The PC automates the switching of the reverse path at the trunk/bridger and the collection and analysis of the ingress, impulse and thermal noise. The return plant can be separated into small reverse path segments by using: trunk/bridger switching (off-on/6 dB) or outboard RF switches and RF switches in optical nodes. The smaller the reverse path segments, the more efficient the reverse plant cleanup and hardening process, and the more cost-effective the maintenance of the plant.

The upstream network cleanup effort at Rogers revealed that a majority of the problems in the reverse path originated from the distribution/feeder network. The primary causes of these noise impairments were: corroded connectors, splices, tap plates, broken sheath, poor grounding and poor termination. The opinion that the majority of the noise problems is generated from the home has not been supported by the Rogers' field trials and the data collected.

> "The opinion that the majority of the noise problems is generated from the home has not been supported by the Rogers' field trials."

The key requirements for obtaining and maintaining two-way plant are:

- An automated ingress/impulse monitoring system.
- The ability to divide the plant into small reverse plant segments.
- Network management and change control systems.
- Greater coordination and communication between office and field staff.

Plant construction

The phased approach to plant upgrades used by Rogers involves dividing a system into phases or hub areas that are fed by a single fiber hub. This use of fiber hub areas allows a particular area to be treated independently from the other hub areas to allow:

- Bill of material (BOM) databases for costing.
- Project management of each hub area as a sub-project.
- Each hub to be constructed as a sub-project.
- Each hub area to be tested and certified as meeting the performance objectives.
- Troubleshooting and cleanup of two-way plant on an area-by-area basis.

Adequate time must be scheduled to carry out the rebuild, balancing and repairing of physical defects. The additional time needed to conduct bi-directional balancing will not be as onerous as revisiting the network to activate the upstream at a later time.

Technical audit processes

Once the hub area is constructed it is important to carry out a performance certification test (or technical audit) to provide quality assurance (QA) to the group that will have the responsibility to operate and maintain the plant. The purpose of an audit is to ensure that the services (HSDS and DTV) can be supported on the plant.

This is accomplished by taking a number of samples from important locations and from different components that make up the network. Within each sample for each component, appropriate parameters need to be measured and checked against acceptable audit specifications to ensure new services can be supported.

The key is to take sufficient samples in a short space of time from all major components to assess the hub area to a level of acceptance that all stakeholders have agreed upon. As an example, sample-size determination can be based on use of Military Standard (MIL-STD-105E). The acceptable quality levels (AQLs) can be adjusted for different components in the network based on the proper operation of each component. The accept/reject criteria can be based on MIL-STD-105E for the appropriate sample size and AQL.

The planning, design, construction and operation of plant for HSDS and DTV is a team effort. Many thanks to my colleagues who developed these procedures that I have summarized

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Robb Balsdon, P. Eng., M.B.A., is vice president, engineering services for Rogers Engineering. He can be reached at (416) 442-2814.

Prepare Your Entire Network for Data Services

By John Canning

Recent developments in cable modems—especially the move toward industry standards and the introduction of more economical cable modems that use telephone lines for the return path—are breaking down barriers to entering the data services market.

This market is a new, potentially lucrative business for cable operators. Aside from the cost of cable modems, the data-services-over-cable business will require investment of time and money by operators to prepare for it and to set up the appropriate infrastructure processes. This article focuses on how the delivery of data services differs from the delivery of video services.

Before deploying a cable modem system, a cable operator must decide what resources and procedures will be required to provide data services. Some of the equipment and job functions associated with data services are quite different from those necessary for video services.

For example, a complete cable modem system requires dedicated cable modem and data hardware, new installation procedures, and software both at the headend and the customer premises. In addition, customer service personnel will be fielding much more complicated questions. These are not insurmountable obstacles—they are simply part of the challenges that any enterprise should recognize and prepare for when undertaking a new business.

Deploying a cable modem system will impact three aspects of a cable operator's system: the plant, the headend and the customer premises.

The plant

Cable modem systems are available in two varieties: telephone-return and two-way RF. Telco-return systems receive data over the coaxial cable and send information back over a telephone line. Two-way systems send and receive over the coaxial cable.

Only a fraction of today's networks are two-way enabled, but that's not a major deterrent to entering the data services market. With telco-return cable modems, there's little compromise in performance because, for most users, the critical need for bandwidth is in the downstream channel.

Telco-return systems use existing broadband network, including the same coaxial cable, taps and amplifiers. Thus, the cable operator has a feasible way to enter the market, and its customers can enjoy much faster access to on-line services. The operator can later migrate to a two-way RF system, if desired.

There are various kinds of digital modulation schemes available for data transmission. The more popular of these techniques are:

- Quadrature partial response (QPR), delivering 6 Mbps of data in a 3 MHz carrier.
- Quadrature phase-shift keying (QPSK), capable of 10 Mbps in a 6 MHz carrier.
- 64-QAM (quadrature amplitude modulation), supporting 27 Mbps in a 6 MHz carrier.

The digital signals can co-exist with the analog signals on the same plant. (Of course, it requires some care to prevent interference between the two.) When looking at the spectrum, digital modulation techniques have different characteristics from traditional analog video. Choosing the appropriate modulation scheme involves a trade-off between performance and bandwidth that ultimately determines the total number of channels a cable operator can carry on the network.

QPR technology, with its characteristic of occupying 3 MHz of bandwidth, can exist in regions that 6 MHz channels cannot occupy. This may allow the cable operator to add new services without affecting the current channel lineup.

The headend

The cable modem system headend equipment installs in the existing headend, but does not need to be integrated with other headend equipment, with the exception of combining outputs. A telco-return cable modem system's minimum configuration typically requires a router, a modem pool, a control system, a

downstream data formatter and a modulator. (This equipment list does not address issues such as local content, Internet connectivity, phone connections, and other provider-related services.)

Let's take a look at each part of the minimum configuration:

- A router is a physical interface between the external and internal networks, and also routes data among the various components of the cable modem system.

> "Only a fraction of today's networks are two-way enabled, but that's not a major deterrent to entering the data services market."

- A downstream data formatter takes Internet protocol (IP) over Ethernet traffic and converts it into the proper format for downstream delivery.
- A modulator receives a data stream and modulates it to the desired RF frequency, using a given modulation technique.
- A modem pool combines phone modems with a terminal server, to provide the termination for the telco-return portion of the cable modem.
- A control system (hardware/software combination) oversees the cable modem system. It is responsible for fault, configuration, and customer management.

The customer premises

Installation of cable modem equipment at the customer premises starts with a traditional cable install, but requires some additional steps. Here are some of the necessary steps:

1) As with most cable installations, the installer may tap off an existing drop, or install a new drop. A new drop must be near the customer's PC, not the TV set.
2) Once the drop is in place, the installer should check the cable for signal quality. Although the installer can still use a spectrum analyzer, the signals will look quite different. This is because cable modems use one of the previously mentioned modulation techniques.
3) The installer should make certain that the customer's PC and operating system are compatible with the cable modem.
4) The external cable modem, with an incorporated analog telephone return, connects to the customer's PC via an Ethernet interface. This requires that the customer's computer contain a 10BaseT (10 Mbps) Ethernet network interface card (NIC). This card is readily available, and comes with its own installation software.
5) In addition to the Ethernet card and software, the PC must be able to communicate to the cable modem with Internet protocols (IP). This is accomplished by configuring the correct TCP/IP (transmission control protocol/Internet protocol) stack. This stack is found as either part of the operating system, or as third-party software that must be loaded on the PC.
6) The next step is to attach the cable modem to the PC. Of course, for a telco-return cable modem, a telephone line must be present in addition to the cable. Before actually attaching the modem to the PC, the installer must properly configure the customer's PC.
7) Finally, the installer loads the vendor-specific modem dialer application. Once installed, the customer supplies the telephone access number, user name, and password. Then the cable modem is ready to use.

Start preparing now!

Deployment of a cable modem system requires advance planning and preparation. Installers should start conditioning the plant now for carrying data services. On every service call, the installer should seek to eliminate conditions, such as crimps or unterminated circuits, that may cause ingress and degrade performance.

Should current installers be trained to install cable modems? The new skills required are substantially different from those needed for ordinary CATV installations. As an alternative to training current installers in the intricacies of computers, operators may want to consider interim or permanent "outsourcing" of cable modem installation to computer-savvy local firms.

Other operational aspects of the data services business also can be outsourced. One of the major differences between data and video services is the nature of customer service calls.

With data services, service representatives will receive calls involving everything from data communications to software installation. Operators need to either resolve these questions or direct callers to someone who can. Internet service providers have "help desk" operations that can adeptly handle such calls.

Other candidates for outsourcing include billing, service provisioning and Internet access. In short, if the unfamiliarity of a new task introduces a risk of unsatisfactory performance, outsourcing may be an excellent option for the cable operator.

Equipment vendors can provide valuable assistance, too. The best potential vendors are manufacturers that not only supply equipment for the data services business, but also have in-depth knowledge of broadband networks.

The obstacles to success in the data services business are no longer high costs, lack of standards, lack of in-house skills, and unproved technology. All of these can be overcome by operators who see the opportunities, understand their options, plan for the new processes necessary for a new business, and act decisively to capture market share quickly. CT

John Canning is applications engineer at the Broadband Data Networks Division of Scientific-Atlanta.

BOTTOM LINE

Before You Buy Those Cable Modems...

Moves toward industry standards and the introduction of economical cable modems that use telephone lines for the return path are breaking down barriers to entering the data services market.

But, of course, it isn't just about modems. Data simply isn't the same as video, and equipment and job functions in the headend, plant and customer premises are different.

Among the many network considerations you must eyeball are:

- Digital modulation schemes (QPR? QPSK? 64-QAM?) Choosing the appropriate one involves a trade-off between performance and bandwidth.
- Return path options (telco or two-way RF?) If you are among the many worried about problems in your cable upstream path, perhaps cutting your data teeth with telephony return modems is a good idea. Also keep in mind that a telco-return cable modem system's minimum configuration typically requires a router, a modem pool, a control system, a downstream data formatter and a modulator.
- Installation at the home. Installation of cable modem equipment at the customer premises starts with a traditional cable install, but requires some additional steps. Will you train your installers in this new skill or outsource this job for the time being?

How to Upgrade Power Components

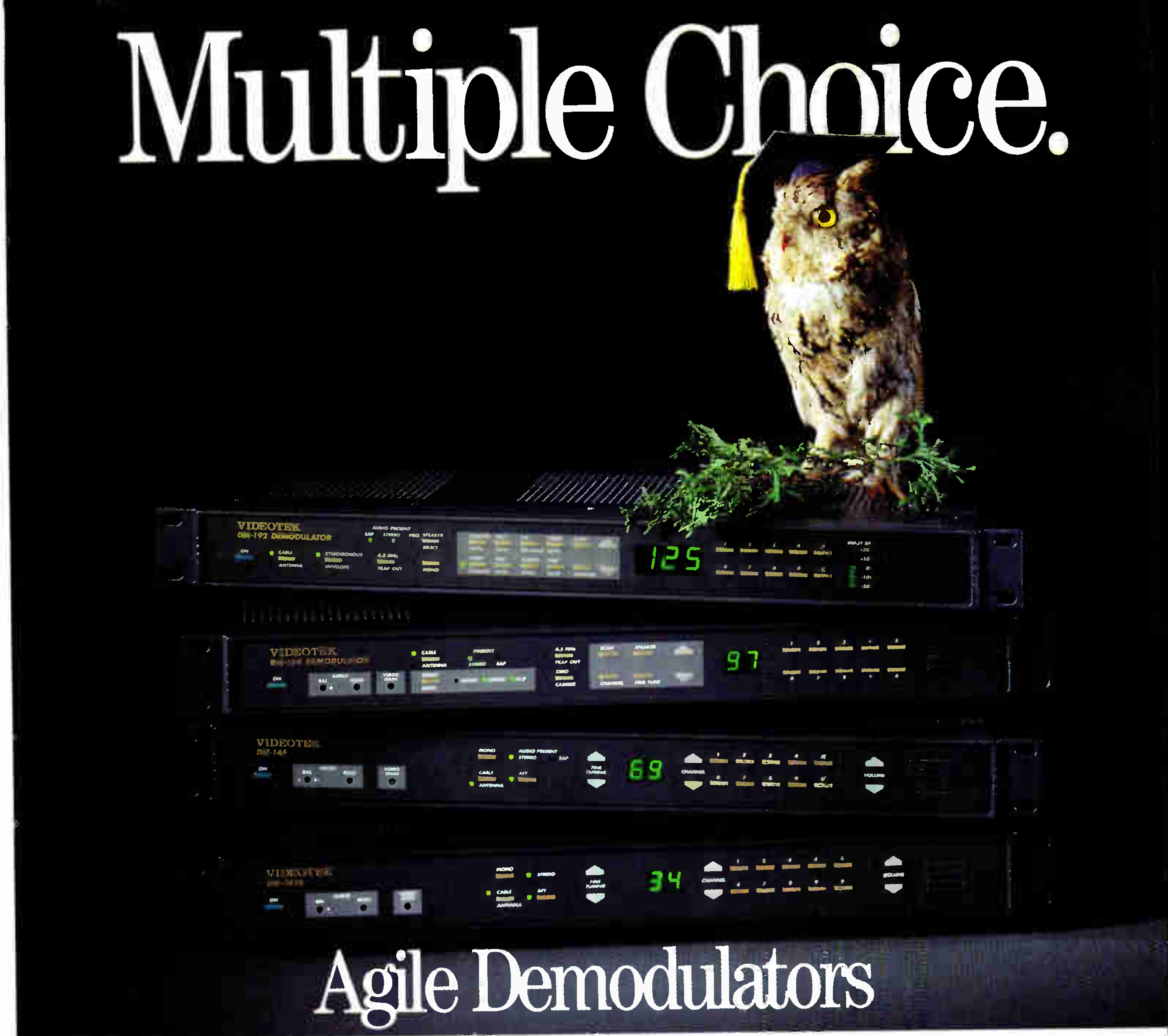
By Eric Wentz

(For further information on this topic, please see Eric Wentz's article from the April 1997 issue of "Communication Technology," page 65.)

System reliability continues to be a driving force in broadband upgrade planning. Industry changes, as well as heightened customer expectations, have had a significant impact on service providers' upgrade plans—in some instances greatly accelerating, and in other cases completely changing, the direction of those plans.

Determining the direction and extent of change associated with upgrade plans requires knowing the capabilities and limitations of the current network. The performance objectives that served as the primary drivers for initiating the upgrade, also often serve as governing parameters for the project.

Because the powering component of the delivery network is extremely critical, and with its close connection to overall system reliability, broadband



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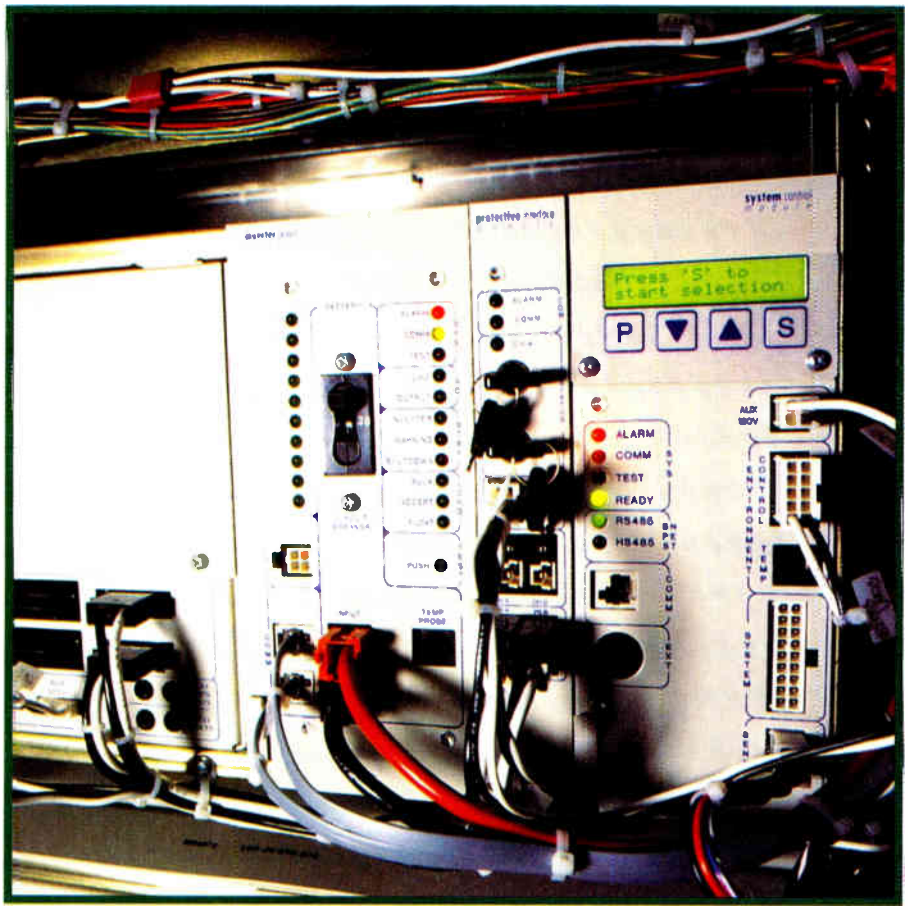

Powering equipment

powering has become a common topic of network upgrade planning. The vast majority of the active components that comprise a delivery network share a common need for clean, reliable, uninterrupted power. Without power, these components simply do not function. Power interruptions and anomalies common to unprotected, unfiltered utility power can result in hardware damage, information degradation and/or loss, as well as a wide array of unscheduled—and unwelcome—system maintenance issues.

UPS-grade power

Because of the direct correlation between the powering component of the network and overall system reliability, the quality and appropriateness of the power system is critical. If service providers are upgrading an older delivery network, there may be a need to upgrade a nonstandby powering platform to a powering solution that integrates uninterruptible power supply UPS-grade power with backup capabilities.

The sophistication of today's broadband networks make UPS-grade power a necessity. Before the days of expanded video, digital signals and the integration of other more "fragile" services such as telephony and Internet access, delivery systems could accommodate the transfer time typical of standby power systems of that era.

In recent years, however, it has become very clear that even brief interruptions in power can have serious consequences on digital transmission traffic such as data, Internet access and lifeline telephony services. Today, UPS-grade power systems, with backup power capabilities, are a baseline requirement for broadband networks. The backup power component of these systems has been dramatically improved, incorporating fully integrated engine-generators, dual power grid switching and enhanced battery management. Such improvements provide much longer backup runtime in the event of extended utility power outages, enhanced battery life and reduced maintenance requirements—all contributing to improvements in the overall reliability of the network.

Migration path

An extensive powering upgrade plan might include changing an existing distributed powering architecture to a centralized node delivery network to leverage operating and maintenance advantages. Migrating from a distributed to a centralized node powering design requires knowing the inherent differences between the two approaches.

Distributed powering

Distributed powering has been the architecture of choice for cable TV networking since the beginning of the industry. This powering method consists of power supplies being placed at appropriate locations throughout the system. The power supplies are housed within enclosures and are usually backed up by a string of batteries. The enclosure, power supply and battery string comprise a stand-alone power system that provides the appropriate power to nearby signal amplifiers and other system actives. The number and location of power supplies depends on the power requirements of the delivery system and is heavily dependent on subscriber density. Enclosures can be strategically placed and added to the system as the subscriber base increases, and can be pole-, wall- or ground-mounted.

Several considerations have made distributed powering a proven method in the past and a viable option for system expansion and/or upgrades. The enclosures used in a distributed powering architecture are typically smaller—and less conspicuous—than those used in alternative centralized node applications. (This will be discussed later in more detail.) Several distributed enclosures, however, are required to provide

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the equivalent power of a single centralized node system. The real net effect is a "dilution" of visible hardware intrusion, not really a reduction. This option, however, can prove important in meeting the specific needs of some service areas.

The placement of power supplies within a distributed system is not extremely critical—allowing some flexibility in their location and installation. Most cable technicians also are familiar and comfortable with distributed powering technology, which could ease personnel training requirements to service and maintain the system.

On the other hand, it is often difficult and time-consuming to service a distributed powering system as a whole, because of the many different power supply locations. Additionally, the increased reliability demands of today's communication delivery systems require the integration of technology not economically feasible in a distributed architecture.

Centralized node powering

Centralized node powering utilizes a single location for both the power system and the signal (fiber) node. The fiber node and the power system can be housed in either separate enclosures or co-located in a single enclosure, providing flexibility to meet specific system requirements. ➤

BOTTOM LINE

Powering Up

Planning a powering upgrade? If so, your powering upgrade plan might include changing an existing distributed powering architecture to a centralized node delivery network to leverage operating and maintenance advantages.

- Distributed powering consists of power supplies being placed at appropriate locations throughout the system. The power supplies are housed within enclosures and are usually backed up by a string of batteries.
- Centralized node architectures are typically designed to provide signal to a 200- to 2,500-home serving area, depending on the services to be provided.
- Power system flexibility is the key in a powering upgrade plan. The power system should incorporate a "growth path" that allows it to grow as the system grows and the powering solution must pass the "forklift" test—it can be installed today and added to and enhanced rather than ripped out and replaced (i.e., by a forklift).

Centralized node architectures are typically designed to deliver signal to a 200-2,500 home serving area, depending on the services provided, their corresponding power requirements and subscriber density. Historically, telephony has been powered in a similar manner, but centralized node powering is a relatively new method for powering video service.

Economic advantages exist as a result of the reduced number of power supply locations in a centralized node system. Installation costs are lowered for a given home-serving area as are maintenance and other life-cycle costs. Higher overall operating efficiency also can be achieved through balanced loading—reducing overall operating expenses.

The critical importance of appropriate battery selection and maintenance cannot be overemphasized. Regardless of the powering topology, batteries provide the first-line defense to utility instability or loss, and ensure that system actives receive the necessary and appropriate power. Too often, service providers falsely con-

> "Economic advantages exist as a result of the reduced number of power supply locations in a centralized node system."

sider battery selection a "noncritical" decision, sometimes making cost or other nonperformance issues the primary criteria. Gel cell batteries, designed specifically for float-service, broadband applications, have been shown to provide the longest life and most reliable performance—as well as the safest application. Battery selection remains a critical element in centralized node powering, but this approach allows the consideration of several additional backup powering options, all serving to increase and enhance reliability.

Because fewer power supply locations are required in centralized node powering, several advanced reliability features can be considered that would not be economically feasible with multiple smaller enclosures. Backup engine-generators, which run on natural gas or propane, can be incorporated in addition to battery backup—providing additional system reliability during extended utility outages.

Environmentally controlled cabinets can be integrated to prolong the life of

batteries and system components, adding both increased reliability and decreased overall cost-of-ownership.

Dual power grid switching also becomes a viable option as part of a centralized approach. Where access to more than one power grid is available, reliability levels can be increased through an integrated power grid switching capability that allows the system to use a secondary power grid as an additional source of backup power.

Since centralized node powering usually utilizes multiple power supply modules within a centrally located enclosure, it also becomes practical to integrate an additional power supply module to back up the others—providing N+1 redundancy. The integration of N+1 redundancy allows complete on-line serviceability that is critically important as lifeline services such as telephony, paging and 911 are added to the traditional video service offering.

Interactive status monitoring and control, which are crucial for alerting technicians to power problems before they have an impact on customer-observed performance, also are simplified and enhanced with this type of powering architecture. All of these advanced features, as well as the overall component count reduction, serve to make the system more reliable.

Flexibility is a key ingredient to formulating an effective broadband powering upgrade plan. The power system's flexibility should support efficient operation with an existing network, while allowing the powering component of the system to grow incrementally with the addition of expanded services and increased subscriber penetration. The power system should incorporate a "growth path" that allows it to grow as the system grows. The powering solution must pass the "forklift" test—meaning that it can be installed today and added to and enhanced rather than ripped out and replaced (by a forklift).

Power system flexibility, however, should not limited to power rating alone. An effective powering solution also will allow the service provider to configure a number of other features to meet the specific needs of the build. Flexibility and choice are essential. Enclosure size, configuration, mounting options (ground, pole, underground), status monitoring and enhanced reliability options should all be tailored to the particular needs of the application.

If a service area happens to have access to overlapping power grids, a power system that allows dual power grid switching might be an effective choice. With a primary and secondary utility feed, service providers could further minimize the chance of a complete utility failure. CT

Eric Wentz is the marketing communications manager for Alpha Technologies. He can be reached at (800) 421-8089.

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Reader Service Number 60

Fiber Cleaning System

Tyton Hellerman has unveiled a new, hand-held fiber-optic connector cleaning system. The Fiberclean system is a refillable dispenser that contains 10 feet of "ultra-white" nonwoven, lint-free film for complete removal of dust, dirt, oil, and grease from fiber and ferrule end faces. The system keeps the film clean and dry and holds it in place during the cleaning process.

Reader service #313

Modular Cable Tester

Progressive Electronics, a manufacturer of wire and cable locating and testing equipment based in Phoenix, AZ, has introduced its Model 468, modular cable tester. The product is said to provide a fast and accurate method of testing the most common modular configurations for opens, shorts, reversals and transposed pairs. It is designed to withstand accidental connection to active circuits and the transmit and receive units also provide all test results via easy to understand sequencing LEDs. The transmitter unit supplies a tone signal useful for identifying the far end of the cable under test.

Reader service #311

Taps, Splitters and Couplers

Raychem Corp. has produced a new family of 1 GHz taps, splitters and couplers for broadband cable TV systems that provide a platform for future service upgrades. The Legend Series of outdoor and indoor products offer improved electrical performance to 1 GHz, network design flexibility and mechanical robustness.

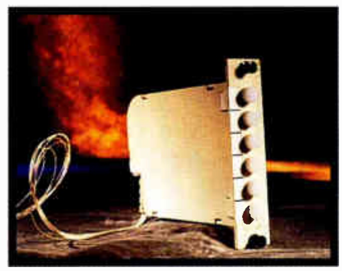
Reader service #312

Metallic TDR on a PC Card

The time domain reflectometer (TDR) is used as a troubleshooting tool, as a way to assess the condition of a cable or as a condition monitoring tool. CM Technologies has built upon this knowledge with its latest product, the PC1-3100 personal computer-based metallic TDR for use with any laptop, portable or desktop PC with a full-sized, 16-bit ISA slot. The product has a measurement rate of 6.4 giga-samples per second, a maximum range of 96,000 feet and can resolve defects to within one inch.

The card also comes complete with a data acquisition and analysis software package for either DOS or Windows. The software allows the user to save and recall TDR waveform files for future comparison of up to eight user selected overlays in the overlay mode, and the ability to zoom in on any portion of the waveform in six steps up to 64x for detailed analysis.

Reader service #309

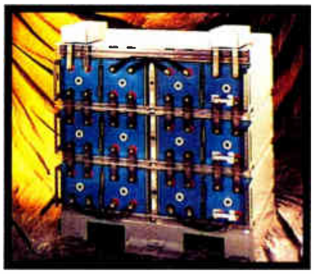


Snap-Fit Splitter Modules

The new customer-configured snap-fit splitter module developed by Telect Inc. is the latest addition to Telect's DataLINXS and LANLINXS fiber enclosure product lines. The modular units provide a protective, enclosed environment for fiber splitting as well as network testing and real-time monitoring. The modular design allows users to purchase only the capacity they need, saving both space and money.

The self-enclosed splitter modules snap into DataLINXS and LANLINXS fiber enclosures and occupy one six-plate section for up to six terminations. Two modules can snap together to expand capacity to 12 terminations.

Reader service #310



Modular VRLA And DC Power System

The DDH VRLA battery from Yuasa-Exide comes in 24 V and 48 V versions, rated from 120 Ah to 6,000 Ah (three-paralleled string configurations) and up to 2,000 Ah (nonparalleled string). The battery features a Skate-Key compression system for faster installation; Xtractor plates for easier cell installation; alignment pins for full front access; Snap-Fit safety shields; air cooling holes for thermal management; top covers; power transition plates; and pallet-style base plates.

Y-E's Horizon Series 24 V power system includes the Vector Series H24V100 HFSM (high frequency switch mode) rectifier and H48V24C10 HFSM DC/DC converter modules. These modules "hot plug" into an intelligent backplane connected to the controller/monitor and simplify installation and management of component level settings.

Reader service #308

MDU Addressable Splitter System

Electroline has developed its CAT-T addressable splitter units, which provide on/off or two-tier addressable control of up to 64 tap ports. The CAT-T units are essentially slave units that connect to an addressable CAT splitter.

Up to three CAT-T splitters may be connected to a CAT. The cable operator has the choice of providing power to the CAT station from the network, or from the premises in which it is installed.

The CAT splitter system offers automated control CATV service connects and disconnects (on/off control), or as a system that can control two tiers of service, allowing immediate service activation.

The CAT and CAT-T feature a small footprint, especially useful for pedestal mounting.

Reader service #307

Taps, Splitters and Couplers

Raychem Corp. produced a new family of 1 GHz taps, splitters and couplers for broadband cable TV systems that provide a platform for future service upgrades. The Legend Series of outdoor and indoor products offer improved electrical performance to 1 GHz, network design flexibility and mechanical robustness.

Reader service #306

The following is a listing of some of the videotapes currently available by mail order through the Society of Telecommunications Engineers. The prices listed are for SCTE members only. Nonmembers must add 20% when ordering.

- *Interdiction and Other Signal Security Techniques*—Paul Harr, Roger Pence, Leonard Falter and Terry Mast define and evaluate signal security methods of preventing service theft, including positive and negative traps, scrambling, interdiction and video compression. (1 hr.) Order #T-1107, $35.

- *Digital Compression: Expanding Channel Capacity While Enhancing Video and Audio Quality*—This presentation features Thomas Elliot (moderator); H. Allen Ecker Ph.D.; Richard Prodan, Ph.D.; and Geoff Roman. This program deals with the realistic goals and benefits to be derived from digital video compression. It covers trade-offs such as pix quality vs. data rate vs. cost, data rate vs. ruggedness vs. cost and features vs. value vs. cost. Digital video compression architectures, performance of various digital techniques and DigiCipher and DigiCable products also are discussed. (80 min.) Order #T-1111, $45. CT

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

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CALENDAR

August

14: Society of Cable Telecommunications Engineers Satellite Tele-Seminar program, "Video transport (part one)," Galaxy 1R, Transponder 14, 2:30-3:30 p.m. ET. Contact Janene Martin, (610) 363-6888, ext. 220.

18-20: 1997 Great Lakes Cable Expo, Indianapolis. Contact show management, (317) 845-8100.

28: SCTE Badger State Chapter seminar, project management, Green Bay, WI. Contact Brian Revak, (715) 493-2605.

18-20: 1997 Great Lakes Cable Expo, "Convergence: The Next Step," the Great Lakes Cable Television Association, Indianapolis, IN. Contact (317) 845-8100. CT

Planning Ahead

Oct. 6-7: Society of Cable Telecommunications Engineers regional training seminar, "Introduction to data communications," Toronto, Canada. Contact SCTE National Headquarters, (610) 363-6888.

Oct. 14-16: Mid-America Cable Show, Kansas City. Contact (913) 841-9241.

Oct. 20-22: Eastern Cable Show, Atlanta. Contact Southern Cable Television Association, (404) 255-1608.

Oct. 20-22: 20th Annual Newport Conference on Fiberoptics Markets sponsored by KMI Corp., Newport, RI. Contact Carole McCormick, (401) 849-6771; e-mail: kmi@ids.net.

Dec. 2-4: Converging Technologies Expo & Conference, Los Angeles. Contact John Golicz, (203) 256-4700, ext. 121.

Dec. 10-12: The Western Show, Anaheim, CA. Contact the California Cable Television Association, (510) 428-2225.

CABLE TRIVIA

By Rex Porter

Our historical guru (aka Editor Rex Porter) has provided us with these trivia questions on the cable industry. The first person who sends in the most correct answers will be the award winner. Good luck!

Your answers need to be sent to: The Trivia Judge, *Communications Technology*, 1900 Grant St., Suite 720, Denver, CO 80203 or fax: (602) 807-8319.

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05. ❑ Cable TV Contractors
06. ❑ Cable TV Program Networks
07. ❑ SMATV, DBS Operator
08. ❑ MMDS, STV or LPTV Operations
9A. ❑ Microwave
9B. ❑ Telecommunications Carrier
9C. ❑ Electric Utility
9D. ❑ Satellite Manufacturer
9E. ❑ Satellite Distributor/Dealer
9F. ❑ Fiber-Optic Manufacturer
10. ❑ Commercial TV Broadcasters
11. ❑ Cable TV Component Manufacturers
12. ❑ Cable TV Investors
13. ❑ Financial Institutions, Brokers & Consultants
14. ❑ Law Firm or Govt. Agencies
15. ❑ Program Producers, Distributors and Syndicators
16. ❑ Advertising Agencies
17. ❑ Educational TV Stations, Schools and Libraries
18. ❑ Other (please specify) ______

C. Please check the category that best describes your job title: (check only one)
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20. ❑ Management
21. ❑ Programming

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23. ❑ Director
24. ❑ Manager
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26. ❑ Technician
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28. ❑ Sales
29. ❑ Marketing
30. ❑ Other (please specify) ______

D. Which one of the following best describes your involvement in the decision to purchase a product/service? (check only one)
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32. ❑ Specify
33. ❑ Evaluate
34. ❑ Approve
35. ❑ Not involved

Trivia #15 answers
1) Davco Electronics
2) Could be used as a spare headend for any VHF channel
3) Ameco
4) is placed toward the top of towers
5) Phelps Dodge
6) Dupont

Trivia #16
1) In 1986, this company became the first to scramble its signals full time:
A) Showtime
B) Playboy
C) ESPN
D) HBO

2) In 1993, this company tried, unsuccessfully, to acquire TCI and its 9.7 million subscribers for $33 billion:
A) Southwestern Bell
B) AT&T
C) Bell Atlantic
D) Pacific Bell

3) In addition to its 25.51% share in Time Warner Entertainment, US West also purchased which three of the following companies?
A) Viacom, Wometco and Storer
B) Viacom, Wometco and Georgia Cable
C) Continental, Wometco and Viacom
D) Georgia Cable, Wometco and Continental

4) Which statement is *not* correct?
A) Crown Cable sold to Charter Communications and Marcus Cable Partners.
B) McClean Hunter Ltd. sold to Rogers Communications who sold all 550,000 subs to Comcast Corp. for almost $1.3 billion.
C) Newhouse Broadcasting merged its 1.4 million subs with Cablevision Systems of Long Island.
D) TCI bought TeleCable Corp. for $1.4 billion.

And the winner is...
The winner for Cable Trivia #15 (which ran in the June issue) is Fred Steelman. Congratulations Fred! CT

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Bangor, Maine	November 12-14, 1997
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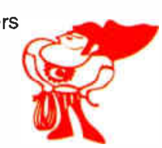

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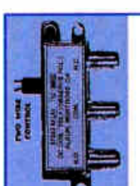

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Return path in RF amps quiz

This month's installment is designed to test your knowledge on a variety of aspects involving the return path in RF amplifiers that have been presented in this column.

The topics and months where they appeared are: "Return path in line extenders: Parts 1 and 2" were in January and February; "Return path in distribution amps: Parts 1 and 2" were in March and April; and "Return path in bridger amps: Parts 1, 2 and 3" appeared in May, June and July. © NCTI.

1) The Jerrold JLX series line extender return amplifier module
   A) Has approximately 41 dB of RF signal amplification.
   B) Can attenuate the input signal level prior to the return RF amplifier, using the input attenuator pad.
   C) Can use a high-split band (750-1,000 MHz).
   D) Commonly uses the 50-750 MHz frequency band.
   E) Accommodates interactive services such as basic cable or local over-the-air signals.

2) Which of the following is (are) correct for determining the proper reverse equalizer for a Texscan 1PAL line extender amplifier?
   A) Leave the jumper wire in the reverse equalizer plug-in location if the required equalizer value is zero.
   B) If your system utilizes more than one reverse carrier, measure only your system's highest reverse video carrier signal level.
   C) Install a 0 dB equalizer in the reverse equalizer plug-in location is the required equalizer value is zero.
   D) Subtract 30 dB (to offset the attenuation of the test point) from the measured signal level to obtain the actual highest reverse video carrier signal level.
   E) Both A and C.

3) What is the required reverse attenuator pad value for a Texscan 1PAL line extender amplifier when: 1) the actual highest reverse video carrier signal level is 35 dBmV; 2) the system-required highest reverse video carrier signal level is 33 dBmV; and 3) the test point attenuation where the SLM is connected to the upstream amplifier is 30 dB?
   A) 30 dB.
   B) 22 dB.
   C) 8 dB.
   D) 2 dB
   E) 2 dB.

Return path in distribution amps

4) In a Scientific-Atlanta System Amplifier II, reverse RF signals received at more than one RF output port (reverse RF input port) are combined together at the
   A) Automatic level and slope control.
   B) Main output diplex filter.
   C) the auxiliary and/or reverse signal directors.
   D) Input diplex filter.
   E) Main forward RF input port.

5) When adjusting the reverse gain control on a Philips GNA distribution amplifier,
   A) Adjust the reverse slope control if the actual slope determined is not within your system's slope requirements.
   B) Adjust the gain control as required to match the actual highest reverse video carrier level (at the upstream amplifier) with the system-required highest reverse video carrier level.
   C) Verify a signal generator is connected to the first reverse amplifier upstream of the amplifier under test.
   D) Verify an SLM is connected to the distribution amplifier under test.
   E) Adjust the gain control to the required gain reserve.

Return signals in bridger amps

6) The return amplifier module
   A) Is used during an unexpected loss of AC input voltage to the trunk amplifier station of trunk amplifier component failure.
   B) Amplifies the forward frequencies (5 MHz to 300 MHz).
   C) May have an equalizer located on the input or output of the return amplifier.
   D) Receives data signals sent by the headend, converts these signals to amplifier station tests, and transmits the answers back to the headend for translation.
   E) Both A and B.

7) The slope control
   A) For the return amplifier permits adjusting the output levels by 0 dB-9 dB to match the input requirements of the next return amplifier.
   B) For the Scientific-Atlanta automatic control module is located on the front of the trunk module.
   C) Is always a 10-position of 14-position dip switch for a return amplifier module.
   D) For a return amplifier module typically is a thermal-compensated control to compensate for changes in return signal level due to temperature variations.
   E) For a typical return amplifier module has a range of 6 dB.

Next month's installment will include the answers to this quiz and begin a new series on troubleshooting the drop system. CT

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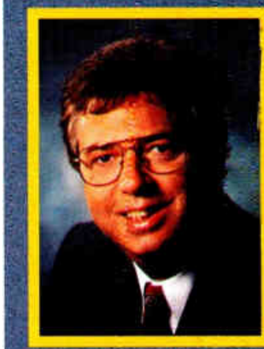
By William W. Riker



Improving Customer Service Through Training

In the 24 years that I have been involved with the cable telecommunications industry, I have seen many changes occur. In a relatively short time, cable TV has evolved from small "mom and pop" businesses scattered across the United States to huge multiple system operators that encompass large regions and serve millions of customers.

As broadband operations have grown, so have customer options and, in turn, their demands for quality. I remember when our industry was dabbling in the areas of interconnecting alarm systems and providing other services to the home such as energy management and power monitoring. Now we are looking at a future of high-speed data modems, digital technology and, eventually, a multitude of telecommunications services converged to be available through a single service provider.

More than ever before, technology is driving not only broadband, but other telecommunications services as well. With stiff competition from these other providers, cable operators must examine how they are going to face those challenges while protecting their most important asset: the subscriber.

My early experience in cable TV was with systems that provided entertainment services (not considered a necessity) and we conducted customer service accordingly. The industry traditionally received bad marks in the area of customer service, most of them deserved.

Numerous studies have evidenced the fact that consumers, on the whole, aren't as satisfied with their cable service as they could be. One recent survey showed that only 3% of consumers would choose their cable operator as a single provider for all their video, voice and data services. In short, the broadband industry has a negative customer service image and we need to fix this.

The "On-Time Customer Service Guarantee" (OTG) is a great start to improving our rapport with subscribers. This program, supported by the National Cable Television Association, the Marketing Society of the Cable and Telecommunications Industry, the Cable Telecommunications Association, Cable Television Public Affairs Association, the Cable Television Advertising Bureau and the Society of Cable Telecommunications Engineers, was introduced two years ago to shine a more positive light on our industry.

The guarantee states that if a scheduled installation is late, the installation fee is waived. If a technician is late for a scheduled service call, the subscriber receives a $20 credit on the next bill. The OTG is designed to help operators improve their image in customer service through national marketing efforts, by improving job performance and by increasing overall customer satisfaction.

In theory, this guarantee should help revive the public's confidence in the cable industry. However, before operators can put the plan into action by providing the best possible service to subscribers, they must first evaluate the comprehension and abilities of those employees who will be carrying out the OTG.

In other words, you can't guarantee improved customer service without first having well-trained technical personnel. Poorly trained technicians and installers working in the field, as well as uninformed customer service representatives, are not effective employees. Most employers believe that quality training at all personnel levels will result in improved customer satisfaction.

In response to this need for quality technical training, SCTE has created two new opportunities for broadband professionals. The Society's latest technical certification programs are Telephony and Service Technician, set to officially debut this fall.

Proof of this renewed emphasis on training was provided when Cable-Tec Expo 1997 exceeded all previous attendance records. As predicted in my opening remarks at the commencement of Expo '97, this year's show was the largest and most widely acclaimed technical convention the Society has ever offered.

A total of 8,200 people, including 4,600 registered attendees and 3,600 exhibitor personnel, gathered for the event. These 1997 figures represent a 14% increase over last year's show in Nashville.

We are proud to be one of the few industry trade shows to experience such dramatic growth in attendance in the past year. With this, our 15th annual Expo, we have seen the number of registered attendees double in the last five years.

This growth may be attributed to Cable-Tec Expo's emphasis on providing technical training opportunities to an industry that has become highly dependent on the application of new technologies. CT

Bill Riker is president of the Society of Cable Telecommunications Engineers.

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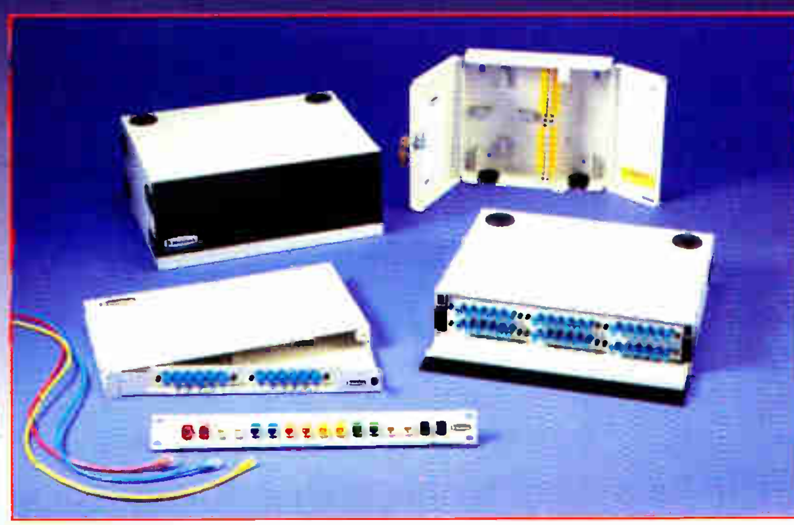

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