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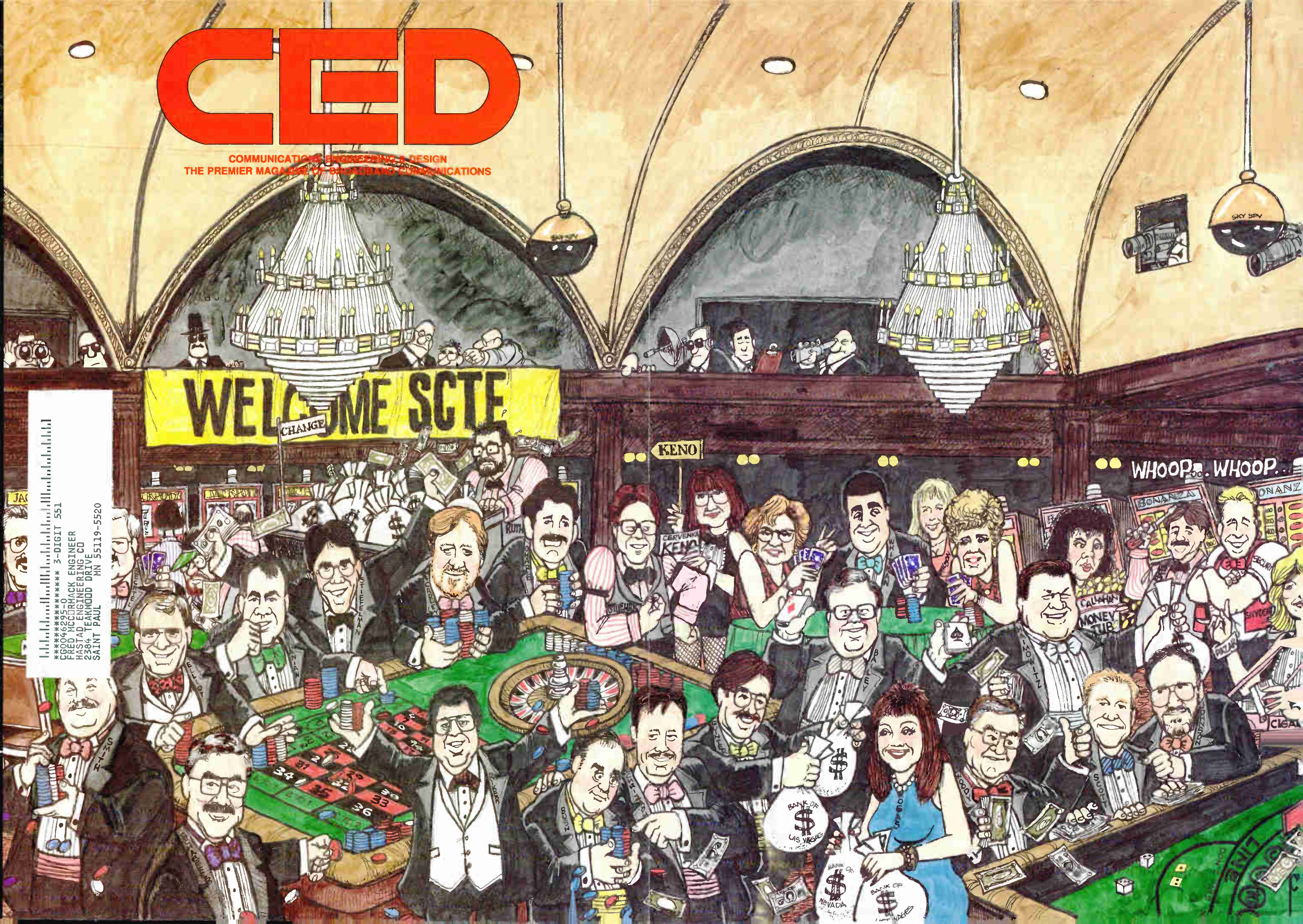

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Contents

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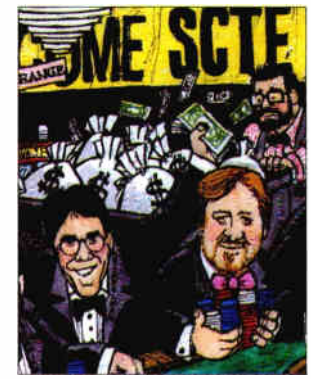
Features



About the Cover
The SCTE gathers in Las Vegas. Illustration by Rob Pudim.

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Taking a few arrows in the back

Competition in the future is going to be brutal. Today's cable companies that are preparing to become full service telecommunications providers can learn a few lessons from the marketing wars that are filling up so much commercial TV airtime. Take the AT&T/MCI debate, for example. MCI has been fairly successful in taking away AT&T customers by touting lower rates, but loses one in six converts because AT&T literally "buys" them back with cash payments if they'll switch back.

When MSOs enter the fray for information and voice services, you can bet the local telcos will fight hard to keep their present customers. They'll go after the jugular: the MSOs will be branded as unknowledgeable upstarts with low-tech networks that pale in reliability when compared with the tried-and-true telephony network.

Those in the know can argue that TV outages are different than telephony outages because people use the TV more than they use the phone, and that consumers are more tolerant of telephone problems because they can just hang up and re-place the call. Those complicated and cumbersome counter arguments simply won't work with the consumer, however. It's a smarter move to improve the network.

So just how reliable are today's cable networks, and what can be done to improve the numbers?

The Bell companies have a target of 99.99 percent reliability, or 53 minutes of outage per year. What is often misunderstood is that that number does not include the telephone instrument, the inside wiring or the wiring between the central office and the home. It's a benchmark for the trunk network and switches.

How do cable companies compare?

David Large, a 30-year cable industry veteran who is now a consultant, took a typical hybrid fiber/coax network, broke it down into segments and determined that signals on such a network would be "available" 99.92 percent of the time (398 minutes of outage per year). Because people aren't watching all the time, the perceived reliability is 99.975 percent, according to Large's work.

That may be reliable enough for entertainment video, and it may actually be more reliable than the phone network, Large argues, but he nevertheless has some thoughts on improving reliability:

✔ Putting rings in the fiber network may not be the best use of money because the fiber network is extremely reliable already;
✔ Distribution reliability could be improved with hardened power supplies and status monitoring devices;
✔ F-connectors could be improved to dramatically improve the numbers; and
✔ The greatest contribution could be made by improvements in the headend through faster repair times and redundant components.

Large estimates that cable systems could reduce outage time to less than three hours a year by making these improvements. That's good news, because unless consumers are convinced that cable network reliability has improved over the years, operators are going to take a lot of arrows.

Roger J. Brown

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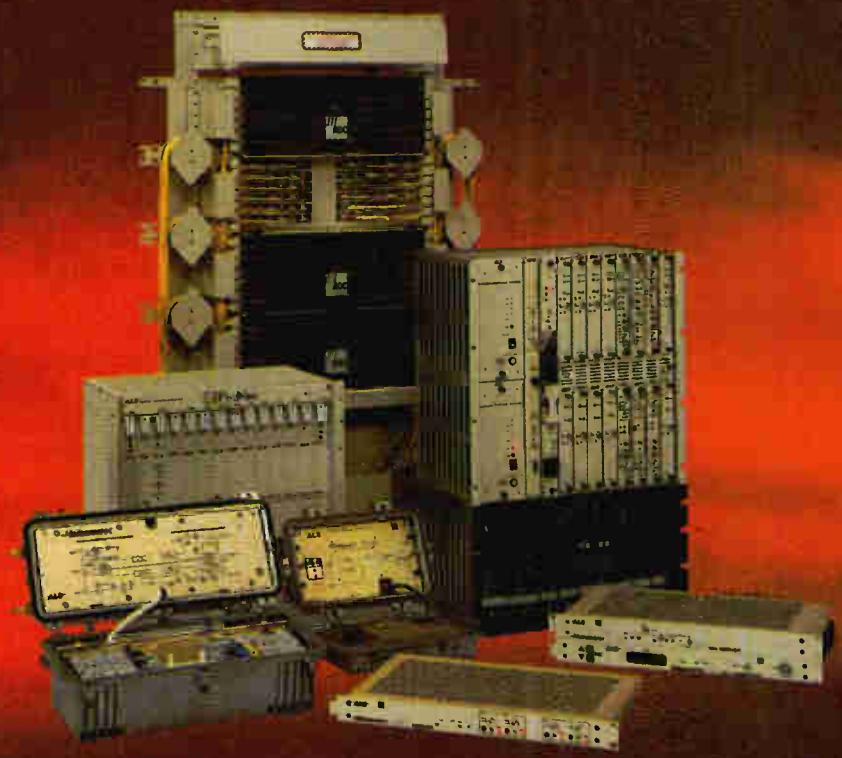

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Bell Atlantic backs off HFC builds, cites reduction in costs for digital nets

With its efforts to begin constructing its hybrid fiber/coax video dialtone systems set back by lengthy delays within the Federal Communications Commission, Bell Atlantic last month informed the FCC it was withdrawing those applications, opting instead to take advantage of price decreases and improved fiber to the curb technology to build switched digital video networks, according to a company spokesman.

The action covers about 3 million homes in and around Philadelphia, Baltimore, Washington, D.C., northern New Jersey and Hampton Roads, N.J.

The announcement comes as a blow to companies that manufacture HFC gear, yet gives established cable companies in those communities more time to prepare for competition from the huge telco. Vendors who were interviewed with the understanding they would not be quoted expressed some disappointment, but noted that there is plenty of business still to be won, and that HFC networks continue to be the most cost-effective method to build broadband networks.

Fiber to the curb is considered by many to be much more elegant and reliable than HFC networks because the topology pushes fiber extremely deep into the network. But the electronics are considered expensive, and each TV and/or VCR served would need a set-top to convert digital signals to analog format.

Insiders at Bell Atlantic have hinted for months that the RBOC wasn't really happy building what amounts to a typical cable network, preferring instead to push digital and fiber optic technology as far as possible to avoid building what it believes to be an already obsolete network.

Bell Atlantic engineers are expected to adopt technologies like those offered by BroadBand Technologies, in which the company purchased $7 million in warrants for the company's stock in a "purely financial" transaction that company executives said was unrelated to the decision to pursue FTTC technology. BA already uses BBT gear in its Dover Township, N.J. video trial.

BBT reportedly has made significant progress in cost reducing its equipment, with prices falling by 50 percent over the past 10 months, according to statements attributed to Rick Jones, BBT's executive vice president. Some analysts say switched digital gear has reached cost parity with HFC for networks that would serve densely populated areas. Others remain skeptical, however.

For example, a spokesman from Pacific Bell Video told sister publication *MultiChannel News* that it plans to continue its widescale deployment of HFC networks as aggressively as ever because the company is convinced it can save millions in maintenance costs with the approach.

Just a few weeks ago, the company named Scientific-Atlanta its key supplier and integrator of a video delivery system that includes analog and digital headend gear and set-tops. PacBell and PacTel Video Services both intend to purchase up to $150 million in equipment from S-A over the next three years. Specifically, S-A will provide analog boxes that offer on-screen graphics, PPV ordering and a variety of other features. Digital set-tops will provide full interactivity for movies on demand, games, shopping and other applications. These units will feature the new PowerTV interactive operating system.

Insiders at Bell Atlantic have hinted that the RBOC wasn't happy building a typical cable network

Also going full steam ahead is Southern New England Telephone, which has also chosen to use the HFC model.

Perhaps not so coincidentally, Bell Atlantic recently partnered with Nynex to invest $100 million to acquire 45 percent of CAI Wireless Systems, an operator of several microwave MMDS systems. Through that investment, the two RBOCs have licenses to deliver video in metropolitan New York City, Albany, Buffalo, Syracuse, Boston, Hartford, Providence, Rochester and Norfolk, Va. After closing some other deals, the company expects to acquire licenses for Pittsburgh; Cleveland; Bakersfield and Stockton, Calif.; Philadelphia; Baltimore; and Washington, D.C. The latter three cities are locations where Bell Atlantic will not build HFC networks.

PacTel also announced its intention to enter the "wireless cable" market in late April by acquiring 100 percent of the stock of Cross Country Wireless, which holds licenses to provide microwave video in Los Angeles and Orange counties as well as the cities of Riverside and San Diego. The deal is valued at $175 million: $120 million in stock and assuming $55 million in debt. Cross Country has been operating since April 1991 and now serves about 42,000 subscribers in Riverside with 31 channels of video.

PacTel intends to spend another $20 million or so to build out a digital MMDS system to serve these areas as a complement to the HFC network it's building that will one day transport both video and telephony services, said Michael Fitzpatrick, president and CEO of Pacific Bell Enterprises. That digital network will be used to offer near video-on-demand as well as traditional cable TV services and local channels. "It's a real jump start to the video dialtone program we continue to build out," said Fitzpatrick.

The company decided to buy into MMDS because it provides a method to compete in video without having to build a massive infrastructure, Fitzpatrick said. "There's a crying need for an alternative to existing cable service," he said. "Consumers want more choice, reliability and programming than they get today."

With the acquisition, PacTel now has the ability to serve more than 5 million homes in southern California with a digital network that should come on line by the end of 1996. In contrast, the wired HFC network project is slated to pass just 1 million homes at the same point in time.

TCI ventures into on-line data services

Need further evidence cable operators are targeting the on-line data services for their next meal? Look no further than Tele-Communications Inc., which last month said it plans to develop high-speed, next-generation Internet services for homes and businesses, using its cable TV infrastructure.

TCI Technology Ventures will team with venture capitalists Kleiner Perkins Caufield & Byers to start up "@Home," an on-line service, based on Internet Protocol, that will provide computers in homes and businesses multi-megabit per second connectivity to the Internet and other services. The new company will be headquartered in California's Silicon Valley.

TCI intends to develop the service and offer it to other MSOs under an arrangement similar to its "Headend in the Sky" concept where

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compressed video programming is sold to other MSOs who either can't, or don't want to, foot the bill for digital equipment.

As part of the development process, TCI will issue a request for proposals for high-speed cable modems. TCI is said to be favoring modems that use a telephone return because such units will be less costly and avoid the problems associated with the sub-split return path. Cost models suggest modems need to be priced at less than $300 and drop from there. Today's modems that offer high speed communication in both directions and require a return path link cost upwards of $500 each.

Using the telephone return also won't force operators to build two-way plant immediately. Today, less than 5 percent of the cable plant is two-way activated.

During last month's National Cable Show in Dallas, at least 10 different companies were in attendance talking about such units (see coverage beginning on page 104).

Service will be offered in two or three select markets beginning early next year, said Bruce Ravenel, COO of TCI Technology Ventures.

Will Hearst, former newspaper publisher and VP of Hearst Cable Communications who is now a partner at Kleiner Perkins Caufield & Byers, will serve as the service's CEO.

More information about the @Home service can be found on a new Internet home page: http://www.home.net.

Time Warner takes stake in ITV venture

Time Warner Entertainment plans to become an equity partner in Interactive Digital Solutions (IDS), the Silicon Graphics/AT&T Network Systems joint venture company that was formed last year to provide integrated multimedia software platforms for interactive TV, putting the company squarely in the battle over set-top and other digital interactive device operating systems with such companies as Microware, Microsoft and PowerTV.

Under terms of the agreement announced in late April, Time Warner will become a 10 percent owner of the company. The transaction calls for Time Warner to contribute "intellectual property rights to certain software used in the Full Service Network," which is now operating in Orlando, Fla.

IDS plans to incorporate the FSN operating system software, the Carousel navigator and video-on-demand applications into its products, which will include media servers and software. The system software will be integrated with hardware from open systems suppliers to create a complete network solution for interactive services. Primary customers of such equipment is expected to be telephone companies and cable TV MSOs, broadband network operators and content providers as well.

AT&T and Silicon Graphics were primary technology partners in the Full Service Network, with AT&T supplying its high-speed ATM switch and SGI providing software, the Carousel navigator, VOD and games applications, and media servers for the Network Operations Center.

Sega Channel poised for take-off

Slowly but surely, the interactive game market is positioning itself for a wild ride–and the technology is being put in place to make it happen.

TCI is said to be favoring modems that use a telephone return because they're less costly

Scientific-Atlanta announced it has shipped more than 300 headend systems for the delivery of the Sega Channel and that more than 90 cable systems have launched the service as part of plans by nearly 50 MSOs to offer the service.

The Sega Channel offers up to 50 different games that reside in the headend. Consumers who own Sega Genesis machines can get a special adapter that plugs into the machine that receives games the user wants to play.

Sega Channel games are delivered to the headend via satellite, where it is received and modulated over the cable system using S-A equipment. The cable adapter receives the game and displays it on the TV. Users can play the game until a new game is selected or until it is turned off.

Meanwhile, General Instrument announced at last month's National Show that it has signed an agreement with Catapult Entertainment to incorporate multi-player capabilities with the Sega Channel. Catapult has developed the XBAND gaming network, which allows game players to compete against each other over standard telephone lines.

By incorporating this functionality into the GI adapters, customers can play against each other, compete in tournaments, send e-mail to each other over the Internet, access a central database of statistics and rankings, and use a multitude of other features.

Sega Channel began its national roll out last December. It's a partnership between Sega of America, TCI and Time Warner Entertainment.

Optus Vision awards key technology contracts

It may be building the world's most integrated network a half a world away, but Optus Vision of Australia is looking to the United States to provide key technology components of the network.

Antec has been awarded a $30 million contract for optoelectronic equipment, including 750-MHz capable optical transmitters and fully redundant bidirectional optical receivers. Optus Vision, a joint venture between Optus Communications (Australia's first private telco), Continental Cablevision and Australia's Publishing and Broadcasting Ltd. The company is constructing a 750 MHz digital network that integrates broadcast and interactive video with telephone services over a single fiber/coaxial cable to the home.

Optus Vision intends to pass 3 million homes within the next four years by building plant in Sydney, Melbourne and Brisbane. Total capital expenditure is expected to be about $3 billion.

Optus also awarded a contract to Scientific-Atlanta for that company's dual output amplifiers which will be specially-configured to meet Australia's unique environmental and climatic requirements.

CableLabs issues RFP, is awarded 2 patents

In order to help its member companies seize an immediate business opportunity, Cable Television Laboratories has issued a request for proposal to more than 200 companies, soliciting hardware, software and operational support for high-speed data delivery over cable TV networks.

Responses to the RFP, which is actually a continuation of CableLabs' telecommunications RFP, are due June 9. CableLabs received 43 responses to its telecom RFP, according to Scott Bachman, vice president of operations technologies projects at CableLabs.

A key objective of the RFP is to help MSOs

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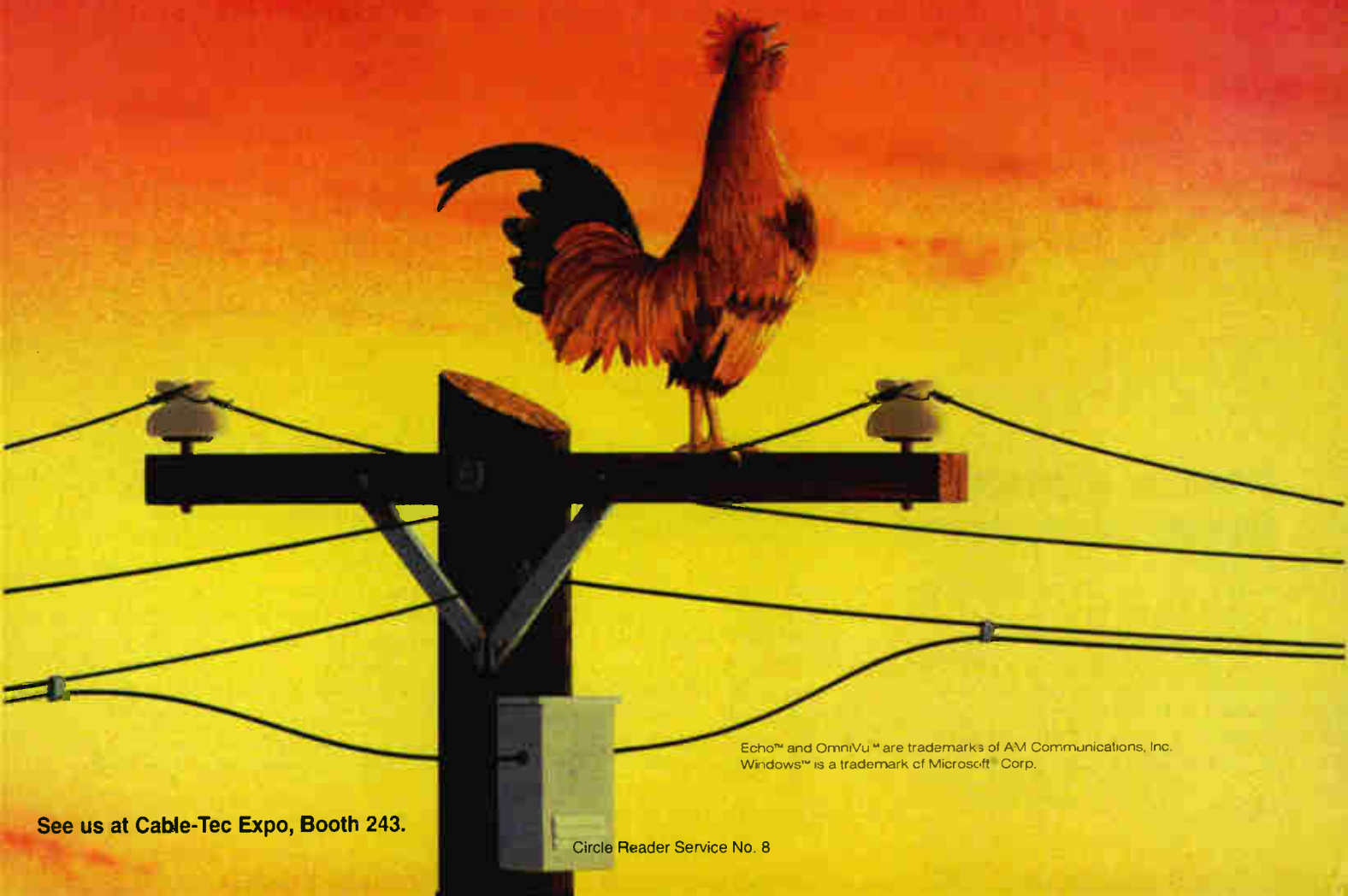

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deploy these types of services cost-effectively. CableLabs will also assist with technical evaluation as well as testing and evaluation of the vendors' equipment. A key goal will to ensure interoperability between systems.

Cable TV's broadband networks can easily support high-speed data services, giving users near-instant access to data without having to "dial-up" the service over the telephone line or wait for information to be sent at comparatively slower speeds, such as 9600 baud, or 14.4 baud, which is common today.

In other news, CableLabs has been granted patents for technologies that allow wireless telephone and data to be delivered over cable networks and a TV signal, respectively.

The wireless telephony patent is for a technology called Digital Remote Antenna Driver, which is used to deliver personal communications services over cable networks. The system digitizes and time compresses the telephone signal between a base station and one or more remote antenna sites.

This patent is derivative of work done by Rogers Cablesystems of Canada for an analog approach. CableLabs has a patent pooling arrangement for such technology with Rogers, which is a member of CableLabs. Rogers last year issued an RFP for use of remote antenna driver technology in Canada.

The other patent is for data that is modulated with orthogonal frequency division multiplexing (OFDM) techniques so that the data can be sent over the TV signal's vertical blanking interval. This approach provides robust, high-rate digital data transmission over a broadcast channel while providing immunity to multipath interference, according to CableLabs officials. This OFDM approach is better than traditional broadband approaches because it allows more time to process the data, said Tom Williams, CableLabs' senior technical staff member and the system's inventor.

Manufacturers interested in licensing the technology should contact CableLabs at 303/661-9100.

GI focuses on telecom, expands training program

General Instrument has established a new strategic business unit to specifically address the needs of its telephone industry customers, the company announced in late April.

Michael Ozburn has been appointed vice president of the new SBU, and will report directly to Ed Breen, executive vice president of marketing and sales at GI. As such, Ozburn will be responsible for the strategic management of the switched digital video program through GI's recent acquisition of Next Level Communications, the hybrid fiber/coax telephony program and the data services PCLinX program.

Charles Dougherty, formerly director of telco marketing, becomes director of marketing for the new unit. He is now responsible for the switched digital video program management and overall network marketing. He will also lead GI's effort to define and develop a next-generation operational support system.

In addition, Ed Zylka, Marty Stein and Terry Foster will now report to Ozburn to provide a computer and video server strategy to the group. Jeff Lanctot, who leads the telephony over cable project, will also now report to Ozburn.

GI also announced a stepped-up broadband training program for its customers and others who want to learn more about broadband technology, from the basics of broadband design to the intricacies of cable-telco relationships.

Course titles include: Broadband Network Overview Training; Broadband Communications Network Design; Broadband Applications Engineering Training; Advanced Broadband Applications Engineering Training; Headend Maintenance and Performance Testing; Plant Maintenance, Proof of Performance and Signal Leakage; and Installation Training.

Training locations, dates, fees and class sizes vary from course to course. Call 215/830-5678 for more information.

Jottings

A memorial trust fund has been set up in the memory of **Jimmy Schulz**, director of technical services for Superior Electronics, who died unexpectedly during the National Cable Show last month. Persons who wish to make a contribution should send it to: The Jimmy Schulz Memorial Trust Fund, South Trust Band of the Sun Coast, 1800 2nd Street, Sarasota, Fla. 34236, attn: account # 01141662. Schulz, who died from either a heart attack or a blood clot, left behind two young children and a wife pregnant with a third . . . **Hyundai Electronics America** purchased **TV/Com International** at a fire sale price of $13 million last month. The acquisition gives Hyundai, one of the largest manufacturers of semiconductor memory in the world, the assets of a company that knows how to build secure digital and analog TV systems, including a digital compression system. Hyundai can now pair the company with its existing Digital Video Systems division to supply standards-based systems. TV/Com was sold by Colorado-based investor Oren Benton, who recently declared bankruptcy . . . Lawyers run amok? **Comsat Corp.** has sued two San Francisco area cable operators and General Instrument Corp., alleging the three have infringed upon Comsat's conditional access technology. Comsat says GI "knowingly infringed this patent," which was first issued in 1984 and reaffirmed in 1990. Comsat says it brought the suit as part of an aggressive effort to protect its intellectual property. GI, in response, said it is "considering various legal action against Comsat for its baseless and erroneous lawsuit." GI says it has a worldwide license to use the technology from Scientific-Atlanta, which licensed the rights from Comsat in the first place . . . In an announcement that surprised no one, the seven owners of **Bellcore** say they plan to sell the huge research and development group. Bellcore is presently jointly owned by Ameritech, Bell Atlantic, BellSouth, Nynex, Pacific Telesis, SBC Communications and US West since the breakup of the Bell System in 1984. Last year, Bellcore had revenues of $1 billion and employed 6,000 people. Martin Kaplan, executive VP at PacTel, said the consortium arrangement no longer makes sense because the member companies are increasingly in competition with one another . . . **Teleport Communications** plans to roll out a dedicated private line data service in its Milwaukee operation in hopes of attracting more business from area businesses that want to quickly and securely transfer data between locations. The "LANLink" service will allow users to share files and databases at speeds of 4 Mbps, 10 Mbps and 16 Mbps. Teleport will begin rolling out ATM technology in New York City this summer . . . **Cablevision Systems Corp.** will integrate Arrowsmith Technologies' Fleetcon software system into its field service operations n northern New Jersey. Arrowsmith now provides such systems to eight MSOs and 14 different cable systems . . . **Your Choice TV** will use TCI's National Digital Television Center located just outside Denver to compress and deliver its signal to cable headends around the country . . . **Integrated Network Corp.**, developer of the Allendale interactive multimedia services network, has joined CableLabs' Cable/Information Technology Convergence Forum. The forum was created to provide greater communication between information technology vendors and the cable industry . . . Public Service Electric and Gas of New Jersey has successfully demonstrated **AT&T**'s Integrated Broadband Utility Solution. The demo was done over Garden State Cable TV's HFC network in Moorestown, N.J. CED

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Farming fiber in the Cox empire

On a farm nestled in the lush, rolling green hills of Hamilton, Ala., Hugh McCarley grew up tending cotton and corn, soybeans and garden vegetables, cattle and horses. "And it didn't take me long to realize that I needed to be in cable TV instead of farming," deadpans McCarley, recalling the uncertainty and instability that plague a farmer's life. As it turns out, this southern gentleman traded the uncertainty of weather and crop prices for the instability of high-tech market forces and the temperamental mediums of RF and optical communications. But it is just that volatile quality of the cable industry that he finds so intriguing.

Hugh McCarley

Fortunately, there has been no lack of transition for McCarley, who is now the director of Engineering Technology for Cox Cable Communications' corporate office in Atlanta, Ga., and who has just taken on the oversight of double the amount of plant he had before, as a result of the merger between Cox and Times Mirror. In parallel with his increased system responsibilities, McCarley is looking to implement new technologies for Cox, working closely with broadband vendors to create new products for Personal Communications Services, conducting tests of wired telephony, and keeping a careful watch over the implementation of new fiber optic architectures into system upgrades.

It has been almost a year now since Cox first introduced a new architecture, dubbed "Ring-in-ring," which is significant for the reliability and network survivability that it provides. McCarley's work on Ring-in-ring, as well as his supervision of the company's fiber deployment throughout the United States, recently earned him the 1995 Polaris Award for fiber optic innovation.

Redundant fiber architectures such as Ring-in-ring will be a key factor in the MSO's–and the industry's–new services equation, as will an overall hardening of the cable communications plant itself. "One of the biggest challenges for us in the next couple of years," notes McCarley, "is that we will have to start running plant that is a lot tighter and better maintained. Even though we are breaking it up into smaller pockets with fiber, potentially every drop out there is a problem."

No grass grows under foot

It became apparent early in his career that McCarley would be looking for ways to break with tradition. Fresh out of Northwest Alabama State College in 1972, McCarley knew that there wasn't much call for electronics engineers in his small home town, so he headed for American Television and Communications in Jackson, Miss., where he served as senior maintenance technician, working with the system's headends and studios and conducting FCC tests. At that point, the first of several major industry shifts occurred. While cable had traditionally been a community antenna service, when the FCC gave the go ahead to enter urban markets, the industry suddenly exploded. And in 1976, McCarley leapt at a transfer from Jackson to Birmingham, Ala., and the opportunity to build a large, urban system. As director of engineering for Birmingham Cable Communications, he handled all plant activity: construction, operations, inventory, maintenance, fleet management and leasing. But once the system had become stable, it was time for the restless McCarley to move again. ATC wanted him to transfer his expertise to a new challenge–setting up the first large division of the company in Orlando, Fla., and overall, assisting in ATC's decentralization process by moving more decision-making power out into the field. And after just 18 months in Orlando, he moved on to Cox as an equipment evaluation engineer, testing new technologies in the lab and in field trials.

A commitment to training

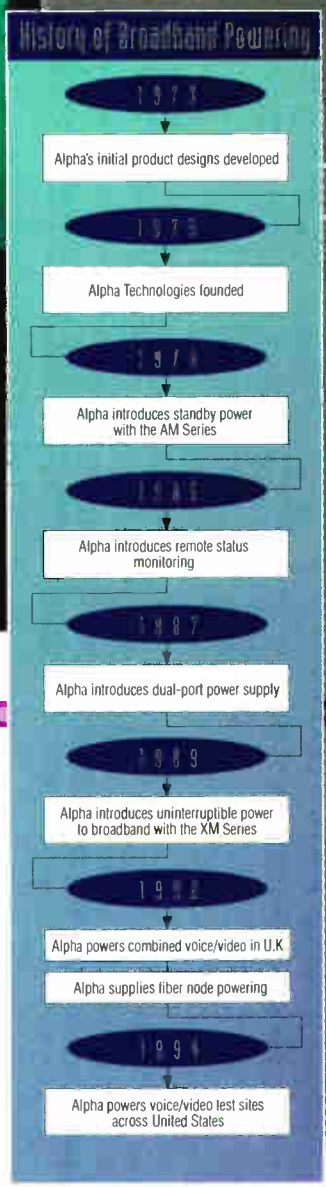
While transition and competition may be invigorating, McCarley acknowledges that they also place major demands on the industry's engineering professionals to keep their skills current with new technology. "We have very good people in the industry, as well as at Cox," he notes, "and we need to make sure that they receive the proper training in order to change with us as we move forward." To advance that goal, McCarley has thrown his energies into professional societies such as the SCTE, in which he serves as a national board member for Region 9 (Florida, Georgia, South Carolina and the Caribbean) and as chairman of the board for the Chattahoochee Chapter. He also works on projects for the Southern Cable Television Association, and the Cable Television Association of Georgia.

And somewhere between his position with Cox and his work with professional societies, McCarley manages to squeeze in a personal life: he still loves to grow things, landscaping and gardening in his free time; he crafts woodworking projects; and he plays golf to distraction. He married his high school sweetheart, Jackye, who is now a real estate agent in the Atlanta area, and they have one son, Chris, who's a junior in high school. And yes, he is a consumer of his product. He watches Discovery, The Learning Channel, sports programs, and the odd episode of "Leave It to Beaver." He's also a fan of cooking shows–especially Southern–and has been known to polish off a plate of fried okra every now and then.

Looking beyond the product of the moment–entertainment–McCarley eagerly anticipates the next major quake in cable. "We will be able to offer consumers anything they want," he concludes. "We believe that we have positioned Cox to be the telecommunications company of the future." CED

By Dana Cervenka

Broadband Powering Leadership.



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ALPHA TECHNOLOGIES

The Power of Experience.

Electronic community mirrors real one

By Wendell Bailey, VP of Science and Technology, NCTA

The Internet, the World Wide Web, the information cloud, the network of networks, hypertext, the National/Global Information Infrastructure, the infobahn, cyberspace–a mere recitation of all of these monikers makes one think of Star Trek and the seamless flow of information and goods in that far off time, and that's not altogether bad. On the other hand, there is a term that is beginning to be applied to this effort by civilized nations to create an all-encompassing network of networks. That term is the electronic community, as in a place where community social values are employed using the protocols and terms of the keyboard and computer networks.

The Internet is blind

This electronic community supposedly has many attributes that are attractive, a lack of class distinction being foremost among those that are mentioned. In fact, I am reminded of a cartoon in which a dog at a keyboard is "speaking" to another dog (a friend, no doubt, who is sitting nearby looking interested). The dog tells his friend, "Yes, it's true! On the Internet, no one knows you're a dog!" Good for a laugh, but also the embodiment of a basic truth. When you (or anyone else) is typing on a keyboard, unless you state what your demographic stats are, no one has any idea of your sex, color, ethnicity or anything else about you.

Surely this is a good thing in terms of a community of people who value intellect and personality to the exclusion of all physical characteristics. The latter may cause the human psyche to put in place one or more emotional or mental filters (known as prejudices) of what information or intelligence it finds acceptable.

And lest you think that this idea of the electronic community is unique to my own depraved musings, let me hasten to assure you that this issue became of interest to me when I was speaking to the city council of a quaint Virginia town that is nestled close to Washington, D.C. proper. This town is known worldwide for its charm and vitality and is indeed held up as a model of pleasant living. While I was leading a discussion of the NII/GII for the council of this town (at their request), one member blurted out, "It's all very good for there to be an electronic community for all of these people, but we already live in a fine community, a community of tolerance and intelligence. And we don't want any of our people moving anywhere else, especially to an alternate community that doesn't have the benefits that we can bring."

What's this? A rebellion against utopia? Because, after all, this cyberspace community could be one of prejudice-free interaction among humankind. Surely a mere pencil pusher (no matter how exalted) operating on regular old dirt and concrete competitive turf cannot object? Well, rather than just state the opinion that they liked their community better than the cyberspace community, several other council members began to speak about things they have observed on the Internet and the World Wide Web. That, coupled with things that I have read recently in the trade journals of the Internet crowd, led me to some thoughts and conclusions of my own.

The first one is that there is an alarming and somewhat naive tendency of people who surf the Internet to believe that everything that they see printed there must be true; every database they find there and every research document contains fact; everyone who gives them an E-mail answer is honest and trustworthy; and that all the people they encounter are just like themselves.

Dark corners of the community

While all of these things are probably mainly true, there is ample evidence that cyberspace is a place much like any other place on the planet, and that while it contains nice, tree-lined streets and beautiful green parks, it also has backroads, dark alleys and dangerous neighborhoods. Theft and chicanery, the electronic equivalent of mugging and out and out fraud–these things, too, live on the Internet. Indeed, the moral equivalent of murder on the Internet may be embodied in the piracy of intellectual property, which is something that is causing all of the people involved in the so-called management of this resource to scratch their heads, have meetings and debate the fine points of the law. It's very difficult to police something as esoteric as these items when they are on the Internet.

In many of the newspapers of the major cities, one can find stories of young people who have begun to live vicariously through on-line activities. The authorities who talk about this phenomenon all bemoan the fact that these kids found a community in cyberspace before they had developed the maturity and social skills needed to function in the actual world. This, in and of itself, is sad, but what is possibly worse is that these young people are ill-equipped to deal with the con men and muggers that they may find on the systems.

So I leave you with these thoughts. If you would like the name of the city that brought this to my attention, do not hesitate to call me. It's a wonderful little place, and as soon as I tell you the name, you will say, "Oh, I know that town. It's a nice town." And secondly, if you are a traveler in cyberspace, remember that not everyone you meet is your friend, and not everyone who gives you bad news is your enemy. Use the same level of judgment that you use in everyday life, and someday, the community known as cyberspace may be as pleasant a place as any that you like to visit in person. CED

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Reflections on my final column

By Chris Bowick, Group Vice President/Technology, Jones Intercable

Eight years ago, *CED* magazine gave me the nod to begin writing a monthly column. The goal was to write a lightly technical column on myriad highly technical topics with primary emphasis on the headend. I was given a deadline for the first installment of June 1, 1987, and was asked to create a "catchy" title for the new column.

That same day, I wrote a memo to Jim Farmer (then a principal engineer working with me at Scientific-Atlanta, now with Antec), advising him of the good news and requesting his help. In the memo, I said: "Now for the hard part . . . they want to know what I want to name the column! I have a couple of ideas, but if you can offer any suggestions, please feel free. . . Some thoughts are: 1."Headend Techniques." 2."Headend Corner." 3."From the Headend." 4."Focus on the Headend. . . ".

Jim later offered a few other suggestions, but after some further discussion, "From the Headend" was born. After eight years, 96 deadlines, 94,080 words and 576,000 characters, I've decided that this will be the final installment.

Over the years, the column has covered a vast array of topics, and most are just as appropriate today as they were eight years ago. My first column, for example, was a tutorial on the topic of return loss and reflections. Today, as we begin the deployment of digital, return loss and microreflections remain a hot topic, and will for some time to come.

Other topics covered during the first year included in-depth discussions of noise figure and carrier-to-noise ratio, the subjective effects of differential gain and phase, audio and BTSC stereo encoder topics, video signal-to-noise ratio and NTSC artifacts.

Later, I covered a range of topics on the video and audio front, including a discussion of Incidental Carrier Phase Modulation, audio companding, audio preemphasis and deemphasis, noise weighting (CCIR vs. RS-250B) and optical vs. electrical power.

One of the columns (August 1988) was entitled, "Docket 21006: A Pilot's View." For those of you who don't remember, that FCC docket, which was first released in 1984, outlined the rules that we follow today for CLI and frequency stability in the aeronautical frequency band. In that column, I tried to provide a better understanding of the aircraft navigation and communications equipment that might possibly be disrupted by high levels of leakage from our plant, and why, from a pilot's perspective, we might want to take heed and meet the deadline for compliance of January 1, 1990.

After that, I continued to focus primarily on video and audio performance, but began to expand into tutorials on related topics. Fully one-third of the year was devoted to a detailed explanation of satellite link performance and the definition and exploration of system G/T. In other columns, I investigated such topics as delay pre-distortion in broadcast transmitters, vestigial sideband transmission and the nyquist slope.

Beginning in March 1991, I began to address the coming digital revolution and its implications for the industry. From March through September, six columns were devoted to such topics as Eb/N0 vs. C/N, quadrature modulation, QPSK and 4-QAM, and 16-QAM. In September 1991 I wrote, "...As we begin to deal with the very high data rates and sophisticated modulation schemes required for the transmission of digital HDTV or compressed NTSC, the better the plant's noise and distortion performance must be for successful transmission. Anything that is done today to improve the performance and reliability of the existing analog plant will have a direct impact on the successful future implementation of any future coexisting analog and digital overlays with respect to performance and reliability."

The following month, I became an operator and moved to Jones Intercable. In the process, I gained a completely new perspective of our business. As a result, "From the Headend" began to take on a new perspective. I began writing on topics like network architecture, the competitive aspects of our business, and the system and operational considerations in the deployment of networks and technology. In the last couple of years, I've escalated the digital discussion to include tutorials on the Internet, local and wide area networking, Ethernet, digital encryption, spread spectrum, TDMA and CDMA and cable telephony.

Last February, I tried my first humorous column, entitled, "The Great Drop Cable Conspiracy" (at least, *I* thought it was humorous). It was a tongue-in-cheek jab at vendors, accusing them of breeding brand-loyal rodents who have an insatiable appetite for drop cable. I received more comment on that column than I had in the entire previous eight years combined!

The final gun

The time has come to put "From the Headend" to rest. Over the years, I've had a lot of fun with the column. The staff at *CED* has been great, and has given me broad license to take the column in any direction that I desired. I must admit, however, that I'm looking forward to having an additional weekend free every month without a deadline looming over me. I hope some of you have found my work to be useful at some point during its eight-year run.

Ironically, Jim Farmer will begin writing a new column beginning next month. Quite frankly, I can't think of anyone more uniquely qualified to do so. In the memo I wrote to Jim in 1987, I closed with the line, "I will, of course, be using you as a sounding board, suggestion box, mentor and editor for the column. I appreciate your support." I really have appreciated Jim's support over the years, and I wish him the best of luck with his column. CED

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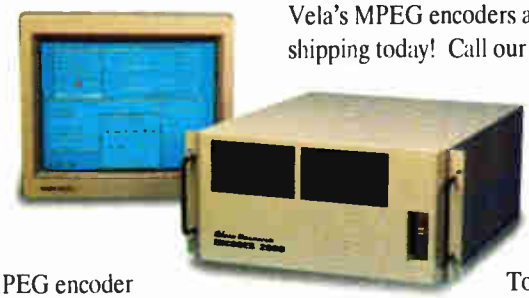

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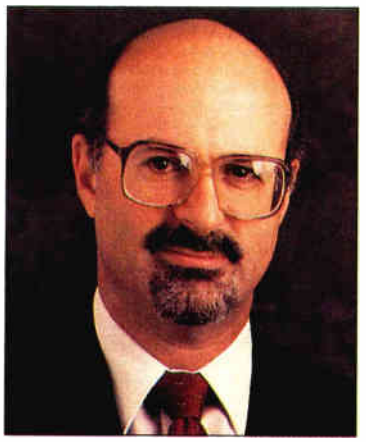

By Jeffrey Krauss, student of techno-politics and President of Telecommunications and Technology Policy, Rockville, Md.

The broadcasters have done it again. They're about to snatch defeat from the jaws of victory. With all their lobbying for "spectrum flexibility," now they're about to learn that flexibility isn't free. The cost could be auctioning of TV spectrum. If so, they could lose the opportunity to broadcast HDTV.

SDTV

Last year, the broadcasters realized that a TV channel carrying a 20 megabit-per-second (Mbps) compressed HDTV signal could be used instead to carry four or six or eight "standard definition TV" (SDTV) signals. They realized they could become multi-channel programmers and compete with cable TV or wireless cable.

Under an FCC policy decision adopted several years ago, broadcasters would transmit their digital signals on a second TV channel. Each TV broadcaster would get to use an additional TV channel for about 15 years, and they would get it for free. This new channel would be used for digital HDTV. The FCC's idea was that consumers would migrate to HDTV receivers over 15 years, and there would be relatively few analog TV sets still in use by the end of this period. At the end of 15 years, the old channel now being used for analog TV would be returned to the government.

Last year's communications legislation contained a section that would have permitted the broadcasters to use the new digital channel for any enhanced video service. For example, CD-quality audio attached to standard definition video would have qualified. Last year's legislation didn't pass, but similar language appears in the 1995 communications legislation. (By the time you read this, the Senate should have finished its work on communications legislation.)

But there's been a drastic change in the atmosphere since last year's legislative efforts. The Republicans now control the Congress. And the Democrats have successfully raised over $7 billion for the U.S. Treasury by auctioning off spectrum for Personal Communications Services. Now the Republicans are looking for something to take credit for, and making the existing broadcasters (or perhaps new players) pay for spectrum is right up there on their radar screens.

Spectrum flexibility seems like a great idea, at first. Let the licensee use the spectrum in the way that produces the highest value. SDTV broadcasting could be a more valuable use, some argue. Broadcasting of SDTV doesn't require expensive new HDTV cameras; it merely requires the same kind of digital compression encoders now being used by HBO, DirecTV and Primestar. It doesn't require viewers to buy a new TV set, it merely requires a new set-top box. They argue that digital SDTV should be viewed as an evolutionary step toward digital HDTV.

But this digital SDTV approach creates some problems. Because viewers can continue to use (and to buy) analog NTSC TV sets, it will take much longer than 15 years for the FCC to take back the broadcasters' analog channels. But the FCC, having recently fallen in love with auctioning the spectrum, wants that transition period to be shorter, not longer.

There has never been any public policy determination that supports multi-channel SDTV broadcasting by a single TV station licensee. On the contrary, the FCC has long had a policy in favor of diversity, giving as many diverse "voices" as possible the opportunity to operate a broadcast station. Rather than one broadcaster controlling four SDTV programs on a 6 MHz channel, this policy suggests the FCC would give that 6 MHz to four different broadcasters, three of which would be new "voices." With digital compression, you don't need a full 6 MHz channel to deliver SDTV.

The FCC may be considering this. They've planned three separate proceedings on HDTV this summer. The third will re-examine the policy of giving each existing broadcaster an additional 6 MHz channel for free. In this third proceeding, the FCC could decide to make broadcasters pay for the additional channel. Or they could decide to auction it off to new wannabe broadcasters.

History repeats

This is the second time that the broadcasters have lost control of the HDTV proceeding. Remember that the broadcasters never really wanted to transmit HDTV signals, because it imposes additional costs on them with no clear expectation of additional revenues. What they wanted to do was stop the land mobile industry from getting access to the UHF television spectrum.

In 1987 the FCC was poised to allocate some of the UHF spectrum for land mobile use. The broadcasters came to the FCC and said, "If you do that, the U.S. will never be able to implement HDTV." But many of the broadcasters never thought that HDTV broadcasting would be technically feasible. They were just buying time. And with the analog techniques that were available in 1987, they would have succeeded. Many of the broadcasters were shocked when General Instrument Corp. demonstrated that digital HDTV was feasible. Rather than a clever ploy to preserve the spectrum against land mobile incursions, HDTV turned out to be a real migration path to advanced video technology.

Last time, broadcasters bet against innovation. This time, they forgot that the spectrum has real value. Spectrum auctions have put that notion front and center.

Broadcasters can still recover the position they abandoned a year ago. If they give up on spectrum flexibility, support a fast migration to HDTV, and agree to give back their old analog channels promptly, all will be forgiven. I hope it works out that way. CED

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that lasts two hours will utilize eight channels if it is to be shown every 15 minutes. This results from the fact that there are eight, 15-minute intervals in a two-hour period. Similarly, if the same movie will be shown every 30 minutes, it will require four channels, as there are four, 30-minute intervals in a two-hour period.

The 90 MHz of bandwidth can be divided up in many different ways, depending on the number of movies to be shown and the intervals between successive starts (e.g., assuming two-hour movies and 8:1 compression, using 120 channels, each of 20 movies can begin every 20 minutes).

What about video on demand (as opposed to near video on demand)? While video on demand is certainly a service that will be provided by the CATV operator, it is not so much bandwidth intensive as it is dependent on an appropriate system architecture (one that segments the system by limiting the number of homes per fiber node), and the addition of intelligent headend and subscriber equipment. The headend equipment will be capable of delivering a single movie to a particular subscriber as needed and may incorporate some form of less-than-real-time delivery (e.g., store and forward). It is expected that a 2,000-household fiber node will require approximately 24 channels dedicated to VOD, assuming 60 percent of the homes passed by cable take basic service, and 25 percent of those subscribe to VOD with a peak usage rate of eight percent. Assuming 4:1 compression, for example, these 24 channels would occupy only 36 MHz of bandwidth.

Regarding standard telephony-over-cable, one 6-MHz channel in each direction will be capable of supporting approximately 375 voice users

Depending on the compression scheme used, the subscriber demand and the number of channels available to the operator for the service, many scenarios can be envisioned related to the provisioning of VOD. In any case, it can be expected that video on demand will require considerably less bandwidth than the 90 MHz shown in Figure 1, thereby freeing a portion of the spectrum for use by other services.

(*Note*: It is assumed here that most systems will not find the need to provide a full slate of NVOD programming and a full slate of VOD programming. Delivery of one service or the other would be most appropriate.)

Telephone service

Telephone service may include Personal Communications Service (PCS) or may be a standard telephony-over-cable service. In either case, the following will serve to explain some of the applicable math.

Regarding standard telephony-over-cable, one 6-MHz channel in each direction (upstream and downstream) will be capable of supporting approximately 375 voice users.

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Assuming a telephony penetration of 25 percent, these two channels can serve a 1,500-home node (1,500 x 25 percent = 375). Two channels in each direction will support approximately 850 voice users. Assuming 2,000 homes per node, these four channels (two in each direction) will support a penetration rate of about 43 percent. The 36 MHz in Figure 1 will support approximately 1,380 voice users. In a 2,000-home node, that equates to a telephony penetration of nearly 70 percent.

(*Note:* The above numbers relating to voice users per channel are based on a Grade of Service equal to P.01. This equates to a call-blocking probability of less than one percent during the busiest hour of the busiest season–BHBS.)

It is signal multiplexing that allows such a large number of users to use such a small amount of spectrum. The bandwidth requirements for a Personal Communications Service will be similar to those spelled out above for standard telephony-over-cable. As time marches on, and multiplexing and compression technologies improve, it can be expected that these services will require even less bandwidth.

Personal computer networking

This particular category covers a wide range of potential services related to data transfer (as with a standard modem). One related scenario might include linking schools together via the cable network to provide a distance learning environment. In this way, for example, a local grade school could tap into the library of a local high school or college. Another scenario may include the private, point-to-point interconnection of business users via the cable network.

Overloading the network with users (and therefore data) will result in data congestion

Products are available today which allow for Ethernet (IEEE-802.3) type data transfer over standard cable television plant. Current technology allows for a digital bit rate of approximately 10 megabits per second (Mbps) to be placed within one 6-MHz channel on the cable network. The number of channels required for a particular service will be dependent upon the number of users on the network and the amount of delay time that is acceptable to the users. Overloading the network with users (and therefore data) will result in data congestion. This congestion results in slower transfer of data. Enough bandwidth will have to be provided to accommodate the number of users and their demands on network speed.

Presently, two 6-MHz channels (one in each direction) will allow for full, two-way 10 Mbps data transfer, allowing approximately 20 to 30 users to share the network without severe delay times. The 24 MHz in Figure 1 will allow for approximately twice that number. The majority of cable operators will likely find most of their success (related to this category) in dealing with point-to-point connections

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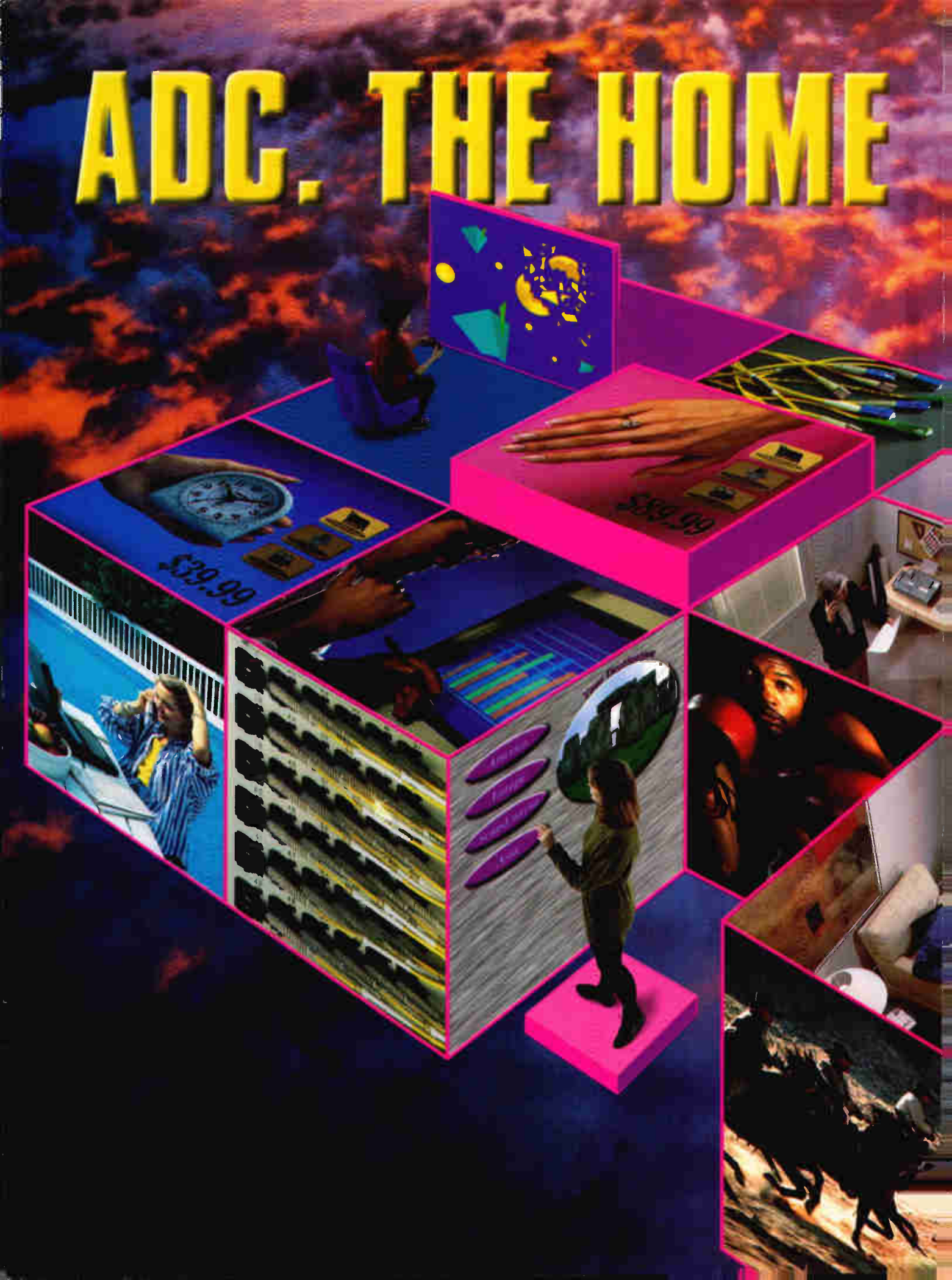
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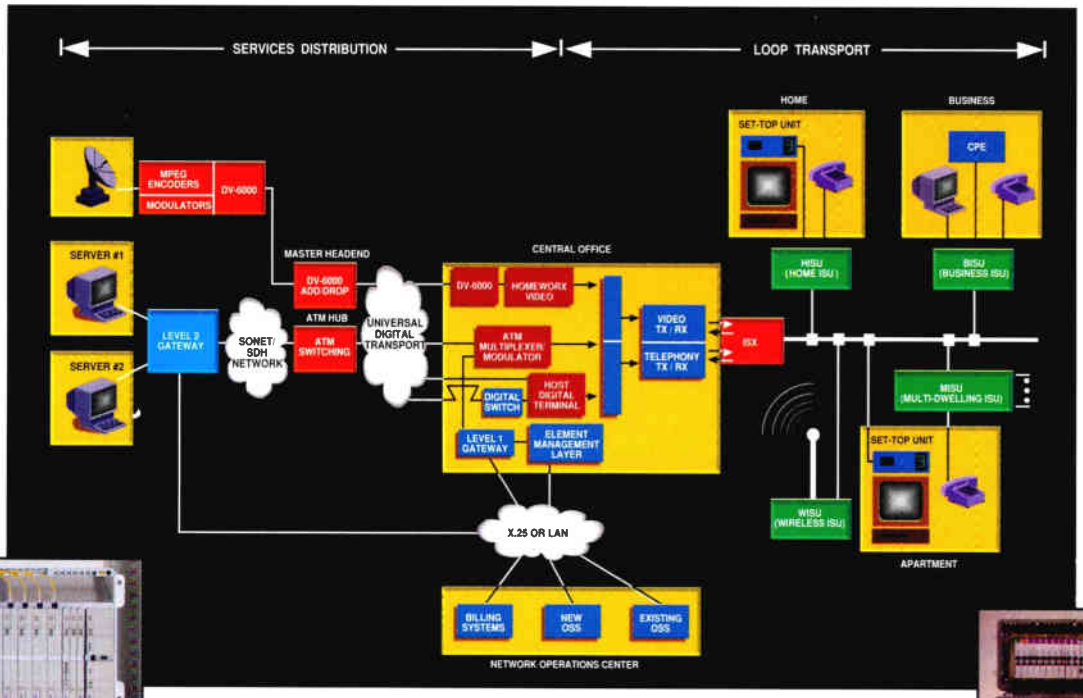

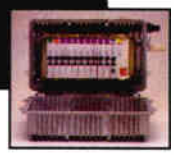

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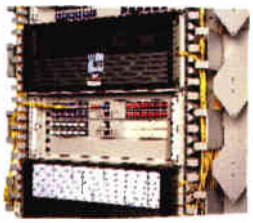

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such as schools and businesses as described above. In these scenarios, 24 MHz should be plenty of bandwidth to provide for a host of options relating to personal computer networking. Again, as technology advances, the bandwidth requirements related to the provisioning of this service will relax.

Digital music

The 18 MHz allows for approximately 30 channels of commercial-free stereo audio programming to be delivered to the customer. The 18 MHz can generally be segregated into smaller portions and placed in the roll-off or FM portions of the spectrum, making it bandwidth-efficient. The programming consists of a wide variety of music, including jazz, rock, country, classical, etc. This technology (known by the trade names DMX, Music Choice, etc.) is already being successfully used by many cable operators around the country.

There are those who will argue that Figure 1 fails to account for other services that may develop five to 10 years from now, and therefore cannot be used to properly assess bandwidth requirements. Figure 2 serves as a counterpoint to that argument.

There are two simultaneous evolutions taking place in the CATV industry:

1. The number and types of potential CATV services are increasing and expanding.

2. Technologies for limiting the bandwidth requirements associated with those services are also progressing.

As technology continues to advance, the use of video compression and other spectrum-saving techniques such as multiplexing will increase. It can be expected that most satellite and pay channels will eventually be compressed, yielding an incredible amount of bandwidth that can be used for other services.

Today's cable operators will find many rewards in limiting their current bandwidth planning to no greater than 550/750 MHz

Figure 2: Bandwidth segmentation (large-scale use of compression)

		= compressed 4:1 (NVOD = 8:1)
Forward only		
Off air, L.O., access	*84 MHz*	*14 channels*
Satellite basic	***72 MHz***	***48 channels***
Pay channels (HBO, etc.)	***11 MHz***	***7 channels***
Pay-per-view	***5 MHz***	***3 channels***
Near-video-on-demand	***90 MHz***	***120 channels***
Subtotal	***262 MHz***	***192 channels***
Digital music service	*18 MHz*	
Interactive (forward/reverse)		
Customer signaling/status monitor	*6 MHz*	
Telephone service	*36 MHz*	
Personal computer networking	*24 MHz*	
Grand total	***346 MHz***	

Practical economics

Before getting caught up in too many arguments about future services, it's worthwhile to take a look at some factors of economics. Relative to system design, and applicable to almost all cable systems, are the following arguments:

1. Any system planned at less than 550 MHz is impractical. With all of the recent advancements in electronics, a 550 MHz build can be done more cost-effectively than a 450 MHz build. In fact, according to most sources, 450 MHz is a thing of the past.

2. As discussed earlier, in order to be prepared to provide the many future CATV services that will be available, a system design which specifies 2,000 (or fewer) homes per fiber node is most desirable. Fortunately, with the cost of fiber-optic equipment dropping, and the availability of a new generation of specially-designed amplifiers and cable, it has been shown that, in most cases, a fiber design serving 2,000-home nodes can be implemented at a lower cost than a conventional coax trunk and feeder design.

If the cable TV engineer follows the above logic and agrees that a 550 MHz fiber design is the most practical starting point for today's rebuilds, a decision then needs to be made regarding the possibility of incorporating a bandwidth greater than 550 MHz. There are three possibilities to consider for design:

1. Build the system at 550 MHz with no regard to future bandwidth expansion.

2. Build the system at 550 MHz, using proper amplifier spacing and an ample amount of fiber to accommodate easy expansion to a higher bandwidth.

3. Forgo the 550 MHz design by immediately building a system with a greater bandwidth.

Which is the right choice? The best answer to this question will be dependent upon the cable company's economic factors, and whether or not the operator feels that he/she will desire to be a provider of such services as telephony-over-cable, distance learning, etc. Community demographics may play as important a role as any in making this decision.

In any case, a few points should be kept in mind. As Figures 1 and 2 suggest, 1 GHz is more bandwidth than most cable operators need to be concerned with. If a system is to be designed with consideration to a capacity of more than 550 MHz, then 750 MHz is an appropriate bandwidth to aim for. In Figure 1, the amount of bandwidth between 564 MHz and 750 MHz can be used for services such as High Definition Television (HDTV), which will require one 6-MHz channel per compressed HDTV channel. This extra bandwidth (up to 750 MHz) can also be used for various digital data services that the CATV operator may want to provide.

A system designed at 550 MHz without a true footprint for expansion to 750 MHz can still be expanded to that higher frequency at some later date. The downside, however, is that the operator will pay a huge premium for extra fiber, construction and high-gain

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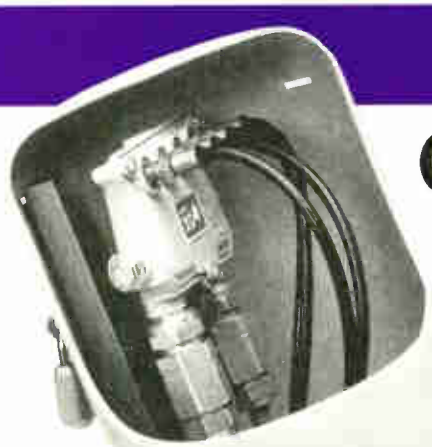

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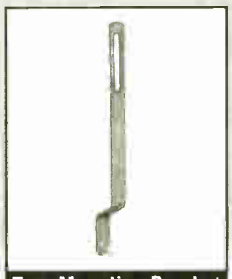

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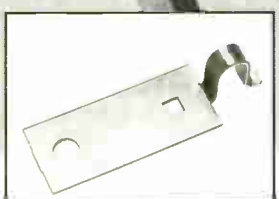

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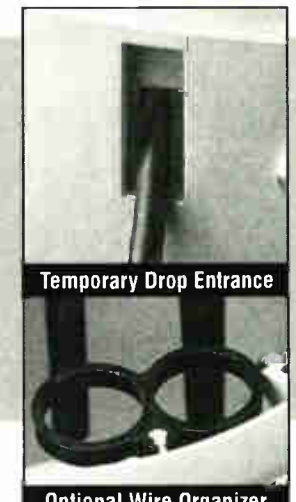

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actives, as compared with the operator who originally designed the system with future expansion in mind.

Finally, a system that is designed at 550 MHz with the proper spacing and amount of fiber to allow for an easy upgrade to 750 MHz will cost approximately 10 percent more for the initial build. However, expansion from 550 MHz to 750 MHz will be relatively painless.

Conclusions

With the advent of such services as VOD and telephony-over-cable, and the continuing development of compression and multiplexing technologies, limiting the number of homes per fiber node is at least as important as (if not more important than) increasing system bandwidth.

Relative to system design, decision-makers can regard a 550 MHz, Fiber-to-the-Service Area (2,000 or fewer homes per node) architecture as a starting point for deliberation. From there, the most important decision is whether or not to consider 750 MHz. If 750 MHz is considered, the operator can either build a 550 MHz system that is spaced for 750 MHz, or the operator can build a 750 MHz system in the first place (which will cost about 10 percent more than a 550 MHz system spaced for 750 MHz). This decision must take into account both company finances and community demographics. For operators building a system today, it is important to keep the following in mind:

1. Depending on the number of channels currently being used for conventional programming services, and taking into account local demographics, many system operators will find that there is no need to plan for a system capacity beyond 550 MHz. Many systems will be able to provide a full slate of conventional as well as interactive programming within that 550 MHz.

The cost premium for the 1 GHz system cannot be readily justified

2. If the operator knows that he/she will want to expand to 750 MHz at some point during the life of the system, it may be more economical to build at 750 MHz in the first place. Otherwise, the operator pays for a full set of 550 MHz electronics now, and has to scrap the entire lot for 750 MHz gear in a few years. In a case such as this, an immediate 750 MHz build will actually end up being less expensive than the 550 MHz build. While this point may sound obvious, it is often overlooked.

A 1 GHz architecture may make sense for those systems involved in pioneering the development of new technologies, but 1 GHz is far too impractical for the overwhelming majority of cable systems. The cost premium for the 1 GHz system cannot be readily justified. (In fact, in most cases it is currently more economical to build a dual 550 MHz plant than it is to build a single 1 GHz plant). Today's cable operators will find many rewards, both now and in the future, in limiting their current bandwidth planning to no greater than 550/750 MHz. CED

Editor's note: This article is an adaptation of an NCTA paper presented in 1993.

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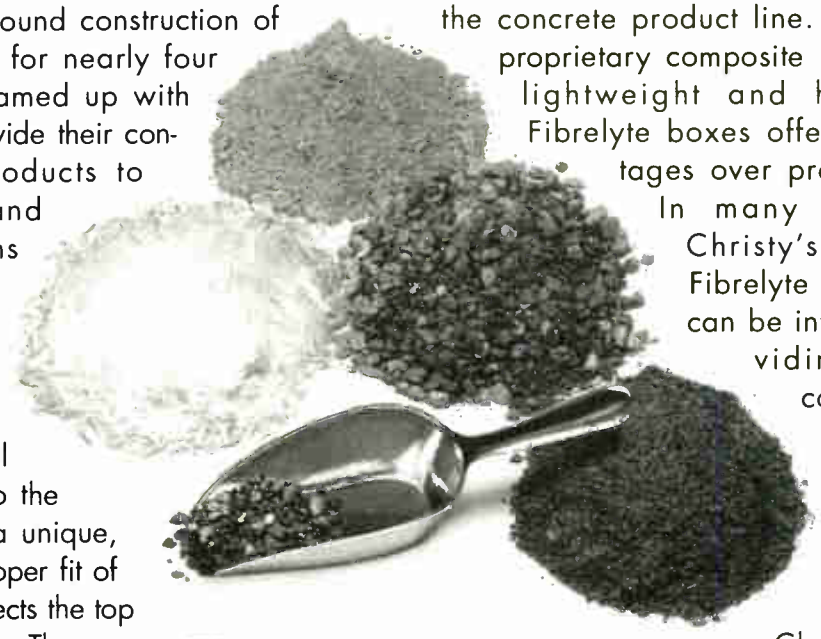

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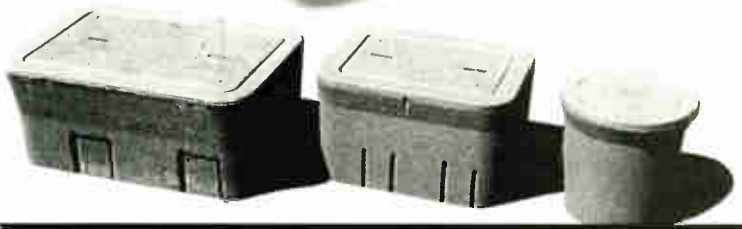

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Common sense techniques for solving the drop cable dilemma

The April 1995 "From the Headend" article by Chris Bowick, titled, "The drop cable dilemma continues," caught my eye. Last month, I was working on drop design ideas which you might be interested in.

Better management of the drop [could be achieved by] printing the footage on drop cable. This would enable the installer to verify the drop length, accurately calculate cable loss, track drop footage, know the amount of cable available on the cable reel, and allow for proper aerial sag between pole spans.

In addition, co-extruding a colored stripe into the drop cable could be used to identify the year in which the cable was installed.

This is nothing new to distribution, fiber and trunk cable. The cost of identifying drop cable is estimated to run about one cent per foot. The benefits are: less cable waste [estimated savings will offset the increased production cost]; an easy way to calculate the drop signal loss–each customer's drop cable length can be recorded; and the year the drop was installed can be easily determined. This would be a comprehensive way to challenge "the drop cable dilemma."

Bob Forde
Technical Operations Mgr.
Viacom, Oroville, Calif.

Mr. Bowick responds: Thanks for your letter and the excellent ideas. Believe it or not, our internal study also indicated that printing the footage on drop cable would be an excellent way for us to better manage the drop–for precisely the reasons you mentioned.

The color stripe, however, did not come up. But it sounds like a great idea.

I'm a regular reader of *CED* magazine and like the breadth of editorial material. I retired in January after 37 years with HP and am enjoying retirement so far, but I have tried to keep in touch with the various technologies. I also continue to edit a quarterly newsletter for an industrial trade association which works on quality and metrology, etc.

As such, I have gotten into e-mail on the Internet to a [moderate degree], and recently got the right software to gain access to the WWW [World Wide Web]. The editorial [by Jeff Krauss in the April issue of *CED*] with all those interesting sites of information was very intriguing. And since I have just started looking for useful types of databases, this sort of guide was particularly interesting for getting started.

Thanks for doing that, and keep up the good work.

John Minck
76251.2776@compuserve.com

Mr. Krauss replies: Thanks for your kind remarks. The Internet is constantly evolving, and I learn about new sites all the time. There are a couple of "free to the trade" magazines that cover the Internet, plus several low-cost popular monthlies that supply an enormous amount of info about the Internet.

Jeff Krauss
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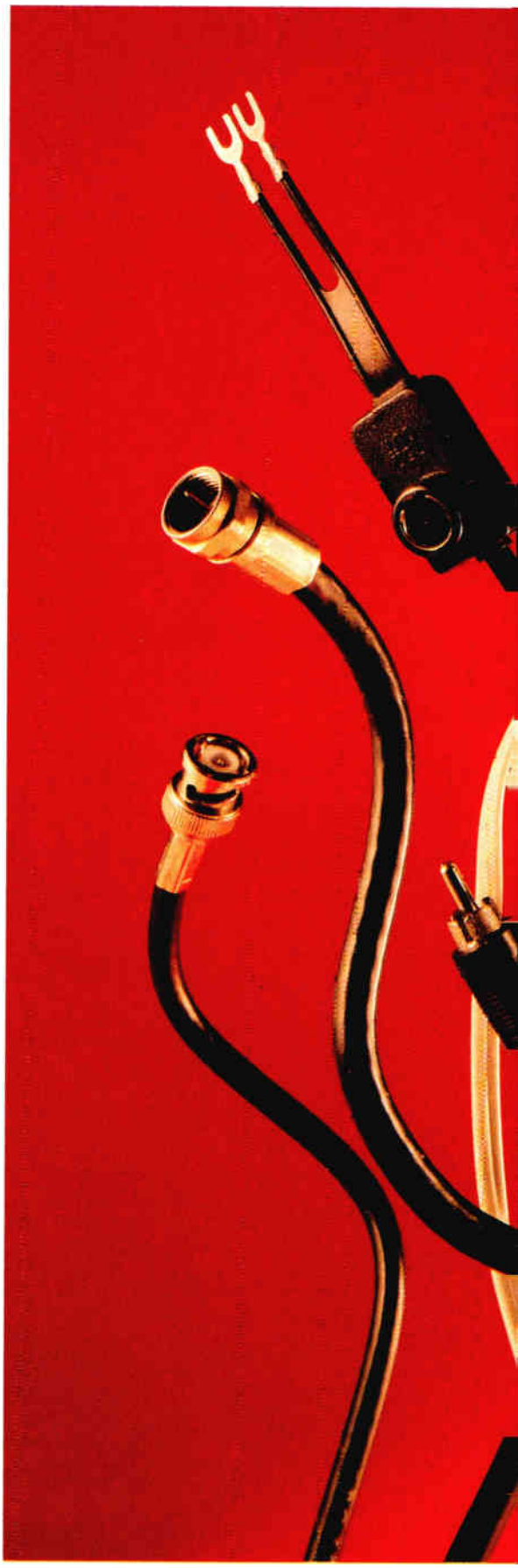
Standards in a digital world

Making sense of the committee process



By Roger Brown

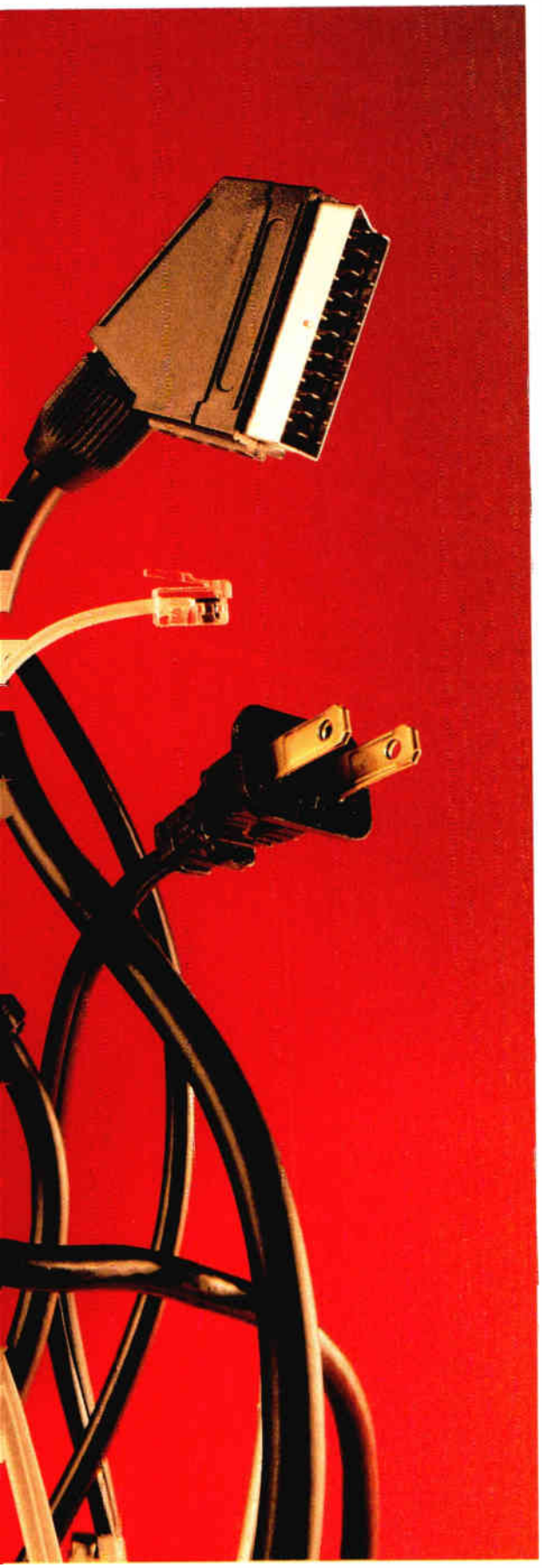
Almost by the time cable operators enter the interactive digital era, they're going to be regulated. Lawmakers are already trying to make sure consumers can buy set-tops at retail outlets, and the Federal Communications Commission has said several times it intends to hold an inquiry on digital standards.

Veterans who remember the days when cable network operators could do pretty much what they pleased will be surprised to know that the interactive environment of the future is already being defined by interests that include the government and standards-making groups so varied no one could possibly track all of them.

History

Standards really aren't new to the industry–technical standards have been around a couple of times and are presently in force–but what is new is where they apply. For the first time, standards will encompass the interfaces to and from one device to another. "The lack of standardization has, frankly, worked to (the industry's) benefit," notes David Large, a former cable system operator who is now a principal with Media Connections Group. "It has given us the freedom to use new frequencies, deploy new services and keep ahead of the pirates by changing our scrambling scheme.

"But," notes Large, "the picture has changed. We



now have a legislative and regulatory mandate that will lead us to standards, whether we like it or not."

Why? What's changed?

The entire landscape has changed, according to Bob Luff, chief technical officer at Scientific-Atlanta. Whereas the industry formerly consisted of thousands of tiny "islands" formed by franchise areas, a future that promises full interactivity with anyone, anywhere will force these once-autonomous systems to cross all artificial boundary lines with universal communications links.

Furthermore, a wide number of industries that used to be separate are indeed converging with a common interest: delivery of video to the consumer. These industries–computer and telecommunications–are familiar with standards and use them successfully to bring about new products and services.

"The future platform on which all of our future revenues lay simply cannot be obtained without interoperability, portability and open standards," notes Luff, who spoke during a panel session on standards at last month's Cable '95 convention in Dallas.

But who develops the standards when there are so many competitive interests? At last count there were at least 50 different groups responsible for developing standards or building consensus. Who can keep track of them all?

"That's the fundamental question," says Wendell Bailey, vice president of science and technology at NCTA. Although it isn't a standards-setting group, the NCTA has taken on the task of trying to monitor as many groups as possible and contribute to those which appear to have the most chance for success, Bailey says. The NCTA board of directors has approved additional funds for Bailey to hire two engineers to help him monitor the groups and put forth the cable industry's viewpoints.

"I call this triage," notes Bailey. "Out of hundreds of committees, I'd guess that somewhere between eight and 15 will be important to us, and another dozen or so we'll need to at least be on the mailing list."

So far, Bailey hasn't hired anyone, but at the time this article was prepared, he was planning meetings with at least two engineers. "This requires careful identification of the groups to determine who will be the most successful. And then we have to cover them."

In the meantime, the NCTA and Cable Television Laboratories (CableLabs) have jointly organized the Science and Technology Caucus, a high-level inter-industry group of leaders who want to ensure the industry has a leadership role in such standards development and to help develop an "enlightened public policy agenda."

The Caucus' steering committee consists of CEOs from seven of the nation's largest MSOs and one programmer, while the technical advisory group that backs up the steering committee is made up of the industry's brightest engineers and visionaries.

But given the inability of the cable and consumer electronics industries to develop an interconnection standard (see story, page 66), is it reasonable to assume a true open standard can ever be developed?

'I'd guess that somewhere between 8 and 15 committees will be important to us'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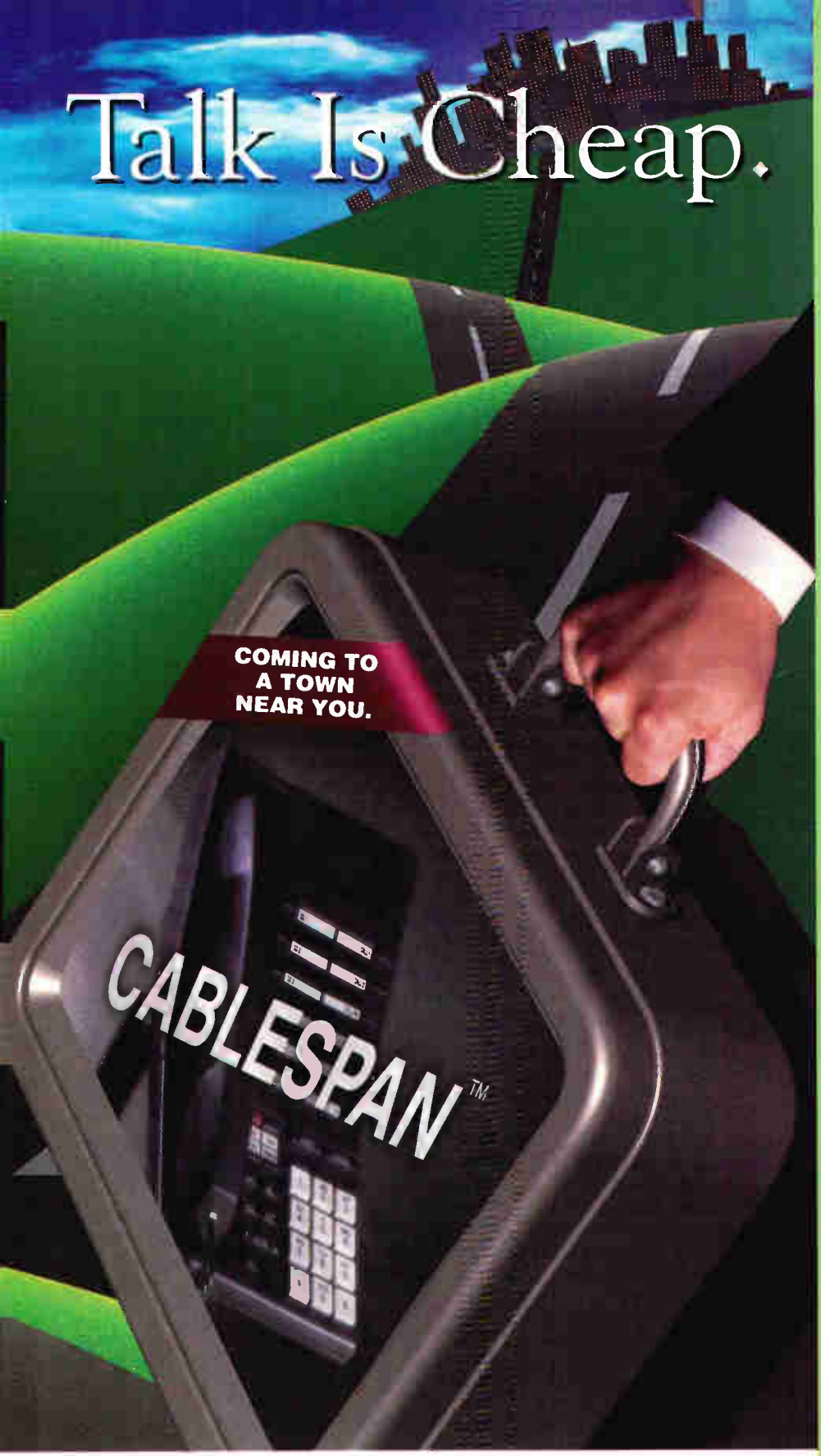

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'Today the world has shrunk electronically, and no one entity can forge a set of standards'

Not only is it reasonable, it's already happening, according to Luff. He believes the actions of the Digital Audio-Visual Council (DAVIC) are non-partisan enough to have a major impact on how interactive digital video networks will look, feel and function in the future.

"Coming to a consensus is more of a problem than people thought it would be," notes Luff. "This is an artifact of the pre-convergence environment where each group had its own suite of industry spokesgroups that looked after their own interests.

"The reality is that today the world has shrunk electronically . . . and no *one* entity . . . can forge a set of standards and protocols and interfaces that are uniquely optimized for their industry," continues Luff. "When that is attempted, the other industries gang up, vote it down, and it won't be approved. We'll have the same stalemate we have today."

DAVIC was convened to overcome those obstacles, to be an "executive director" of sorts, says Luff. Modeled after the successful MPEG standards development, its role is to develop standards for an end-to-end digital system that encompasses all applications, services, networks and hardware that have a prevalent digital component.

This committee effort attempts to incorporate the best components of each system and enlist input from world experts. "When companies began to work together (on MPEG), the compression process and algorithm became embarrassingly better than any single proposal," says Luff.

However, such efforts are often met with great skepticism among people who know how difficult it is to blaze new paths without alienating existing participants who have their own agendas. DAVIC is already turning heads by choosing quadrature amplitude modulation (QAM) as its digital modulation scheme–an approach that is incompatible with the U.S. advanced television standard, which uses vestigial sideband (VSB) modulation.

The Digital Audio-Visual Council made "tremendous progress" by agreeing to freeze a modulation specification based on QAM during its last meeting in Rome, says Luff, who is a member of the DAVIC management committee. Agreement on the specification was unanimous, with Zenith abstaining.

With the exception of three variants, agreement was reached on all the major descriptors of the modulation portion of the DAVIC standard. The three variants include: alphas, or guardbands; burst noise, a recently discovered impairment that is not totally understood; and differences over Reed-Solomon error correction implementation. The expectation is that these variants will be investigated and that a spec will be frozen by the time this article is published.

Zenith, for its part, has some reservations about the DAVIC work. "DAVIC purports to do international standards, but the extreme testing the ATSC did (for advanced TV) is there for the world to see," says Vito Brugliera, vice president, technology market planning at Zenith. "What is apparent to me is the lack of real concrete data defining these systems, and I don't think three months of testing will demonstrate their viability."

But that's the nature of a compromise, counters Luff, who noted that during the last DAVIC meeting, Scientific-Atlanta, General Instrument, Europe's Digital Video Broadcasting group and other competing factions were "willing to put their intellectual property rights on the line to make this happen."

Digital set-tops

Another group gaining acceptance is VESA (Video and Electronics Standards Association), which has been working on a draft open set-top standard for the digital era.

The VOST (VESA Open Set-Top) committee is specifically focused on developing hardware standards for set-tops, including: features and interconnections of subsystems for video and graphic display; audio playback; decompression; networks; add-on peripherals; and placement and interconnection of security features.

The group recently announced an alliance with the NCTA where the Science and Technology Caucus mentioned above would "work closely with VOST to determine appropriate, optimized standards for digital set-top boxes," according to a statement released by VESA. Similar agreements were announced with the National Association of Broadcasters and the Interactive Television Association.

A recent meeting of content developers resulted in a recommendation that set-top manufacturers supply as many high-end features and as much memory as possible, in order to support high-quality graphics for interactive TV, according to Frank Schwartz, chairman of the committee.

At the heart of the matter is whether hardware manufacturers should spend additional money to generate high quality graphics, or continue to build less expensive set-tops with fewer capabilities. "This is a classic struggle," says Schwartz. "But (the content developers believe) that the extra money leads to higher quality, which leads to more compelling content, which leads to greater usage. And more usage means higher revenues. We believe the return revenues will more than offset the costs," he added.

Set-top makers have historically been under tremendous pressure to provide as much functionality as possible for about $110 for analog set-tops. Schwartz says a digital box costing in the $300 to $400 range could have sufficient memory and graphics capability to support interactive TV.

In general, "there was a surprising amount of consensus on most issues," said Schwartz.

But with literally dozens of standards-making activities taking place every day, the concern is that the cable industry will find itself faced with a standard that was developed without its input. If that happens, the environment will resemble the current struggle between the NCTA and the EIA to find common ground.

"The key here is content," notes Luff. "Our business runs on consumers buying content and having to tolerate the technology to get to that content." CED

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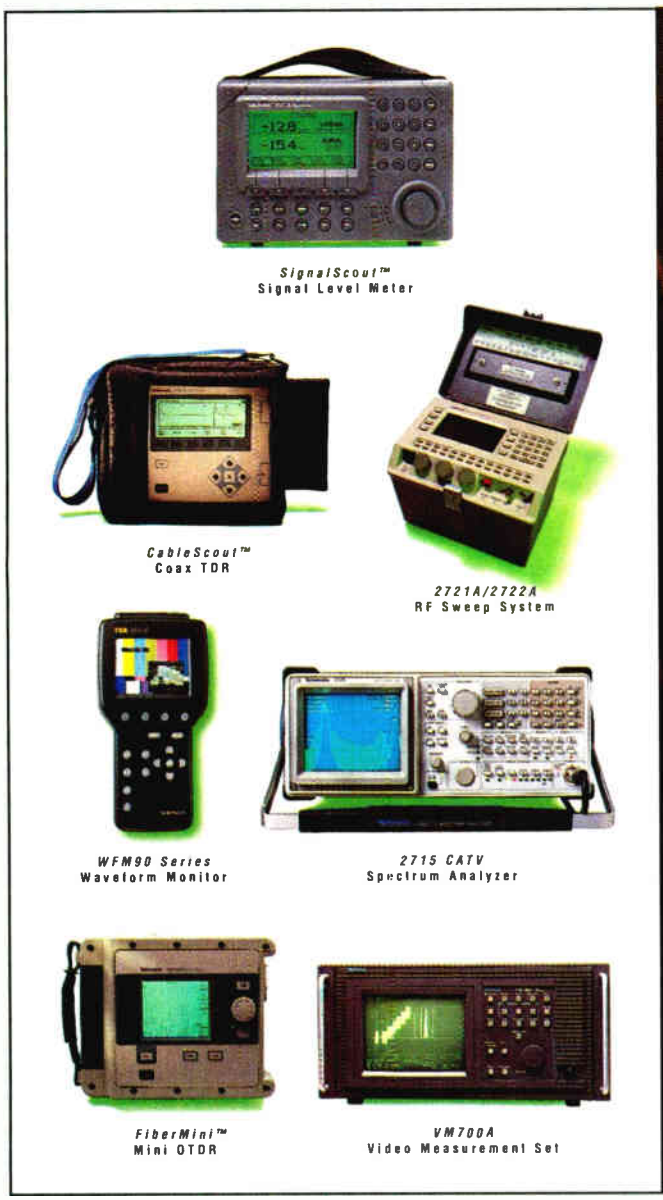

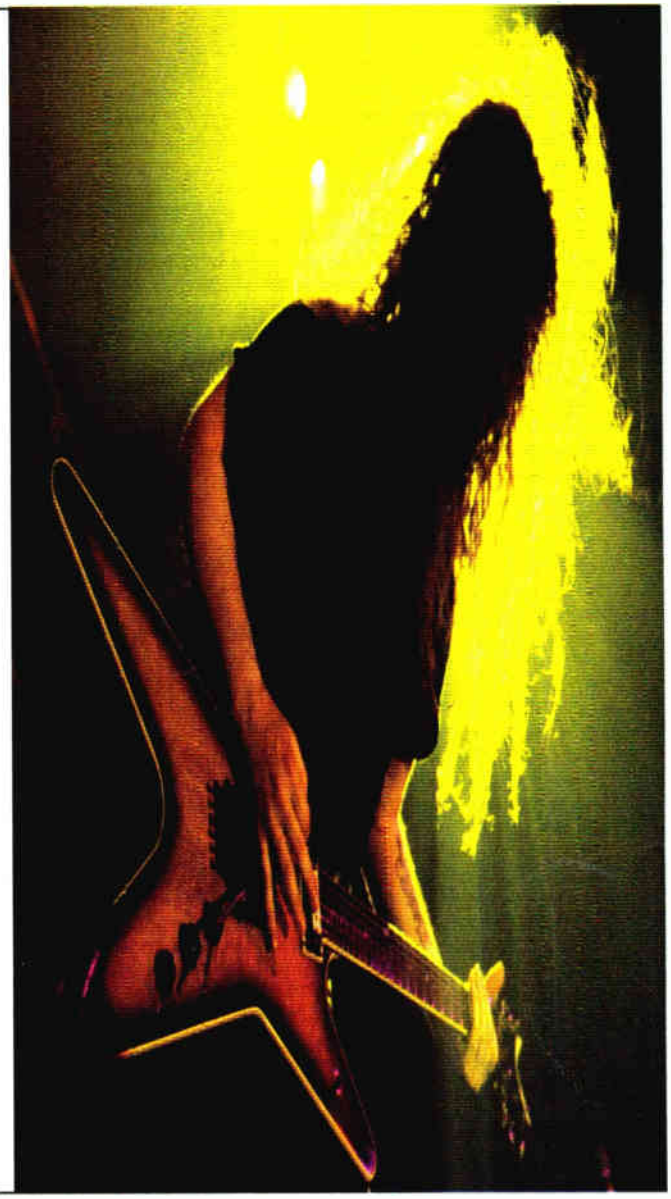

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Hundt to deliver Cable-Tec keynote

Tutorials, workshops fill program

Reed Hundt, chairman of the Federal Communications Commission and the man many in the cable industry love to hate, will be the keynote speaker during this month's Cable-Tec Expo, hosted by the newly-named Society of Cable Telecommunications Engineers.

Hundt's pre-recorded comments will be presented during the Society's annual engineering conference, just prior to the annual awards luncheon on Wednesday, June 14, at about 11:45 a.m.

The addition of Hundt's comments to the program is indicative of the importance of technology and engineering in today's climate. "It's a great honor to have such a prominent official address this year's Expo attendees," said SCTE President Bill Riker. "This is an unprecedented event in the history of the Expo. With all of the current interest in FCC legislation and regulations, I am certain that Hundt's presentation will be a high point of the conference."

Also new this year is the addition of pre-conference tutorials on Tuesday, June 13. Four different tutorials will be presented concurrently from 2 p.m. to 3:15 p.m., and again from 3:30 p.m. to 4:45 p.m. at the Las Vegas Convention Center. Tutorials include:

✔ Audio quality, in room N221. Dom Stasi of TCI, who chairs the NCTA Engineering Committee's audio quality subcommittee, will lead a discussion of audio quality issues and provide an update on the group's focus and progress to date.

✔ Effective learning strategies, in room N223. Ron Hranac of Coaxial International and Pam Nobles of Jones Intercable give insight on the best ways to teach–and learn–new ideas and technologies.

✔ Organizing safety training programs at the system level, in room N227. SCTE staffer Ralph Haimowitz and Barbara Wyatt of TCI provide tips on how to put together effective training and safety programs to avoid injuries and reduce on-the-job risks.

✔ "The Future is on Cable" public affairs program, in room N232. Hosted by Rob Flynn, senior director of advertising and special projects for NCTA. Once again the SCTE and NCTA collaborate on a tutorial for cable installers and techs who will be responsible for carrying out the new customer service guarantees promoted in this industry-wide public relations campaign.

In addition, several key meetings of SCTE engineering subcommittees will be held on Tuesday, also in the Convention Center. From 9 a.m. to noon, the design and construction subcommittee will gather, while the interface practices/in-home cabling group will meet from 9 a.m. to 5 p.m. Finally, the EBS and maintenance practices and procedures subcommittee will meet from 1:30 p.m. to 5 p.m.

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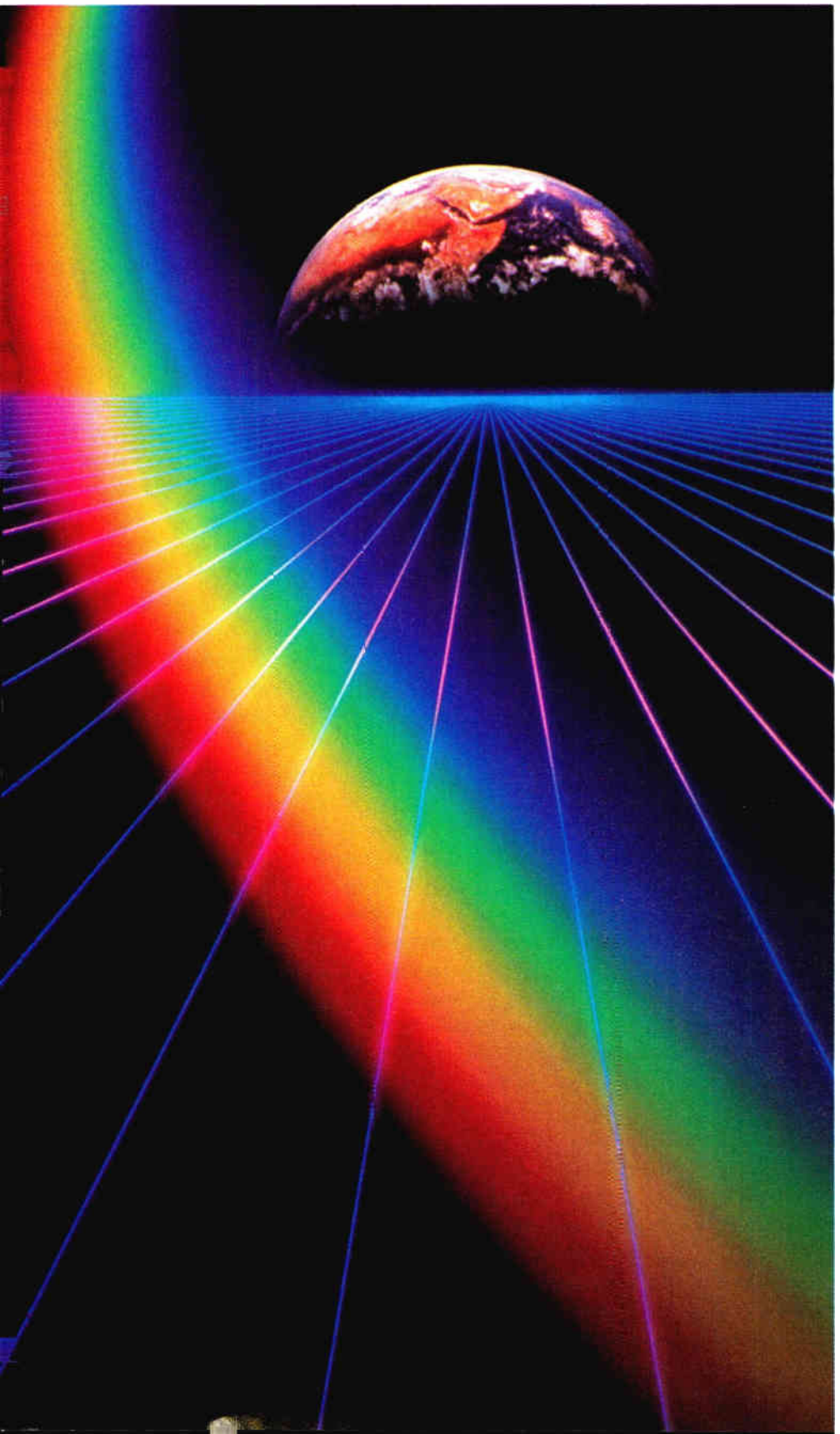

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These engineering subcommittees are always seeking additional members to join the groups, and participation can be used toward BCT/E recertification. Attendees are urged to arrive early and attend these standards-setting meetings that shape the technological future of the industry.

Those meetings will be followed on Wednesday by the annual engineering conference and awards luncheon. The engineering conference will focus on four key areas: system operations, network design, digital technology and telephony.

Ted Hartson of Post-Newsweek Cable will, in his role as "Dr. Strangeleak," moderate a panel on "Improving System Operations–Building on a Firm Foundation," that includes presentations from Syd Fluck of HP/CaLan, Ron Hranac of Coaxial International, Bill Nash of TCI and Pam Nobles of Jones.

Polaris Award winner Hugh McCarley of Cox Communications will moderate "Designing Tomorrow's Broadband Network," which will feature papers from Gaylord Hart of XEL Communications, Al Johnson of Synchronous Communications, Mark Myslinski of General Instrument and Andy Paff of Antec.

"Advances in Digital Technology" will be hosted by Rex Bullinger of Hewlett-Packard. This session will feature talks by Mark Globuschutz of US West, Leo Hoarty of ICTV, Brian James of CableLabs and Jim Radmann from Milwaukee Cable Advertising.

Finally, industry veteran Joe Van Loan moderates "Telephony and the Cable Industry," which features John Anderson of Rogers Engineering, Chris Barnhouse of Time Warner Communications, David Hume of Motorola and Tom Staniec of Time Warner.

Prior to the Expo exhibit hall opening on Thursday, June 15, and Friday, June 16, a series of workshops that focus on real-world issues will be held. These workshops run concurrently over both days and attendees are encouraged to attend as many as possible. The subjects are as follows:

"Alternative applications of hybrid fiber/coax systems," with Mike Nelson, Media General Cable, and Mark Davis of Cox Communications.

"Ask the FCC," with staffers Mike Lance, Priya Shrinivasan, John Wong and Priscilla Wu.

"BCT/E technical certification," with Marvin Nelson, SCTE.

"Digital technology 101," with Megel Brown of Comcast and Helen Chen of Hewlett-Packard.

"Emergency Alert Systems," with Dr. Helena Mitchell of the FCC, Shellie Rosser of Antec and Ken Wright of Intermedia Partners.

"Network architectures," with Jim Kearney and Carl McGrath, AT&T Bell Labs.

"Powering for reliability," with Greg Hardy, Scientific-Atlanta, and Tom Osterman of Alpha Technologies.

"Practical CATV networks," with Bill Morris of Corning Inc., Tony Nieves of Keptel Inc., John Phillips of Siecor and Walt Srode, Philips.

"System tests and measurements," with John Cecil of Hewlett-Packard and Brad Harris of Tektronix.

"Telephony 101," with J.R. Anderson of Antec, Justin Junkus of AT&T Bell Labs and Ralph Haimowitz, SCTE.

The Expo wraps up on Saturday, with the final round of BCT/E and installer certification testing as well as the annual golf tournament, which gets underway at 8 a.m. CED

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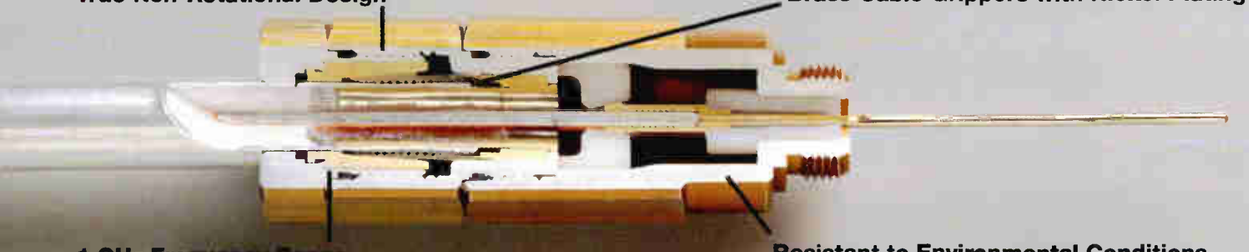

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Attenuation, max. dB	Reduces need for repeaters on long runs	0.2	Not Reported	Not Reported
Hex nuts all same wrench size	Reduces costs for installation tooling and makes installation foolproof	Yes	No	Yes
Positive stop installation	Gives positive proof of proper installation	Yes	No	Yes
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Aluminum Finish	Superior corrosion resistance	Heavy	Light	Clear - Not Visible

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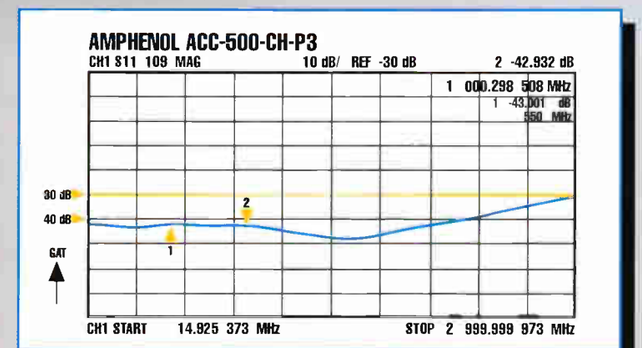
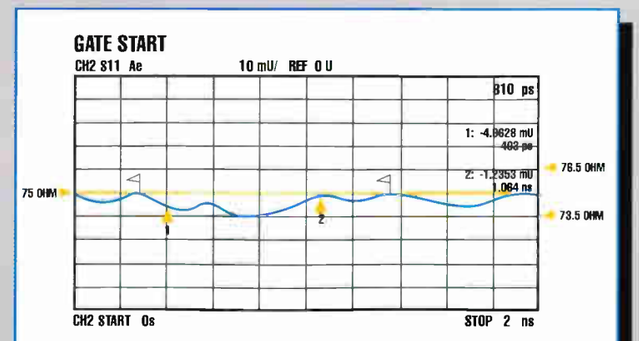


Impedance



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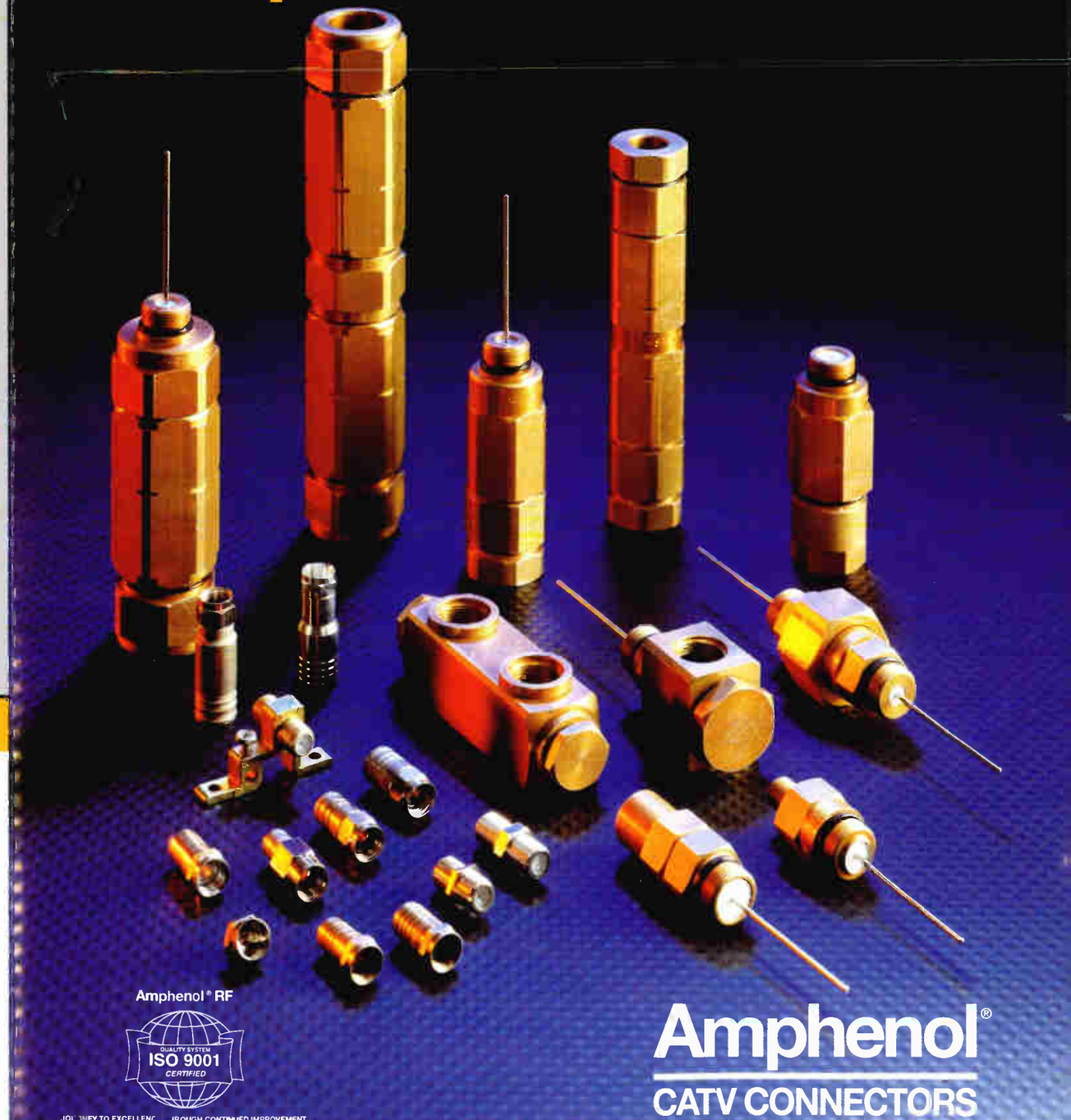

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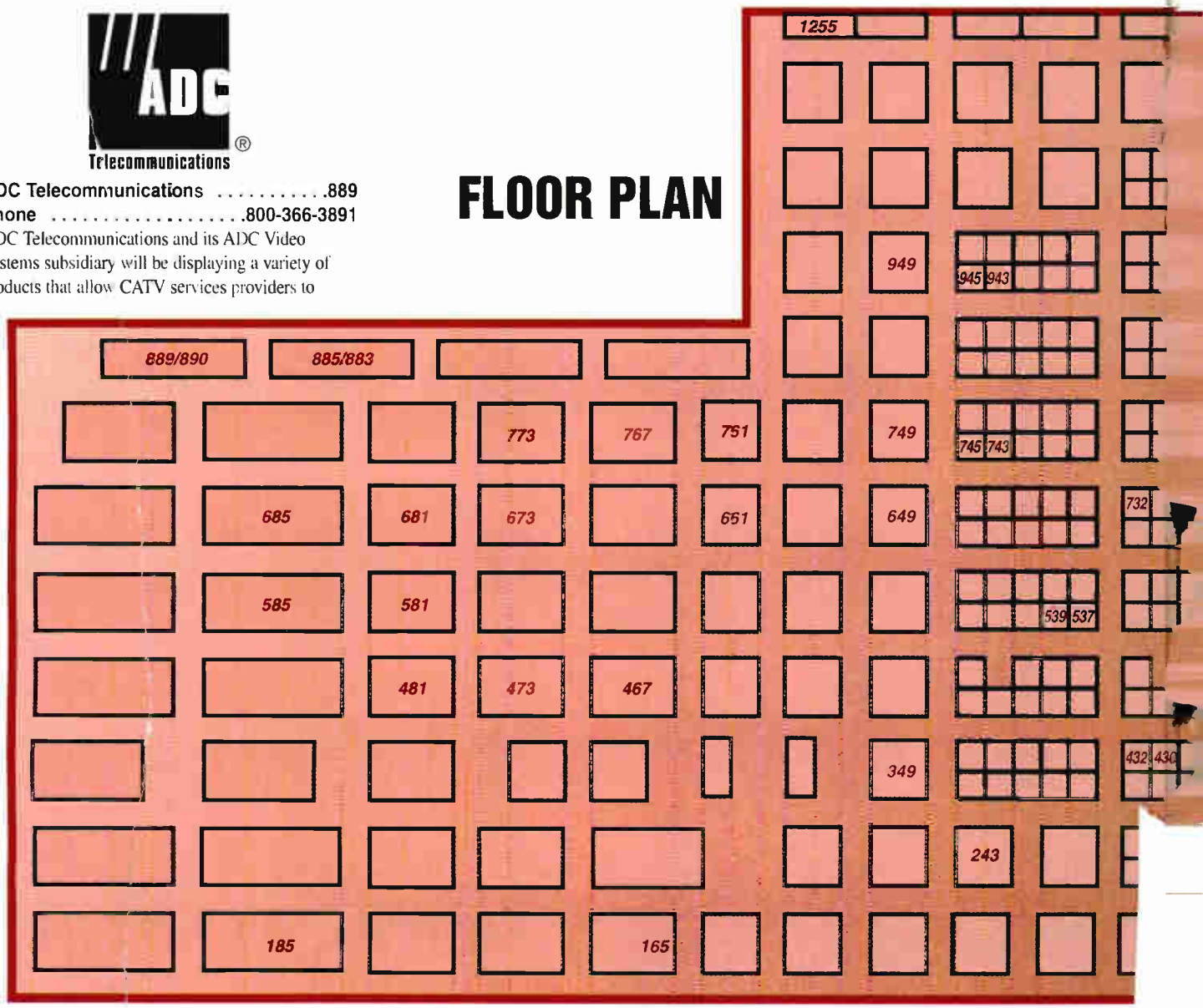

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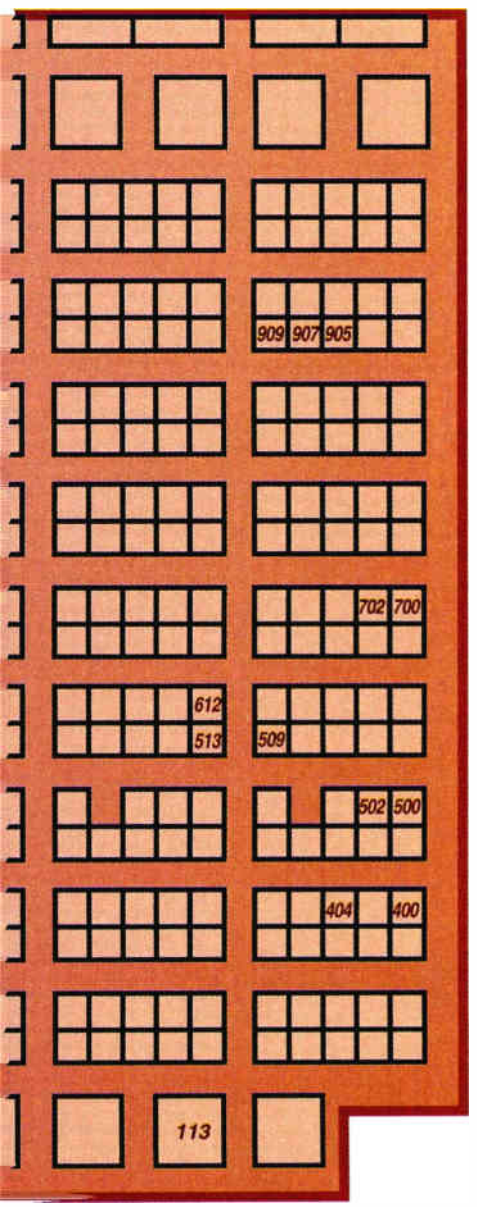

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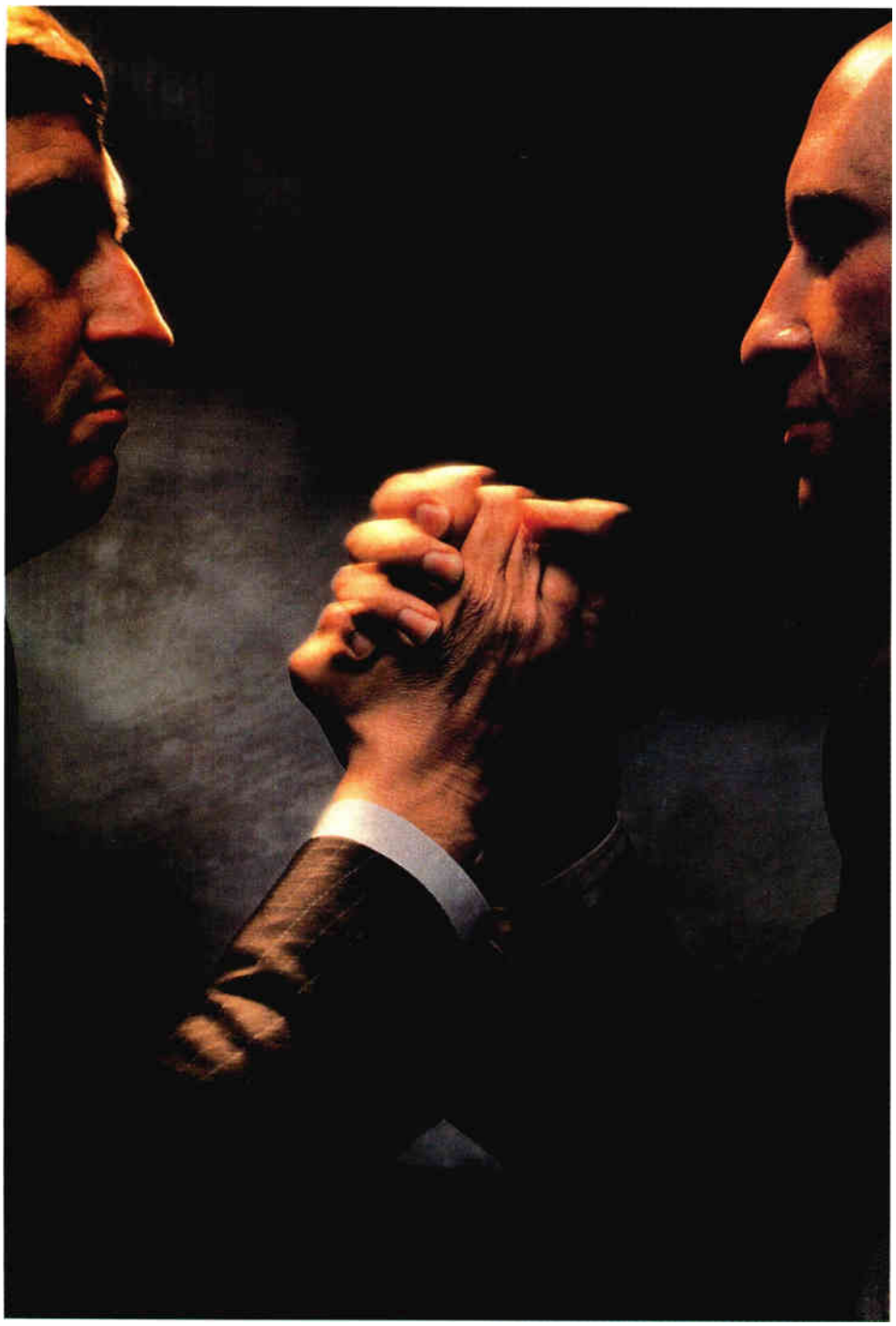
In-home wiring: an arm wrestling match

Debate arises over best way to ensure competition



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By Dana Cervenka

One of the legacies of the Cable Act of 1992 is that cable operators are now required to offer their "inside wiring" to customers who disconnect from their service: if those customers elect not to purchase the wiring, the operator has 30 days in which to remove it, or lose it. While this provision is being quietly implemented as it applies to single family homes, a controversy has erupted in its application to multiple dwelling units (MDUs). That controversy is leading to a wiring tug-of-war, with cable operators pulling at one end, and wireless cable, telcos and other service providers pulling at the other.

In that battle, one of the major skirmishes concerns the definition of where the inside wiring physically begins and ends. When the Federal Communications Commission adopted its rules, it defined the subscriber's inside wiring to terminate at 12 inches outside of the single family home, or, in the case of MDUs, at 12 inches outside of the dwelling unit. Anything beyond that 12 inches is the property of the cable operator. Several groups, including telcos, microwave and SMATV operators, however, objected to the FCC's definition and filed petitions seeking to move the demarcation point beyond the 12-inch mark, to locations where they say it would be much easier to gain access to the wiring, and thus provide service.

Battle in the Big Apple

The most well-publicized wiring disputes have occurred in New York City between Time Warner Cable, and wireless provider Liberty Cable, headed by President Peter Price, former publisher of the *New York Post*. In NYC alone, it is estimated that Time Warner has spent $100 million on inside wiring. And it is to that plant, as well as to that of Cablevision, that Liberty seeks access.

The wiring access issue, says Liberty's Price, is one of basic competition. "How does an individual actually get [other services] without having their floorboards torn up? If you don't address that, forget about programming and technology–there simply will be no effective consumer choice."

Liberty, which currently has about 30,000 subscribers in New York City, has been successful with its approach of privately negotiating with each individual building (apartments, hotels, and other MDUs) it wishes to serve, often by undercutting the incumbent cable operator's prices and offering other special incentives to building managers. Those managers who contract with Liberty for service

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ALCATEL

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must agree to switch all of their residents over to the wireless cable provider.[1]

But Liberty has had some difficulties in reaching its customers. The current definition of inside wiring, says Price, does not go far enough to allow competitive cable providers easy access to subscribers, and is an arbitrary point of demarcation. For example, in the case of MDUs, the 12-inch demarc may be encased in the concrete floor, in the wall, or at some other equally inaccessible location.

For the MDUs it currently serves, Liberty has chosen to connect up either to the junction box in the stairwell, or to a point in the basement where the MATV wiring connects to all of the apartments, and in some cases, is running its own wiring into the building's hallway molding, where space permits. The latter approach is not without problems, notes Price, as there is often precious little space for another provider's wiring to run alongside the incumbent's in the conduit.

"What's the fourth and fifth Liberty of the world to do?," he asks. "Try to jam more in two months later? It's just unworkable." Not only that, but the ownership of the molding itself is often in dispute as well.

A universal demarc

It is because of these physical barriers that Liberty is proposing that a "universal demarcation point" be defined by the Commission. In a letter to the FCC's John Nakahata, who is special assistant to the Office of the Chairman, Price defines that demarc to be "where the individual subscriber line meets the common lines of the incumbent cable provider." For single family residences, that would move the demarc to the pole; for MDUs, depending on the age of the building, that would usually mean that the connection point would be moved to the junction box.

Price feels that this approach is the most sensible solution for providing access to more than one service provider. In the case of single family homes, he believes that, "the consumer won't rewire his home, or turn his backyard into spaghetti to have six competing suppliers run six cables to his house."

Industry sources say that the FCC has some reservations about whether the proposed universal demarcation point would really foster competition, or whether it would merely supplant one provider with another. The broad bandwidth required by video services does not permit the provision of multiple, multichannel services down the same wire. And new services such as interactive video and cable telephony will only compound the bandwidth problem. Separate, parallel facilities would be required to offer more than one service to the consumer.

Price dismisses the bandwidth issue: "There is always a way to serve the one or two people who want multiple services from different suppliers, even though it makes no economic sense." In his letter to Nakahata, he cites consumer behavior in the long distance arena as an example, where few residential consumers choose to sign up for service from different interexchange carriers simultaneously.

The situation in New York is not likely to calm down anytime soon: Liberty's next move will be to offer service to single family residences in suburban New York.

Time Warner, of course, has a rather different view of the inside wiring issue. What operators like Liberty are really after, says Larry Pestana, vice president of engineering with Time Warner Cable property Paragon Cable, is to commandeer the entire, interior wiring infrastructure that Time Warner originally paid for and built–and not just the 12-inch portion that the FCC has earmarked for the wireless operator's use. For a typical MDU in New York City, that original investment in inside wiring could run as high as $200 per unit.

'We should have as many wires to the apartment as there are competitors'

Consumer choice

It is not the cost of the drop wiring itself that is irksome to Time Warner–the operator is generally satisfied with the six-cents-per-foot fee it is paid for inside wiring when a customer elects to purchase it. Pestana, like Price, says that the main issue revolves around allowing consumers to have freedom of choice. He does not agree with Price's view that sharing the same facilities will promote competition among service providers

Pestana explains that the plethora of new, broadband services scheduled to reach the home in the near future will demand separate pipes. "We should have as many wires to the apartment as there are competitors," he declares. "If you have a single piece of coax going into a customer's apartment, that means that they have to buy data services, and video and telephony services that the cable companies will be offering, all from the same guy–I don't think that's competition."

And even before new services are launched, there are technical issues today that are associated with Liberty's approach of connecting into Time Warner's junction boxes, says Pestana. "We have had some problems with signal leakage, and the overall maintenance of the plant becomes a problem," he reports. "As we start offering more sophisticated services, the integrity of the plant becomes more important, and they are not helping that at all."

This has also led to a system management problem. With techs from two different companies working on the same part of the plant, Pestana can no longer hold his people accountable for the condition of the wiring inside the box. Time Warner also reports instances in its New York City systems of cuts in tags used to identify their cable, resulting in Liberty's inadvertent disconnection of the wrong subscribers.

To be revisited

Though the FCC undoubtedly adopted the inside wiring provision in order to stimulate competition and promote consumer choice of services, it's undeniable that operators around the country have an investment of billions of dollars in labor and materials for the inside wiring portion of their plant. While some of that cost was recouped in installation fees, a good portion of it was not, as operators offered free installation as an incentive for new customers. Competitive providers won't have to incur those same costs if they can gain control of the wiring at some central point.

Organizations like the NCTA are keeping a close eye on the inside wiring issue because "in our view, getting control of the cable drop wiring is the whole ballgame," says a spokesperson for the association.

How will the issue be resolved? While there has not been much visible activity on the issue from the Commission since its January meeting, the wiring issue may soon become part of larger interconnection legislation to be born in Congress. The USTA (United States Telephone Association) has filed a petition asking the FCC to take a closer look at the whole wiring topic as a part of the interconnection issue, noting that the cable and telco industries are rapidly converging, and a common set of rules should govern both the industries. CED

References

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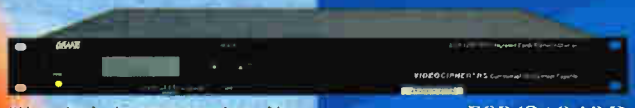

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DRAKE

Compromise reached on command set

Compatibility fighters find some common ground

By Roger Brown

After a lengthy and contentious period of negotiations over the grubby engineering issues surrounding the decoder interface standard, representatives of the National Cable Television Association's engineering committee and the Electronic Industries Association have apparently struck an accord that may finally lead to a compromise agreement. That is, if a new debate between the cable engineers can be set aside.

During an April 19 meeting that was termed "very amicable" and "problem-solving in nature" by Dr. Walt Ciciora, the longtime cable engineer who is now an industry consultant, expert on consumer electronics interface issues and the cable industry's lead negotiator, the two sides reached "an agreement in principal" on several thorny issues.

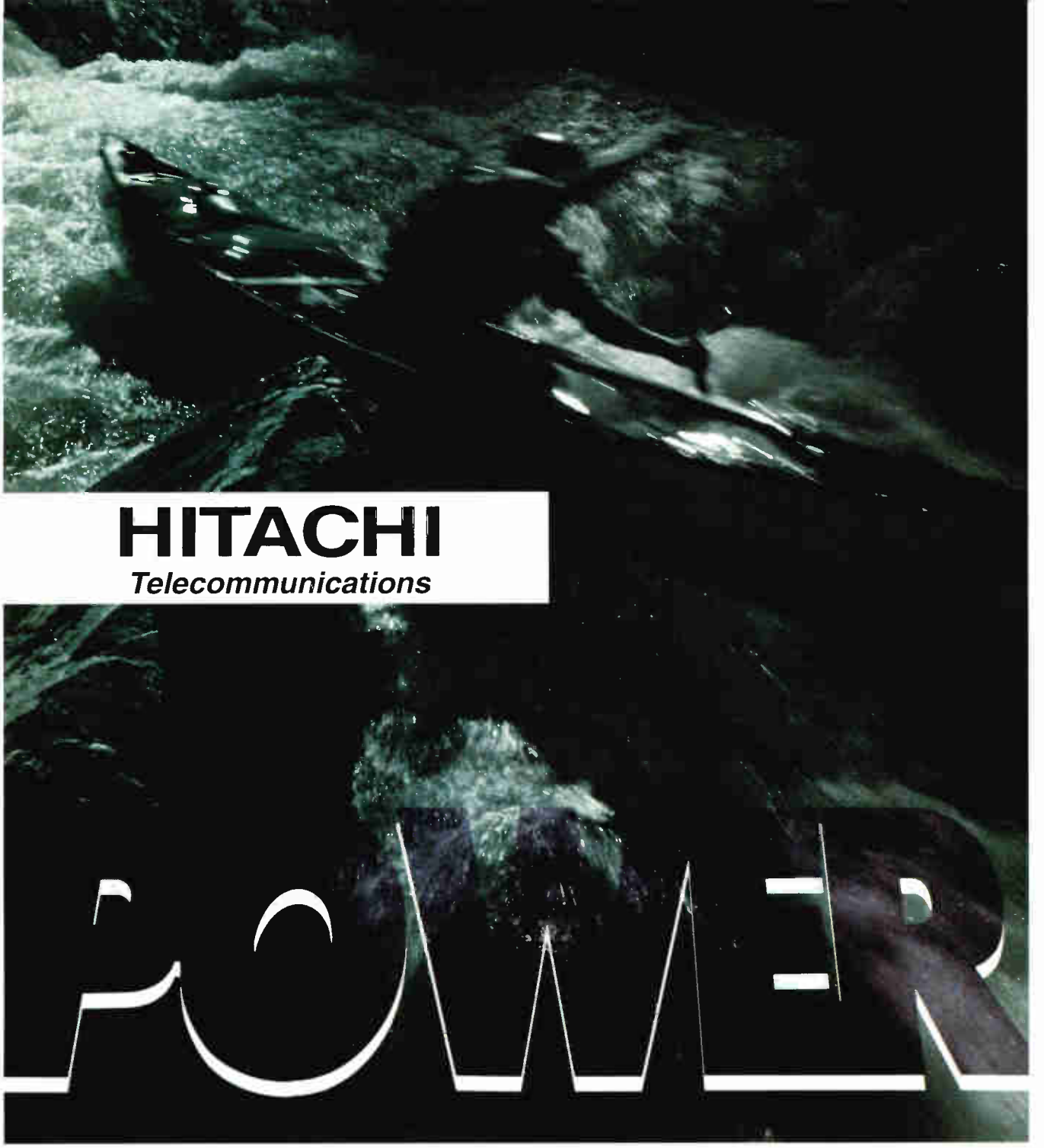
However, Ciciora stressed that the agreement is filled with compromises on both sides, and that negotiations over the details of the agreement will determine if the compromises can hold or not. "There's full realization that the devil is in the details," Ciciora said.

The agreement comes on the heels of a Feb. 3 ex parte filing by the EIA to the Federal Communications Commission, which called for a descrambling-only decoder interface and digital set-top standards. The cable industry, stunned by the filing, lashed out at the EIA, calling the development "a giant step backward." Ciciora even wrote a stinging rebuttal in his *CED* column in the March 1995 issue. For example, he wrote: "The EIA's filing seeks to cripple the decoder interface by limiting it to only the descrambling function. This self-serving position seeks to reserve all value-added electronics for the retail sale, ignoring the destructive impact this would have on consumer choice. This proposal would bring an abrupt end to service experimentation and expansion. It gives new meaning to the term 'set-back'."

Too many concessions?

Ironically, the war of words between the two sides may have been tempered by this recent compromise, but it has begun a new debate among the cable operators, some of whom believe too much was given away in the latest round of negotiations.

For several months now, the NCTA and EIA have been attempting to hammer out the details of a decoder interface standard that would allow consumers to use existing remote controls, watch one program while taping another, and utilize other features without being bottlenecked by a set-top that limits



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access to a single channel at a time. One of the most troublesome issues was related to the method consumers would use to communicate with the decoder, the so-called "command set" or "infrared pass through."

The cable industry, seeking a way to ensure open dialogue with viewers as they head into an interactive age, has held that consumers should be allowed to communicate through the TV's existing infrared receiver. This would allow new services to be deployed almost seamlessly because consumers would have a simple way to communicate with consumer electronics gear.

The EIA objected strenuously to any such proposal, arguing that the infrared unit could become "confused" by such an arrangement, and that such an approach is "bad engineering." The EIA became so upset over the standoff it filed the above-mentioned document with the FCC, calling for a descrambling-only device.

The compromise that was struck will allow communication through the remote control, but only via a series of function, or "F," commands. For example, consumers would be able to respond to interactive ads by "typing" letters of the alphabet through concatenated button commands. This is done by pressing two different function buttons on the remote control to replicate letters of the alphabet.

Under this scenario, each manufacturer will be allowed to continue to pursue unique solutions to the communication issue, said Ciciora, which could lead to even greater consumer confusion. For example, a viewer who owns more than one brand of TV may be forced to have dedicated remotes for each TV, rather than a "universal" remote that could control multiple brands of equipment. Nevertheless, in an effort to move the negotiations closer to conclusion, such an accord was struck.

The compromise will allow communication through the remote control, but only via a series of function commands

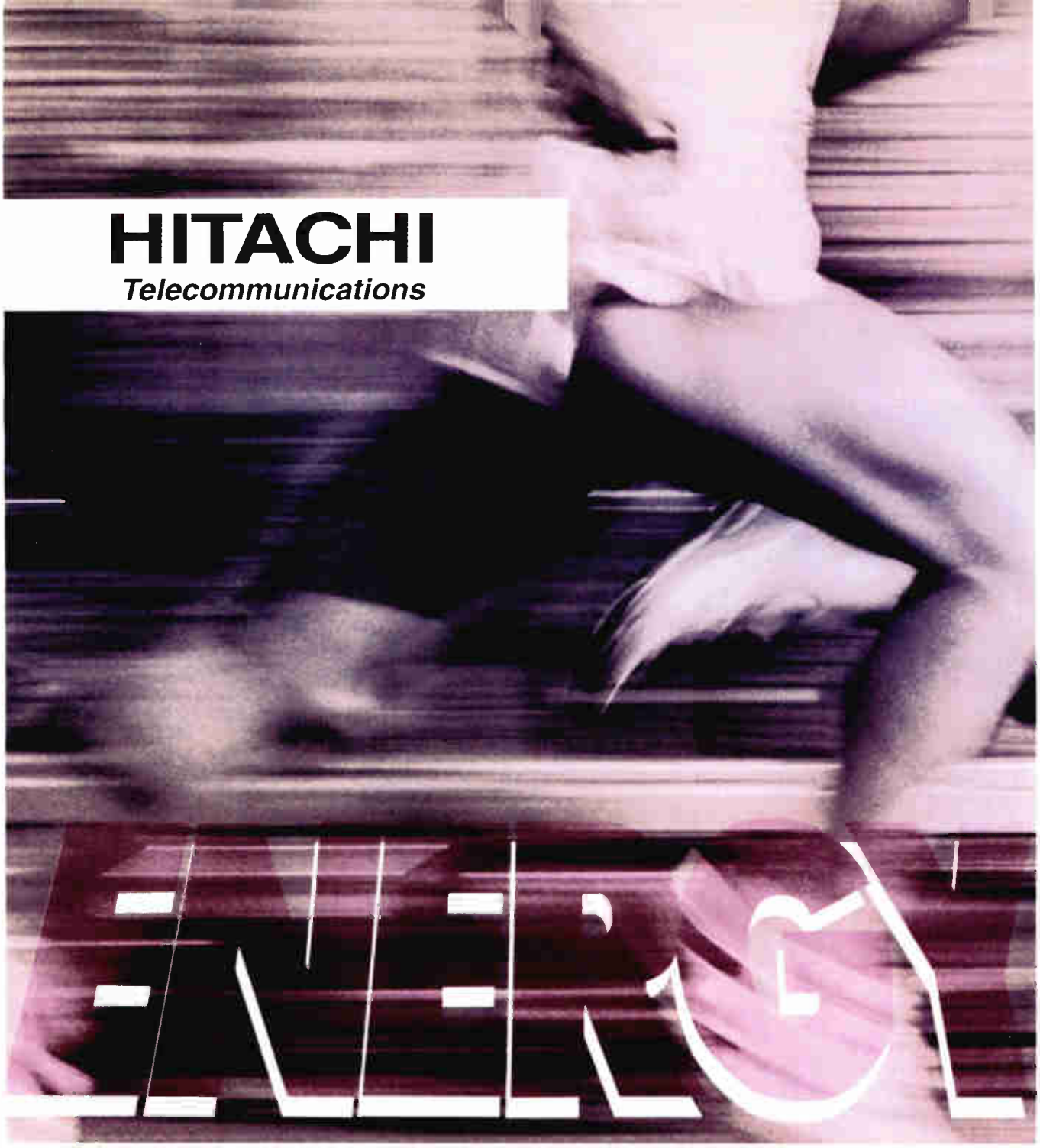
"While that isn't fully unedited or as open as we would have liked, it represents a compromise we could probably live with," said Ciciora.

An uneasy truce

But already there may be a hole in the dike. While representatives from the nation's two largest MSOs, Tele-Communications Inc. and Time Warner Cable, have reportedly given preliminary thumbs up to the draft agreement, others who have more experience with the subtle issues surrounding the negotiations are less than comfortable with the arrangement.

Ted Hartson, VP of engineering at Post Newsweek Cable, said the cable industry should have continued to press for an "open, unedited, near real-time path from the couch to the TV" rather than settle for an agreement that allows consumer electronics manufacturers to use proprietary approaches. "Having unique and/or proprietary codes from the couch to the TV . . . will guarantee chaos," he said.

Furthermore, Hartson believes there is noth-



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ing forcing the equipment manufacturers to comply with the agreement. "In buying into this concept, it is going to be very difficult to assure that the other side complies with the spirit of the intent, which is an open signal path," he said.

"I consider this issue to be my beat—and the other guys are getting away with murder," Hartson said. "What's the rush? Let's not fold up yet. Why not wait to see what the FCC says? It can't be any worse."

Outside of the IR pass-through, there were other issues on the table that were dealt with as well. According to Ciciora, of 10 items on the negotiating list, a compromise was made on each and every one. Some of those items included:

✔ Tuner powering while the TV is turned off. This is important for devices, like set-tops, that need access to the VBI even when no one is watching the TV. The compromise allows for access on a first-come, first-served basis and limits access to any one service to 2.5 hours.

✔ Joint testing. Both sides agreed to test the decoder interface and to jointly fund such testing.

✔ Spare pins. Today's design calls for a 20-pin connector; the compromise recognizes there is a need for additional pins to support additional services and/or communications.

✔ Digital signal pass-through. Both sides agreed that digital signals must be passed through the TV's tuner to an external plug-in module.

✔ No defined footprint. The cable industry wanted the consumer electronics manufacturers to define a footprint for the decoder so that the large cable and connector could one day be replaced by devices that connect directly together. The EIA was unwilling to provide such a design. "That was a disappointment," says Ciciora, "but it's not a deal-killer."

In spite of all the political wrangling, Ciciora says relations between EIA and NCTA have not come unraveled

Although some engineers who have reviewed the agreement agree with Hartson's views, others in the cable industry have told Ciciora they're surprised he was able to get any concessions at all from EIA.

In spite of all the political wrangling, Ciciora says relations between EIA and NCTA had not come unraveled. "All of the talk about an impasse is political talk, not technical talk," Ciciora says. "That comes from the lawyers in Washington. Anyone who comes to the meetings would wonder what planet they're from, because the engineers have continued to work to solve the problems–and been frustrated. We've had difficult issues that could lead to a collapse, but we had not reached the point to where we were sitting there twiddling thumbs with nothing to do."

Therefore, the two sides will continue to work toward a decoder standard until a document is drafted and submitted to the FCC. "It's going to involve a lot of pretty serious engineering work to make sure the agreement in principle can be made to work out," Ciciora says. CED

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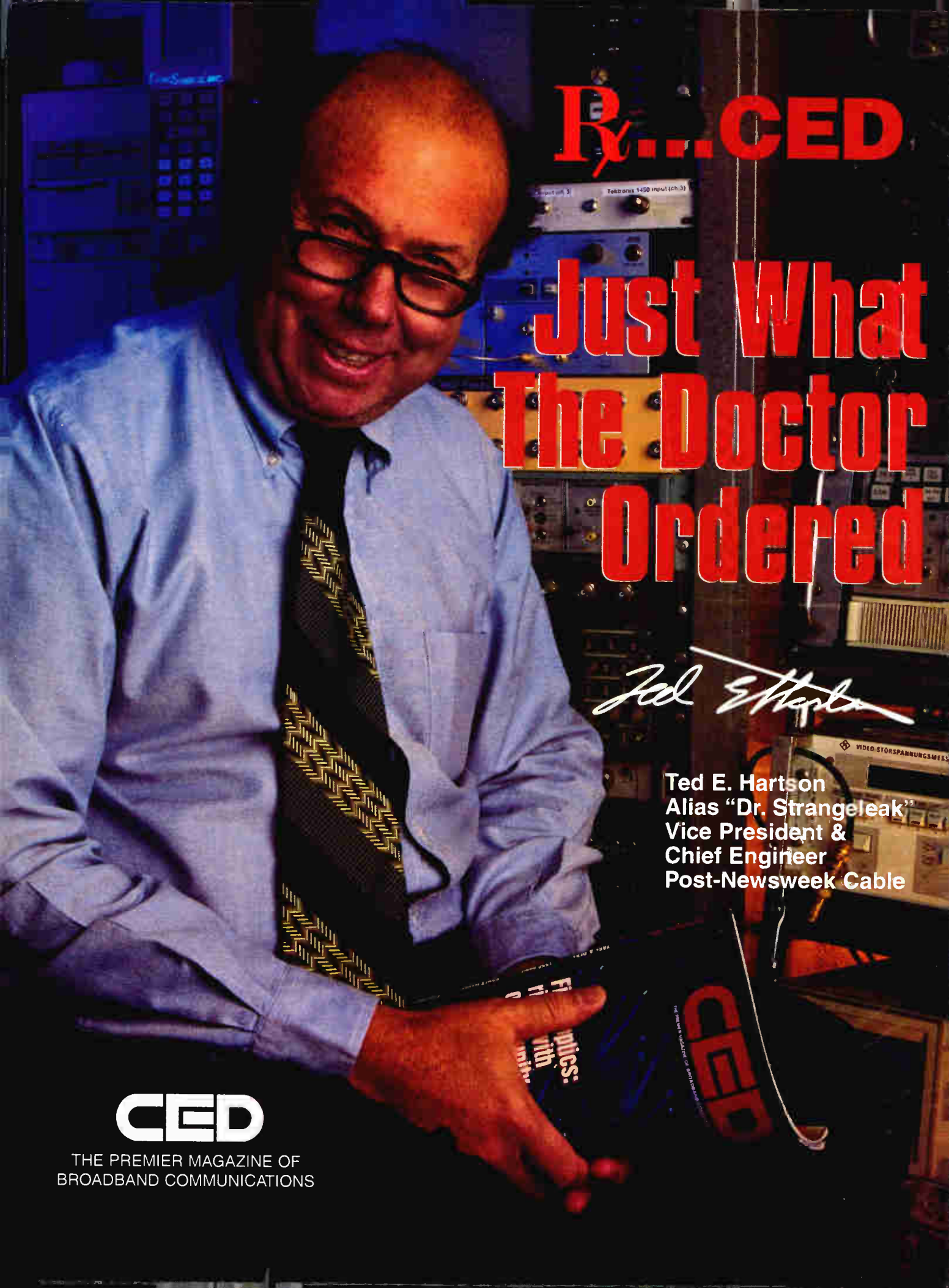
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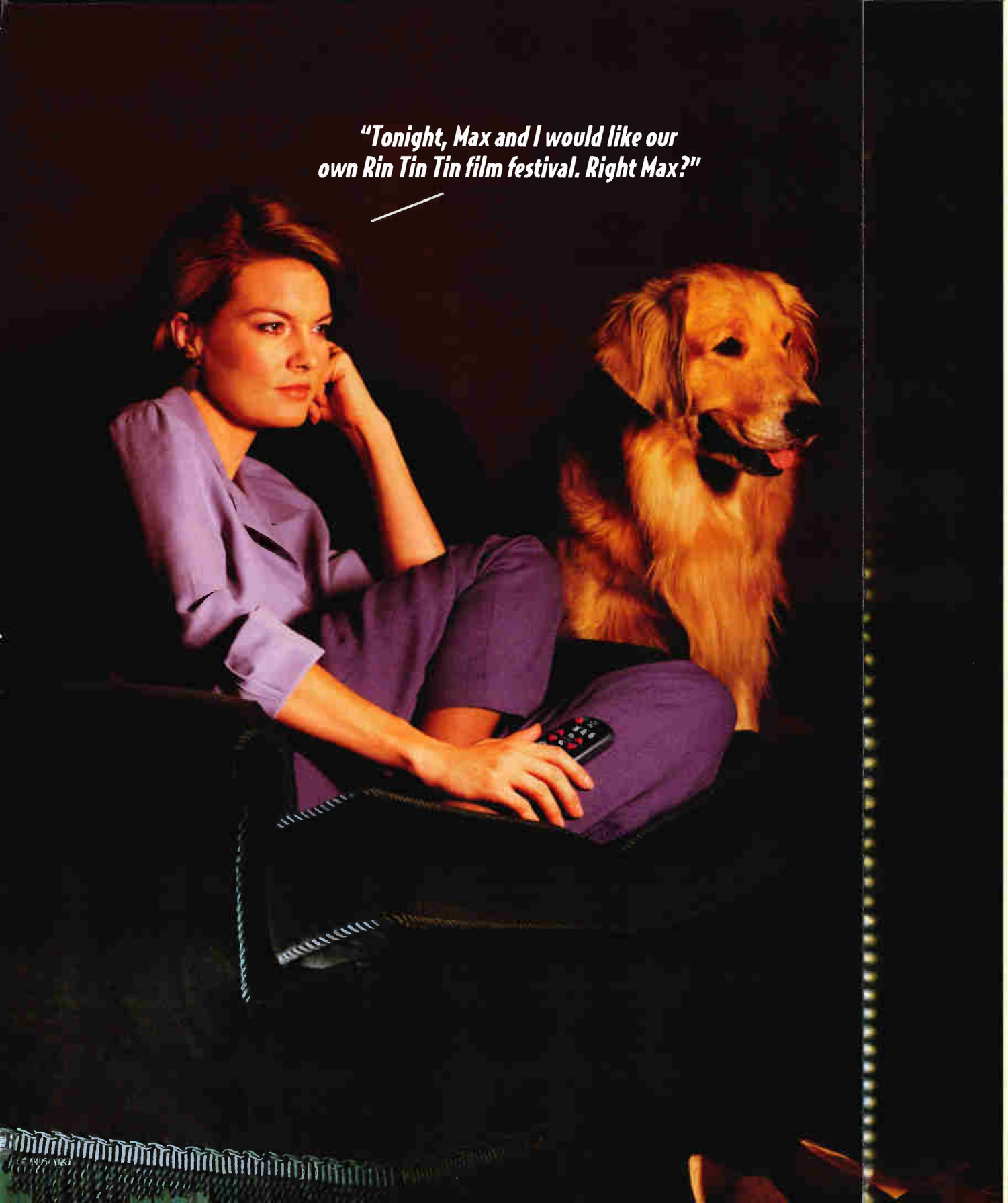

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Delivering video without set-tops

In-the-clear signal delivery

By Roger D. Pience, VP Technology, Watson Technologies Corp.

Editor's Note: *For several years, the cable industry, in concert with the Electronic Industries Association, has been attempting to implement methods to improve the cable/consumer electronics interface while protecting the cable operator's investment in programming. This article was invited to introduce a new proprietary technology that has been developed to address the issue.*

Modernization and innovation are rapidly changing the face of cable television. The technical capabilities of cable TV systems are being constantly enhanced and expanded beyond the traditional entertainment services to provide cable operators with new revenue streams.

A start-up company, Watson Technologies, has developed a new signal delivery and control architecture that is fully compatible with existing coax and hybrid fiber/coax systems. Additionally, proprietary hardware that is part of the architecture restores full compatibility to TVs and VCRs through "in-the-clear" signal delivery methods, and potentially offers consumers total control over their programming choices.

Off-premise control

The elimination of signal theft as well as the set-top box, while offering new marketing and tariffing flexibility with added "impulse" revenue potential, provides exciting new opportunities to the cable operator. The Watson Technologies' broadband system controller provides all of these characteristics.

Cable operators have constructed coaxial and fiber cable networks that are now available to more than 96 percent of all homes in the country, and more than 63 million households subscribe to cable. Today's cable television networks, which rely heavily on set-top descrambling convertors to control programming access and thus the revenue stream, are characterized by unacceptably high rates of programming theft, the inherent incompatibility between the set-top box and the subscriber's TV and VCR, and the revenue-restrictive need to sell only tiered packages. State-of-the-art delivery and control methods for a wide variety of new services are paramount to the survival of cable operators in the face of increased competition.

Watson believes that its proprietary broadband network controller will enhance cable system performance and profitability by reducing unauthorized programming use, increasing the viewer's freedom of selection to an a la carte basis, and allowing for transactional based billing. The off-premise broadband controller provides a secure "in-the-clear" signal transmission path of programming into the home, thereby eliminating the cable-consumer equipment incompatibility problem.

In addition, the core technology will enable media research companies to economically collect more accurate statistical information about program viewing than is currently available.

There are four primary reasons why cable operators have considered off-premise control devices:

✔ Control capability (addressability)
✔ Consumer friendliness
✔ Improved operating efficiencies
✔ Improved security.

Intuitively, addressability and security are not equivalent. Addressability provides the feature of remotely configuring a control device, and used alone, does not provide security. Security, however, is used to reliably supply or deny services or features.

This new broadband controller provides the cable operator the ability to offer the subscriber programming choices heretofore unavailable in a set-top box-equipped cable system. In addition to normal tiering functionality, the controller is capable of providing individualized subscriber programming tiers in a truly a la carte fashion, and unlimited impulse pay-per-view.

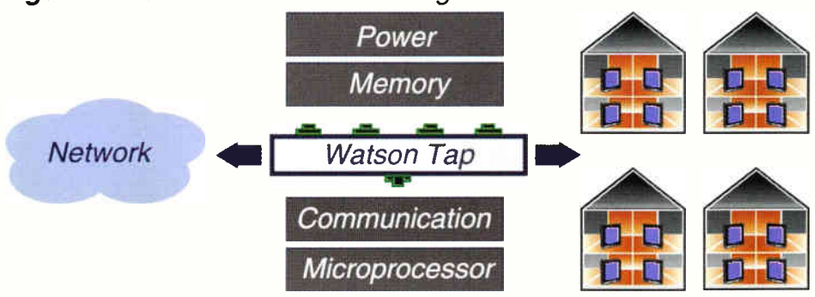
Controller operation

Specifically, the controller reacts to a subscriber request for a particular channel. The channel is requested by the subscriber by simply tuning the TV or VCR to a particular channel. The controller recognizes this request and with appropriate authorization, allows the chosen channel to pass through to the subscriber "in-the-clear" and on-channel. The transaction is recorded for billing purposes. The controller, as configured, is capable of delivering four frequencies simultaneously for each subscriber's residence, thus eliminating equipment incompatibility problems.

Patent pending advanced digital signal processing (DSP) circuitry and Fast Fourier Transform (FFT) processing are used to detect the subscriber's equipment channel change. The combined DSP/FFT microprocessor circuitry informs a frequency selective gate to permit passage of a particular channel. Initially, the cable operator addresses the Watson Tap providing the authorized channel selection based upon the subscriber's request.

Occupying a strategic location in the cable architecture (see Figure 1), this tap provides

Figure 1: *Distributed network intelligence*



distributed intelligence at a physically secure network location. The "off-premise" platform not only provides for all of the necessary functionality of secure digital delivery and full customer control over their programming choices, but provides shared resources for further service enhancement.

Wired telephony, PCS, interactive video and digital programming control and processing are some of the features that can be built into the platform. These features can easily share some of the current resources such as the power supply, memory, microprocessor and communications. Additional network architecture benefits are reduction in the number of line extenders because of the inherent signal gain of the tap.

Paradigm shift

Industry sources indicate that cable operators are poised to invest more than $30 billion by the end of the decade to rebuild or upgrade 75 percent of the existing cable systems for expanded programming and data services. Not to be discounted, the uncertain regulatory environment will dictate new and different cable operating psychology. Driven by technical convergence, the telephone, cable, computer and entertainment industries are each competing for consumers' disposable income. All of this massive change in the industry has caused a great amount of uncertainty. This fact, coupled with the fundamental shift from analog to digital program delivery, results in an opportunity to provide a paradigm shift in the method of providing cable services to customers, and simultaneously controlling and improving on the revenue stream.

This system restores compatibility among all consumer premise equipment consistent with current regulatory preferences

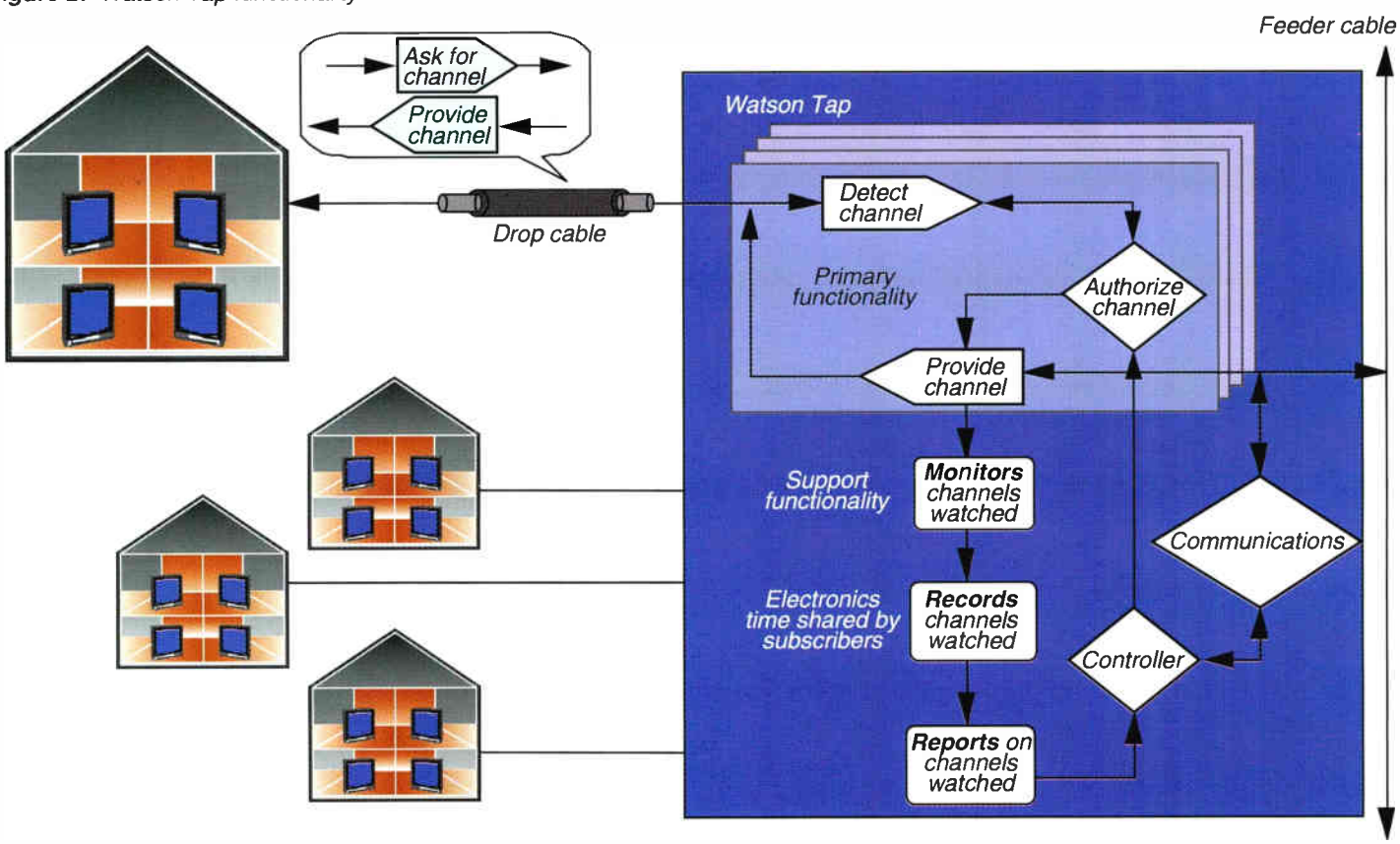
This new architecture provides a solution of providing a programming service tailored to each individual customer and seamlessly controlling the revenue stream. The strategic location outside the customer premise provides an improvement in security from two different aspects.

First is the physical location. Locating the program controller out of the subscriber's reach provides physical security. Functional security is provided by allowing the consumer to view only what he requests from the cable operator. Compatibility issues are solved by removing the set-top box and providing the requested channels in the clear to multiple consumer devices.

Security issues

The functional diagram shown in Figure 2 depicts the significant relationships of the various elements of the control mechanism. The first aspect is that physical security is obtained by placing the "box" outside of the house on the strand or in a pedestal. Functional security is provided by the handshake operation of the consumer asking for a specific channel, and only that channel being provided to the consumer in-the-clear. This process obviates the need for complicated cryptological techniques to guarantee security.

Figure 2: *Watson Tap functionality*



In the present tap configuration, four gates are provided for each subscriber, thereby providing the capability for delivery of up to four simultaneous channels per subscriber. The quantity of four has been selected as an arbitrary system constraint. Because a large amount of the functionality of the product can be shared, the product has been configured to feed four consumers from the tap's physical location. Support functions are also indicated in the block diagram.

Usage by time, by channel, per subscriber is recorded by the microprocessor and upon request is uploaded to the headend for billing purposes. Flexibility and control of each subscriber's service can be dynamically accessed from the headend via the communication link to each subscriber's node.

Summary

Marketing focus groups indicate the customer's desire to control their programming choices. Given full choice, customers will consume more premium programming, as evidenced by the largest movie programmers providing three or more streams or choices. With this system, all programming is in-the-clear, has the potential to be a la carte, and restores compatibility among all consumer premise equipment consistent with regulatory preferences.

The tap's position allows customers to control their premises, and operators to secure and control their programming services

A new tap allows all cable-ready consumer electronics devices to have friendly, transparent and fully compatible access to all cable program services. System signal security is enhanced at two levels without the need for advanced encryption, while providing all signals in-the-clear. The enhanced security, freedom of customer choice and new marketing opportunities provided by this system promise to improve the cable operator's bottom line.

The tap's position–at the end of the network but outside the home–allows the customer to have control over their premises, and allows the network operator to secure and control his programming services. This is analogous to the transition the telephone industry made many years ago.

The functionality provided by the tap allows the operator to distribute intelligence to the edges of the network. This distributed intelligence concept is similar to the transition the computer industry made from mainframes to client/server platforms. CED

About the author

Pience is a 22-year veteran of the cable television industry. Most recently, he was director of engineering for the National Cable Television Association (NCTA).

Watson Technologies was founded in 1993 by John C. Watson in order to pursue the development of an in-the-clear cable signal delivery architecture.

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Focusing in on customer satisfaction

Process re-engineering hones new systems

By John Greening, vice president, programs, and Jan Lubin, senior CATV consultant, Arrowsmith Technologies Inc.

The future of the cable television industry will be intensely competitive, market-driven and technology constrained. Winning in a free market will require the cable industry to build customer loyalty, modify cumbersome processes and create a team of employees and suppliers focused on customer satisfaction. To realize such a future, the cable industry must contemplate re-engineering some of its business processes.

Business process re-engineering involves the careful analysis of current business practices and the step-by-step deployment of more effective processes, including the implementation of advanced operational support systems. The overall goal is to provide excellent customer service by empowering employees, which should in turn increase revenue and profitability.

Process re-engineering alone, without the installation of new technologies, will not attain the desired result and wastes a cable operator's precious financial resources. Ensuring that a true catalyst for change exists requires new tools, as well as techniques to enable the cable company to meet its re-engineering goals.

Defining needs

Once it has been decided to undergo re-engineering, cable operators need to define what is required to meet their future goals.

The first approach, the operations assessment phase, should focus on a thorough audit of existing operations and their inherent limitations. For example, the most common bottlenecks in cable field service operations are:

- ✔ reliance on antiquated manual work orders
- ✔ excessive paperwork and double data entry
- ✔ lack of real-time information sharing between customer service representatives (CSRs), dispatchers and technicians
- ✔ wasted time as dispatchers and technicians communicate via voice-only radios; and
- ✔ lack of real-time information on which dispatchers and managers base sound, proactive decisions.

An objective evaluation

To effectively evaluate the company's field service processes, cable operators should enlist the expertise of an outside organization that can objectively evaluate the company's workforce, procedures, equipment and technology. The ideal alliance would be with a company that has an array of experience in large scale system design, logistics, training and an enabling technology solution that provides an order of magnitude for change.

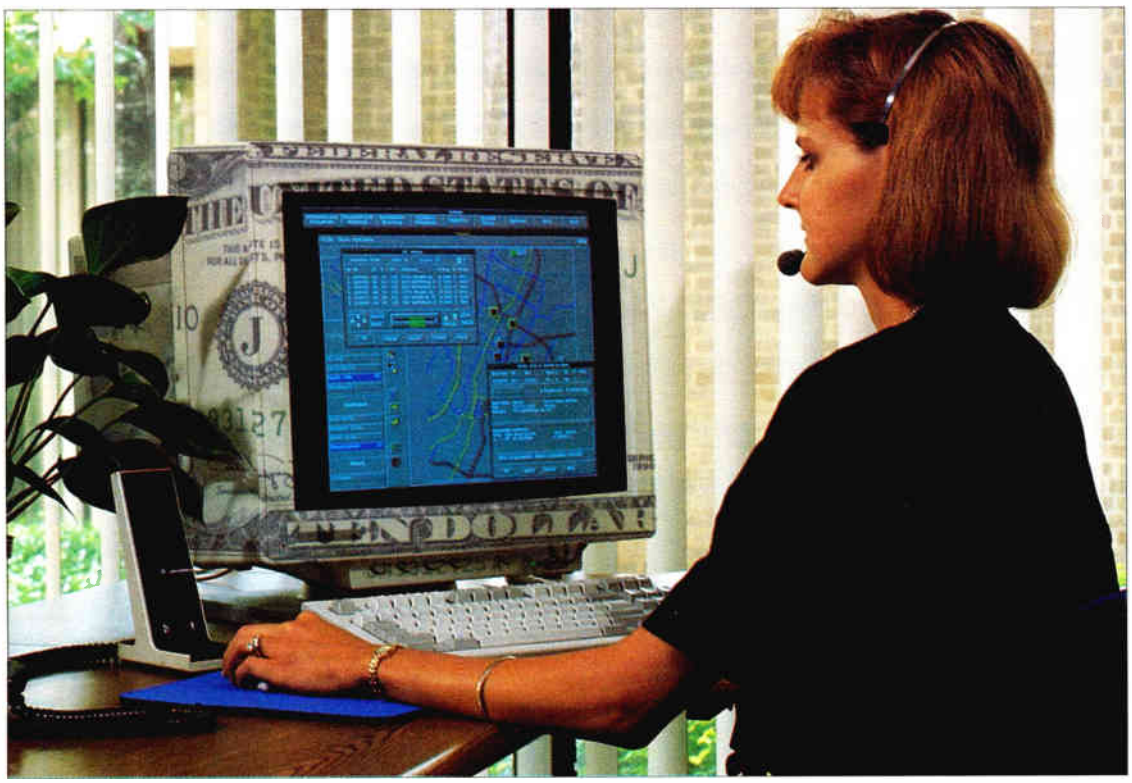
Although consultants are typically chosen for the evaluation process, their inability to provide the tools to facilitate the change often leaves cable operators without a working solution.

To execute the next step of re-engineering, an internal task force should be formed to include at least one individual from each applicable department of the cable company. Management, customer service, routing, dispatch and the technical staff should all be represented to address the complete business operation and to receive general consensus on the re-engineering effort. Together, they can define a full array of practices that need to be evaluated for change.

The internal task force would work closely with the external evaluation team to identify areas for improvement.

Assessing operations

The next step in process re-engineering is more time consuming, requiring an evaluation of the many aspects of



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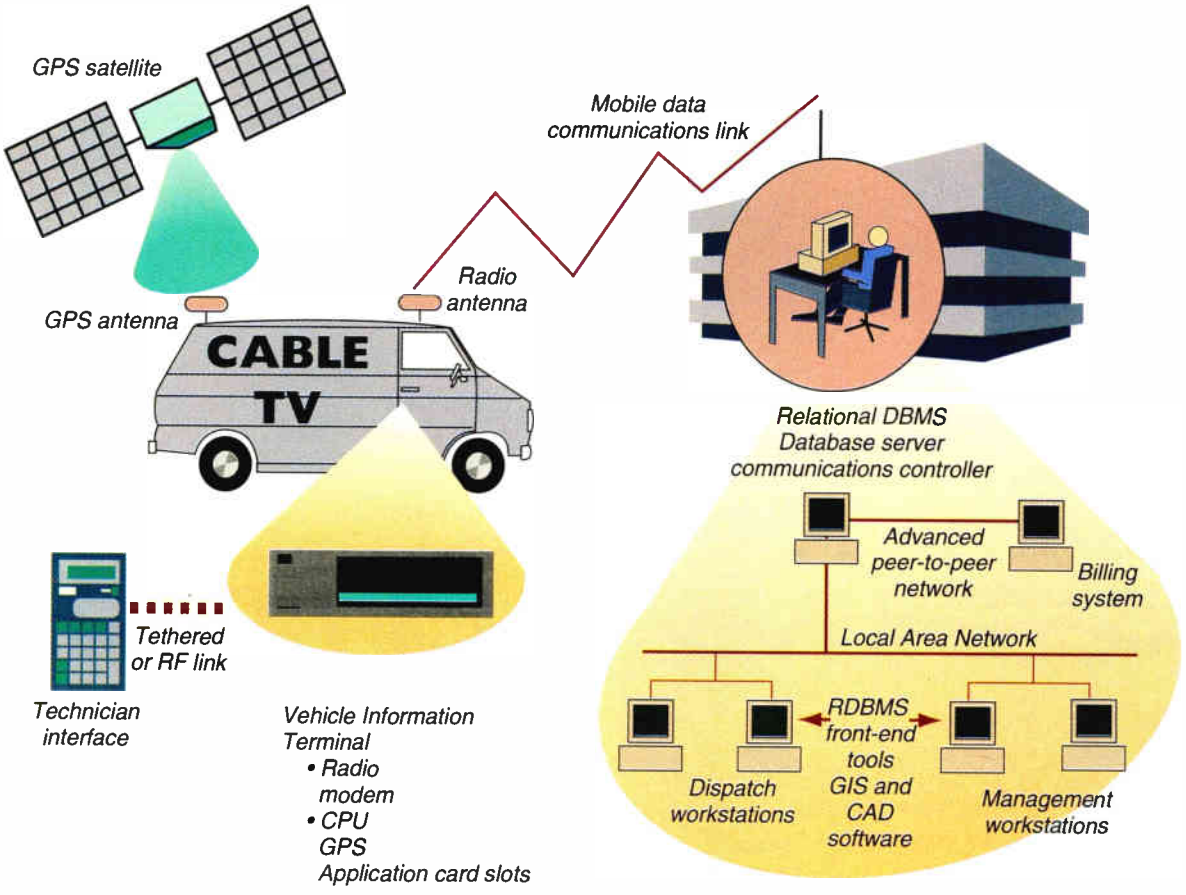
the cable company's operations. The assessment can be broken down into four categories: company performance, financial performance, work flow and the charting of data flow. The information gathered from the assessment will be used to set the cable company's goals and to develop processes to support the realization of those goals.

formed as well.

The information gathered from working alongside the employees will then be analyzed using proven qualitative and quantitative measurements. The data can be visualized through flow charts, highlighting work flow, and information flow, needs and decision points.

The qualitative and quantitative measurements enable the operator to determine the actual cost of each task, including employee and equipment costs. These measurements also provide the operator with a road map for improvement. For example, if automated dispatch systems are installed, how much time would be saved by the technicians and dispatchers each day. For every minute saved, a technician can be utilized to better serve the specific goals of re-engineering, such as sell additional services, preventive maintenance and customer education.

Figure 2: *Fleetcon design overview*



For example, field personnel would be interviewed and observed throughout the day in order to gather baseline measurements. How long do the technicians typically spend on check-in, obtaining equipment, tools and convertors, and collecting and reviewing the day's work orders? How long is each job? Drive time? How many minutes are wasted trying to reach a dispatcher by radio or telephone? How much additional time goes into completing paperwork and balancing the money collected at the end of the day?

In addition to observing field personnel, similar processes with routers, dispatchers, customer service representatives, administrative support and management will be performed.

Redesign and renewal

The design process focuses on how the cable company will operate after the re-engineering evaluation is complete. This step of re-engineering is very dependent on the external expertise of a solutions provider. Redesign involves developing new work flows, collecting required data and identifying the tools that will be available to the company's management and workforce.

At this stage, various hardware and software components of a total workforce management system come into play. The external service provider and the cable operator juxtapose each component to the problem it solves and develop new work flow charts that help meet the cable company's predefined goals.

The design layout is, in effect, a three-dimensional puzzle comprising people, processes and systems. At the end of the decision process, the solution is a road map leading to improved customer service, employee empowerment and increased revenue and profitability.

System elements

An effective workforce management system has three distinct elements:

✔ vehicle information terminals (VIT)

✔ data communications links; and in addition,

✔ the home office (base station).

The VIT is comprised of a Global Positioning System (GPS) receiver, a single-board computer, expansion slots for adding functionality and a handheld computer that connects the technician and the office to one another. The wireless, mobile data communications link connects the vehicle and home office. The office, or base station, houses a database server, multiple dispatch/management workstations, and, of course, powerful application software.

The most obvious VIT component is the technician's handheld computer. The device has a graphical user interface that displays

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work orders and captures information the technician enters.

At the start of the workday, the technician simply turns on the handheld computer and sees his first job displayed, complete with any special information: for example, a notation that the customer has an unruly dog or must leave the house by 9 a.m.

Electronic sign-off

Whether the technician leaves from the office or from home, check-in is as easy as pressing a button on the handheld computer. The "on job" button starts the first job, and the "off-job" button completes it. The technician can even have the customer sign off on the work order, using an electronic pen, for example. The handheld computer also has a graphical icon labeled "break," and one for "lunch."

At the end of each job, break or lunch hour, the work order for the technician's next job is transmitted instantly–via the data communications link–to the vehicle's computer and into the handheld computer. The technician never has to sit around in an ice storm or on a sweltering summer day, trying again and again to get through to the busy dispatch office.

Back in the cable operator's office, customer service representatives are given increased functionality to better serve customers. Billing information is automatically downloaded into the system as it is entered by the CSRs and made available to support routing, dispatch and fleet operations.

The system makes CSRs an even more valuable part of the company team. If a customer who is waiting for installation or service calls with an emergency –perhaps rushing to school to pick up a sick child–yet wishes the technician to wait for a few moments if he or she is not there when the tech arrives, the CSR can download that call into the system. The system will match the customer to the appropriate technician and transmit the information to him.

Computer Aided Dispatch

A bigger change is in routing. The best electronic workforce management systems completely transform the routing process, computerizing the assignment of work orders. The basis for this transformation is GIS software like that employed by the nation's E911 networks, which creates and stores detailed, full-color area maps and calculates the shortest or best routes in a flash.

Process re-engineering seeks to minimize the stress of implementation through training, team building and total quality management

Using GIS dramatically reduces the amount of time it takes to schedule a fleet of technicians. It also can virtually eliminate circuitous routes and mismatches between technicians and jobs.

Some systems offer a choice between interactive routing and automated routing. With interactive routing, all the jobs for each future routing date are downloaded from the CSR's subscriber management system to the server. When an employee is ready to prepare the next day's routes, his computer will display a full-color area map with an icon for the location of each service call.

All it takes to create each tech's route is to "point" and "click" on the icon, "drag" it into that the tech's schedule window and "drop" it into the schedule. The system will optimize and verify each schedule.

Dynamic dispatch capability

Interactive routing can be an alternative to, or a backup for, automated routing. The latter is based on computer-aided dispatch (CAD) software. CAD uses sophisticated algorithms that automatically assign work loads in a way that maximizes cost savings within the cable company's constraints.

For example, automated routing takes into account technicians' hourly and overtime wages, fuel costs, driving distances, the mathematical importance of meeting time windows, FCC work order aging requirements and even technicians' skill sets.

A dynamic dispatch capability assigns the right jobs, in the right order, to the most appropriate technician, all automatically. It also collects information on technician performance, customer no-shows, area demand and the like, giving management a sound basis for future business decisions.

At any time, for convenience and in emer-

gencies, the dynamic dispatch functionality can reassign a single work order or realign an entire schedule. Workdays are not disrupted because technicians receive only one job at a time.

Implementing change

Even when the goals are clear and the planning collaborative, change is hard. That is why process re-engineering seeks to minimize the stress of implementation through training, team building and total quality management (TQM).

The training component is straightforward, and is certainly the most important. Each employee is given a framework for his new way of working, plus plenty of hands-on time with the new system. Most employees quickly decide that the new system is easy and even "fun" to use.

For example, technicians like the one-key convenience of a handheld computer that they can take into the house. Schedulers enjoy using full-color, icon-based maps backed up by computer skills. Dispatchers appreciate being able to focus on exceptions instead of repetition. CSRs like sending information directly to technicians, and management gains access to the real-time information that fosters sound decisions.

Team building elaborates on these advantages. For example, the internal process re-engineering task force is able to demonstrate to technicians how the new system makes workdays not just easier but safer. One press on the handheld computer's "alert" button summons aid in any emergency.

Total quality management (TQM) elevates team building to an even higher level. With the outside consultants acting as facilitators and a cross-functional company team steering each meeting, TQM helps employees to recognize that by improving company processes, the new system improves their job security.

The cable company can now continually monitor its processes and progress through monthly, quarterly and annual reviews

Measuring the results attained from an electronic workforce management system is the final step in process re-engineering.

Setting goals

As mentioned before, baseline measurements are taken and goals established early on. All the data is collected and recorded a month before the new system is installed. When the same tasks and times are measured and entered a month afterward, the system automatically generates a full set of reports showing quantitative changes in, for example, job performance, mileage, vehicle wear and overtime expenses.

The cable company can now continually monitor its processes and progress through monthly, quarterly and annual reviews. Again, the system itself automatically performs most of the mathematical calculations. It also furnishes cable franchisees with support for their on-time performance reports.

Summing up

Cable television operators are having to act promptly to maintain market share, and also to prepare for new products and services. The technology that will allow these companies to provide the reliability that customers demand is here, now.

However, the technology does not come in a neat box that a cable operator can purchase and plug in. Instead, it comes as an integrated hardware, software and service solution that impacts everyone from the newest field technician to the CEO.

The complexity of process re-engineering can be simplified when coupled with tools that provide a catalyst for change. Process re-engineering gives the cable industry a competitive advantage, with the aid of new technologies. CED

About the Authors

John Greening is Arrowsmith Technologies' vice president, programs. Greening has responsibilities which include the definition, development, installation, customer training and customer process re-engineering for all of Arrowsmith's various telecommunications solutions.

Jan Lubin, Arrowsmith's senior CATV consultant, is responsible for overseeing the company's process re-engineering consulting services for cable television operators.

Tom Elliot answers our questions

SCTE chairman provides status report

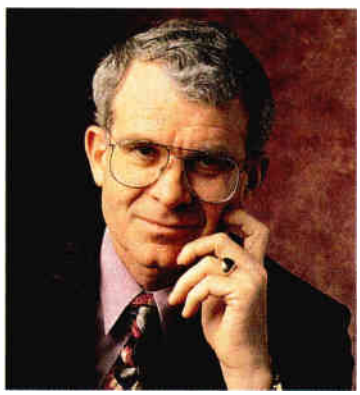
Editor's note: *This month, Tom Elliot, senior vice president of engineering and technical services at Tele-Communications Inc., steps down after two years as chairman of the board of the Society of Cable Telecommunications Engineers (as the group is now known).* CED *Editor Roger Brown recently interviewed Elliot regarding the major issues facing the SCTE as it moves forward. What follows is an edited transcript of the interview.*

Q: What are the biggest strides the Society has made in the past two years?
A: I think it's most useful to look at the way the Society has moved over the past 10 years or better. I think we can all be proud of the fact that it has moved from a small group that was dangerously close to disappearing to a real factor in the cable scene today. My view is that some of the challenges on the plate are quite different than they used to be, but I think we've done quite well in the last couple of years. The Society continues to grow, and we've focused on the fact that the industry will become very competitive and driven by technology.

I believe that through the vision put forth by the leaders of the Society, we've tried to be proactive in this area. We've had a couple of meetings with a facilitator that focused discussions on strategy and how the Society needs to change to serve its members in the best possible way. We've scrubbed that process through the membership with questionnaires, and through the Board members to make sure we're benchmarking this roadmap properly.

There are huge challenges here because this world is going to move so quickly. The players are going to move fast. As someone who's deeply concerned about the welfare of the Society, we have to deal with these issues. Our choice is to deal with them on a reactive or a proactive basis. In my view, we want to be proactive.

Q: Is the proper mechanism in place to do that?
A: I think so. The Society, through Bill Riker's leadership, has really been doing a good job of this all along, given the level of resources it had to draw from. We've always had a great group of volunteers, a good group of people who help on a long-term basis. The vendor community is very supportive. With the growth the Society has experienced over the last few years, we've been able to do more. The question is, is it enough? Once again, it's a matter of taking the resources you've got and trying to put them to the best use. Clearly, there are more things we'd like to do.



Q: How can the Society rise to the challenge of standards-making in an industry where seemingly everyone wants to develop standards?

A: One thing we have done is to get more aggressive about that than we've ever been. We've had different committees working on a range of practices for some time. A lot of those have found their way into things like Bellcore standards. That ought to be a feather in our cap. If you look at the three different groups that focus on these issues, you have the NCTA Engineering Committee, which is good, but is in place to support the NCTA's lobbying efforts; there's CableLabs, which is not an open group, nor is it set up to deal with these issues directly; and you have the SCTE, which is a due process organization. I think the industry is well served by having an organization do these things. SCTE brings a lot to the table. We also are moving forward on our ANSI application. I'm unhappy that I'm not able to report that's done, but we're moving ahead on that.

Q: I understand EIA had some objection to that application.
A: Yes it did. We're working with EIA and ANSI to resolve that. EIA saw this as a potential overlap where a lot of different things they are interested in are the same things we're interested in. We believe we have worked our way through that. EIA is also attempting to spread its wings into areas that, frankly, the SCTE would serve better. So you have the normal competitive process where organizations are trying to expand their area of influence. The EIA, through some of its activities with Congress and the FCC, has not endeared itself to the cable industry, so the cable industry is much more comfortable with the SCTE representing these issues than it would some group that is not sympathetic to our problems. I think that in the next few months we'll have that process done.

And that gets to the core issue.

Q: Is SCTE's role simply to work with the myriad other standards-making bodies that are out there, or to be more aggressive than that?
A: I think there are many other cases where SCTE is most effective taking the leadership role. A lot of these other organizations have all kinds of [tangential] issues to deal with. They are often groups that have a singular purpose in mind, and they may not be in sync with the broadband distribution business. The output from some of those groups is sometimes too broad and their standards sometimes need a lot of additional work to make them applicable in the real world. But most of the work SCTE has done to date is actionable. It has tolerances and detail. It's something I can take without any further work and order product from it. We try to be really practical. I'm proud of the work we do today. The Cable-Tec Games are an example. Those are a lot of fun because they're a test of people's skills–people who are doing real things.

Q: Does the SCTE infrastructure have to grow to monitor these groups?

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A: We hope to continue the success stories we've had with those who have helped us get this far. I think it's a real strength of the Society that we've had a huge group of folks who spend useful, productive time on things they care about. On the other hand, there are some things you need to do to support a higher level of activity in a more professional and better way. The good news is that membership is up, which gives us more resources. As that happens, its appropriate to reinvest. For example, I personally started the Interface Practices Committee and was able to essentially contribute my time and effort, and that of other people here at TCI, to the Society. Initially, it was just a few dollars. But as you get hundreds involved, it's unrealistic to expect companies to pick all that up. The Society needs to step into those costs.

I think the issue is managing the costs. If we can put a few dollars in or a few people in at the right time, we can see great results. One example is the updating of the BCTE process. The issue is enlightened but good management.

Q: What are you the most proud of during your tenure with the SCTE?

A: I think I can take credit for starting the engineering committee structure. I also began thinking about managing the Society's growth. I think I was instrumental in developing the five standing committees–finance, planning, operations, engineering and training–We have a way of thinking about anything that comes up. Now we have a way to debate issues as they come up. It helps the Board think about how to do things; it helps the membership in that if they have a particular issue, they know who the chairman of the committee is. I feel good about the structure.

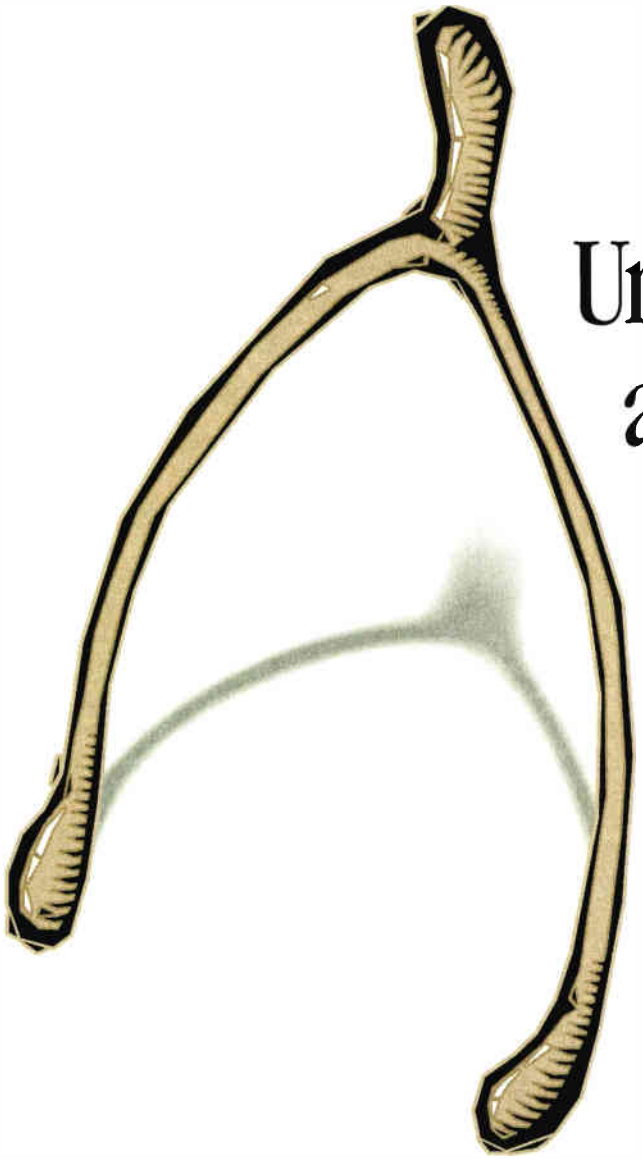
Q: Vendors have taken a strong role in the committees, often to the point that they outnumber operators. How much of a concern is that? Should operators get more involved?

A: The process has obviously worked well to date, and one of the reasons why is because the vendor community has been supportive. Part of the formula for success is to stay in touch with the vendors. We have a good mix of members. Most trade organizations suggest you need a one-to-one mix of vendors to operators at events like the Expo.

When you get into committees, they've always consisted largely of people who are supported and driven by the vendors. There's nobody in there who'd like to see more operator participation than the vendors. One of their concerns is whether they're getting the message from a broad enough cross-section of the MSOs. The issue there is that the pool of engineering talent is continuing to collapse as a result of consolidation which the industry must go through and will for some time. So there's a key issue the Society must focus on: getting the message out to other disciplines–making sure top management understands what the Society is, what it does, and the benefits of being a member. As a group, that's a challenge for us. Engineers tend to be doers; we're not good at promoting what we do, we just do it.

Q: One of your past goals was to improve that situation. Are you happy with the progress made so far?

A: I think we've made some big strides, but am I happy with it? I think not. There's lots of additional work to be done. The Society's visibility is up, and we're adding a staff position



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in marketing that will increase recognition. We have some campaigns that are yet to be rolled out, but there's movement toward enhancing the recognition of the Society. On the other hand, that job is never done, and you can never do too good a job of it. That's an ongoing job we'll have forever, I think.

Q: What about the Society's curriculum? What's happening there?

A: Most of our stuff we're trying to produce with modern tools. We have some contractors we work with to do this. Even with the written curriculum, we can now update it faster and keep things more current. But we also have to use other tools of the trade, including video. As you know, we've used video tapes and the satellite Tele-Seminar Program, and we have to continue that. I think our tapes are getting better: they're more professional.

Now, we're spending time trying to understand how to move into interactive training. It's pretty expensive, and the production techniques are just beginning to be turned into standard operating procedures. We can't get too far out on the bleeding edge of that, but we need to be aggressive. I think we're positioned about right: if there's any risk there, it might be that we're a little conservative.

Q: Where should the Society focus its future? What's the most unfinished business?

A: We have to make sure people outside of engineering understand what we do and why we do it. We need to get input from a broader range of the industry. As time goes forward, none of us will be isolated islands. There's hardly an hour that goes by where my operations engineers here at TCI don't interact with our marketing folks, financial people, regulatory people, etc. We need to make sure we let these people know what we do that adds value. But we also have to ask how we can make it easier to do ad insertion or sell ads, or market different services. We need input from all the disciplines in the industry. I think we're doing that. That one never goes away.

'What's going to happen to display technology and the cost of it has a huge impact on our business'

We also need to look at pressures that are coming at the industry. What's happening with microprocessors and the cost of memory, and what impact will that have on our industry? I spend time looking at things like displays–it turns out that what's going to happen to display technology and the cost of it has a huge impact on our business. I learn more that way than by looking narrowly at the parts of our business. This might include virtual reality because that's coming along quickly and might change the business.

Today, you have to think about the whole of wireless technology, and how that will impact our customers' expectations. The challenge for the Society is to throw a net over all this and evaluate what gets caught–and we'll have to do it pretty regularly to make sure people are trained correctly, and that we have standards that cover the issues. There's a lot of work there. CED

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Recipe for a successful OSS Broadband networks demand operations support

By Richard Schwarz, Business/Market Planning, New Network Operations Applications, AT&T Network Systems, and Steven Kreutzer, Systems Engineering, Advanced Services Operations System, AT&T Bell Laboratories

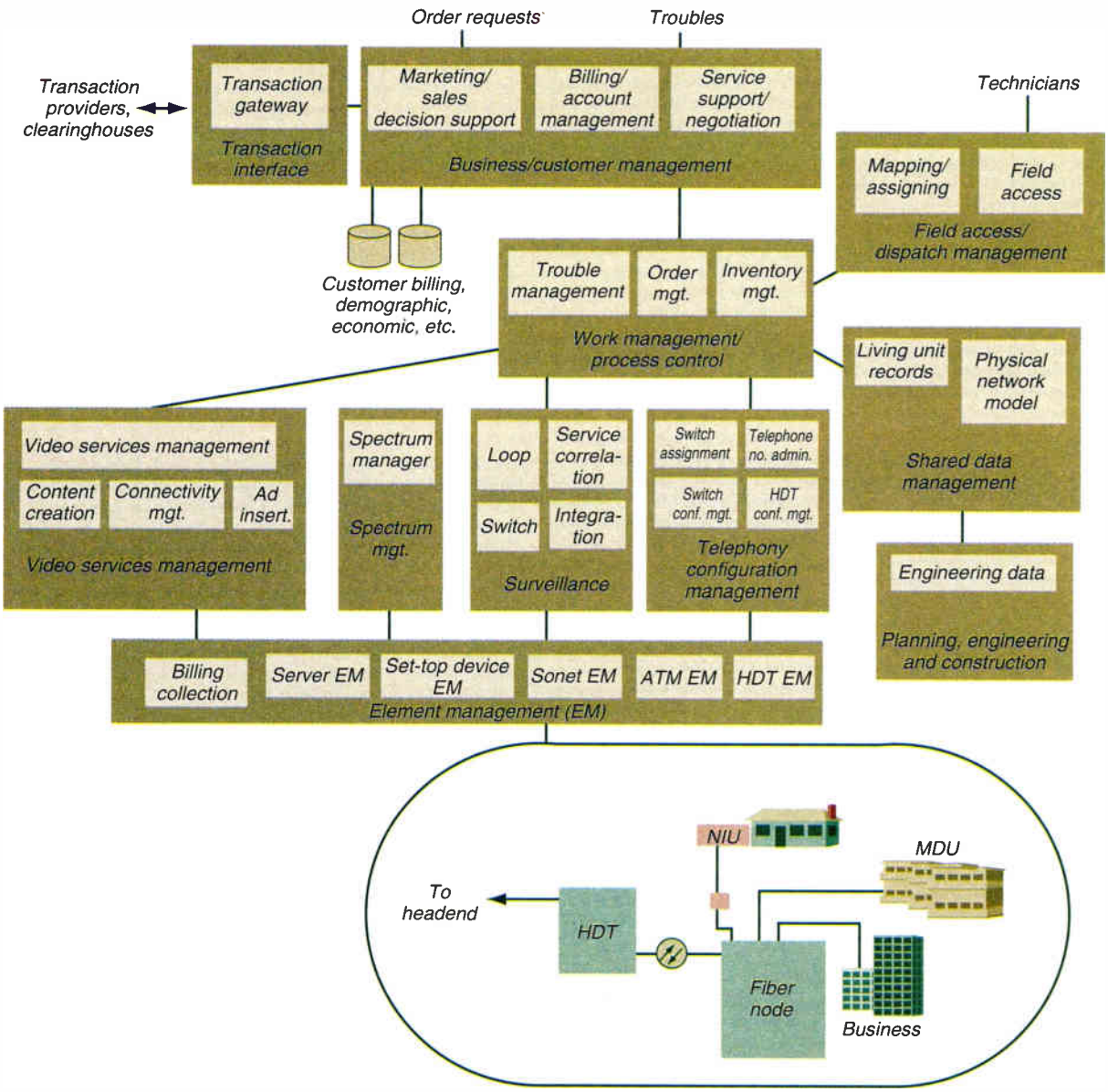
The world of the multi-service broadband provider will be dizzying–new services, new customers, new equipment, tough competition, unprecedented complexity. How can an MSO remain sure-footed and fast-moving? By depending on an integrated operations system.

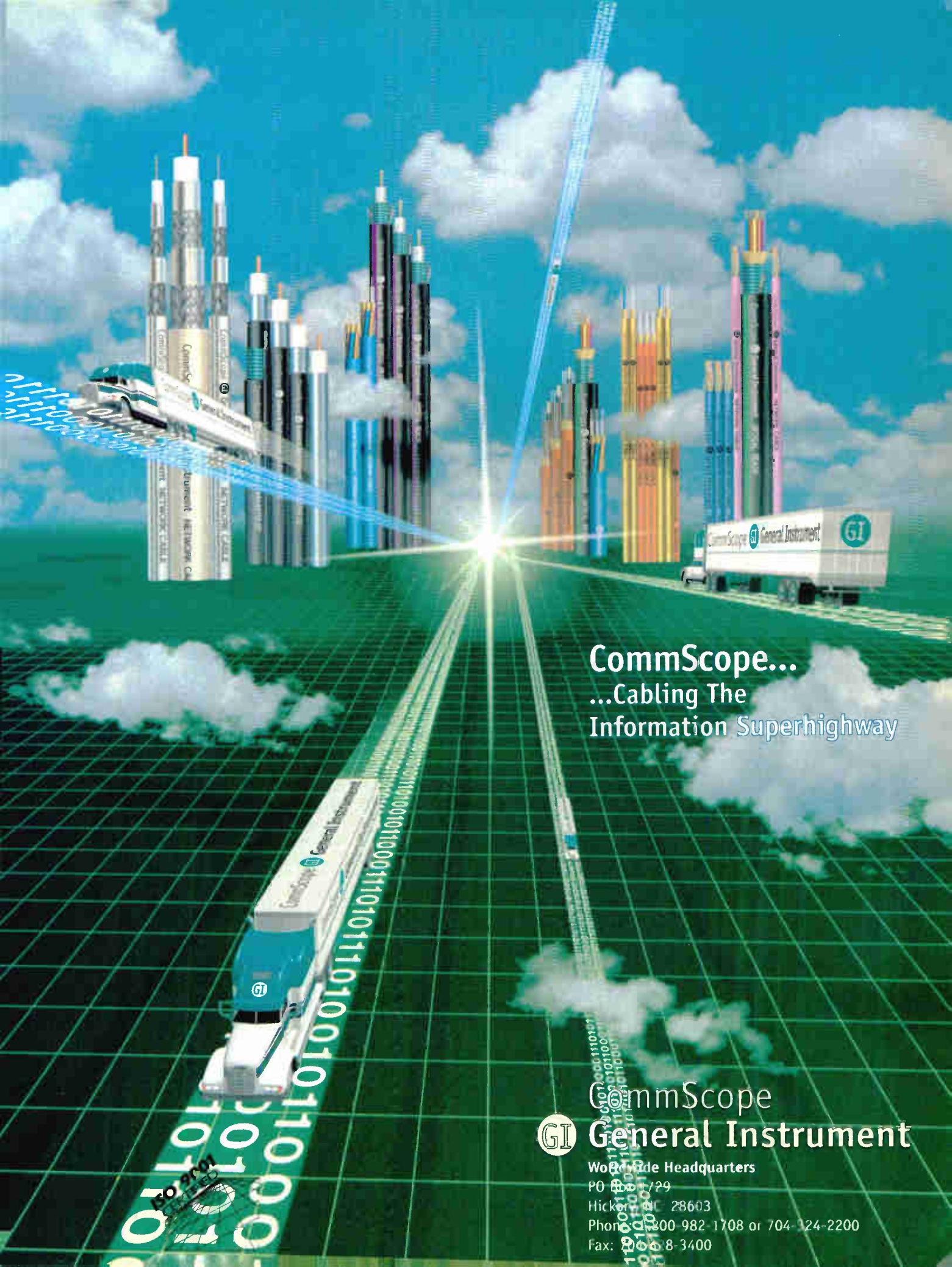
A well-designed and thoroughly integrated operations system can help MSOs negotiate all of the broiling changes that lie ahead. Such a system can help MSOs:

✔ incorporate into their networks an incredible amount of complexity arising from new technologies and services;
✔ increase service and process reliability and quality, satisfying customer demands that ratchet ever higher;
✔ reduce time-to-market;
✔ keep costs under tight control;
✔ attract and retain programming and advertising; and
✔ create a climate for favorable regulatory rulings.

The integrated OS can also help MSOs

Figure 1: *Video/telephony hybrid fiber/coax network*

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meet specific demands created by individual new services–telephony is perhaps a good paradigm. Because people's lives and livelihoods depend on telephone services such as Enhanced 9-1-1 and 800/900 calling, customers and public utility commissions demand a high level of reliability. Outages must be measured in just seconds per year. In addition, interexchange carriers will demand that providers satisfy tough performance metrics on both reliability and quality.

Building a smoothly functioning multi-service broadband network will take more than upgrading transmission systems and installing a few switches and software programs. Success will require an intense, precise re-engineering of operations.

The carefully designed operations that result can ensure that customers' requests for new services meet prompt responses, multi-vendor network elements work together smoothly, business systems promote innovative marketing, problems are resolved before the switchboard lights up with complaints, and new services are brought to market rapidly.

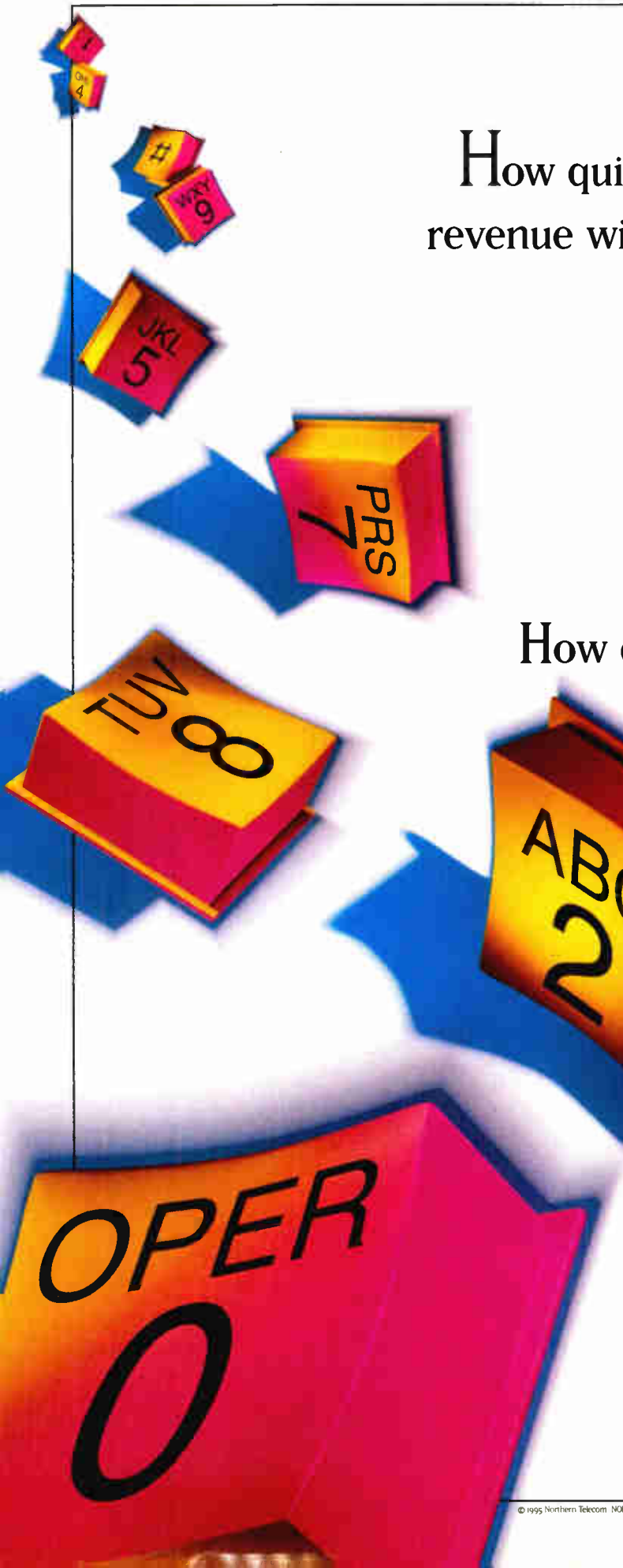
But that's *only if* those operations have the right support—a well-integrated operations system that coordinates network elements with business activities and initiatives. This operations system must integrate and implement end-to-end operations processes spanning the entire network. It must filter and interpret the enormous amount of information coming from intelligent network elements and make it useful and manageable.

The result? Quality that satisfies the most demanding customers and flexibility that defines a competitive advantage. And savings in cold cash–preliminary analyses suggest that operating a broadband network with integrated OSs need cost only half as much as is spent on operating today's single-service telephony networks.

How to manage complexity

In order to support multiple, interactive services, today's straightforward broadcast cable television network architecture must be enhanced and augmented. Deployed in these new architectures will be a profusion of new intelligent network elements. Master headends and distribution hubs will be augmented by digital video and data servers, host digital terminals, and switches to route signals to specific parts of the network. Residences and businesses will need more complex equipment, such as network interface units and digital set-top boxes, to interpret signals and deliver subscribed-to services. These intelligent network elements will generate a vast amount of information on their status, activity, and on traffic patterns and signal quality as well.

Intelligent network elements will generate vast amounts of information on their status, activity, and on traffic patterns



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MSOs will find that making effective use of that information is the key to success. For example, it can enable them to provision services faster, resolve problems before they affect service in many cases, dispatch crews to fix–not just find faults–and create precisely targeted marketing.

The key will be integrated operations systems that use intelligence in the network elements and the dynamic information they provide to support dynamic network operations. The integrated OS can provide a seamless transition path by supporting existing as well as new services with the same operations processes.

Service provisioning

Let's look, for instance, at how the integrated OS can enhance provisioning and maintenance of new services in a complex, multi-service network. Again, let's use provisioning of telephony service as an example. Today, this provisioning is generally done in discrete steps. The customer service representative (CSR) takes a customer's order and ends the call. Then the order is sent to an order-processing system that divides the order into subtasks; the subtasks are assigned to different personnel or downstream systems to identify available facilities or install new ones, turn on service, set up the billing account, and so on.

Only after the subtasks are underway is it possible to accurately determine precisely when service will be activated. If any service order information is missing or incorrect, the order is delayed pending manual intervention.

Currently, most MSO fault management is reactive rather than proactive–troubles are usually reported by customers

If, however, intelligent broadband network elements and the information they generate are effectively used, most tasks can be accomplished during the customer's call. As the CSR electronically enters a service order, the OS can determine the facilities needed, communicate directly with the intelligent network elements to determine availability of resources and facilities, issue the proper electronic provisioning commands, and set up a billing account. If the appropriate resources are available, the CSR then tells the delighted customer that service will begin within a few minutes.

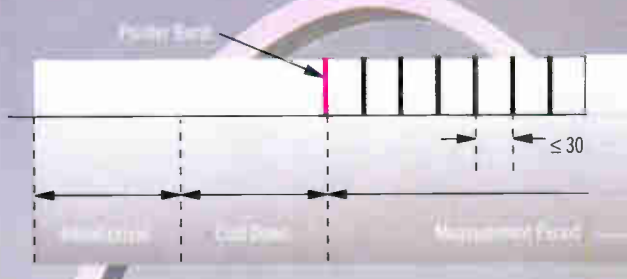
Common data model

The integrated OS ensures accuracy by employing one data model that is common to all operations and is synchronized with the actual state of the network.

In some cases, this type of provisioning for broadcast services is supported by current MSO business systems, but the dynamic provisioning of multiple complex broadband services represents an order-of-magnitude increase in complexity.

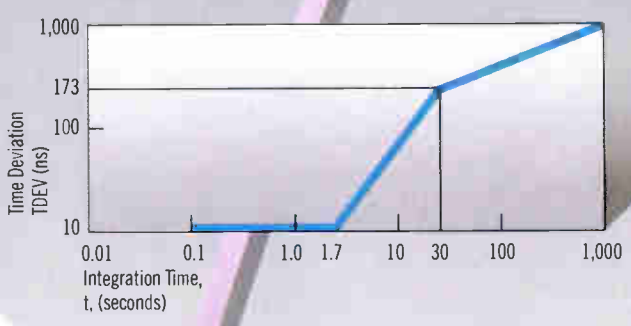
Broadband network maintenance can be just as streamlined and dynamic. Currently, most MSO fault-management is reactive rather than proactive—troubles are usually reported by

Synchronous

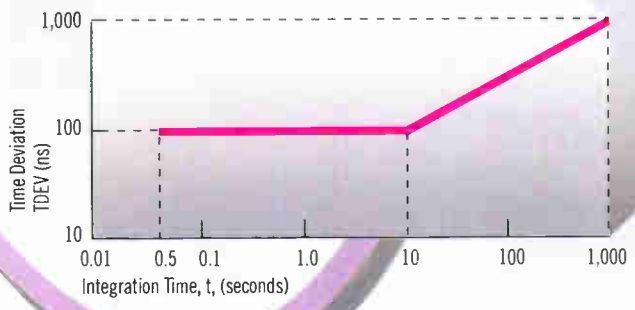


Burst Pointer Adjustment Test Sequence

Time Deviation for OC-N Reference Signals



Time Deviation for DS1 Reference Signals



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SONET

WHAT IS SONET?

The telecommunications industry today is evolving to Synchronous Optical NETworks (SONET). This evolution is being made possible through the industry acceptance of an optical interface standard, commonly referred to as the SONET standard.

WHY USE SONET?

Fiber optics is greatly influencing the communications industry. It is the transmission medium being deployed in new interexchange carrier (IXC) long haul routes, as well as local exchange carrier (LEC), inter-CO (central office), and intercity routes. Fiber is currently used for new feeder plant routes and is starting to be deployed in local loops (fiber to the home) for residential use.

Today, the fiber optic transmission equipment available from one vendor will not interface with the equipment available from a different vendor. This incompatibility becomes an obstacle in midspan meets for multi-vendor environments.

SONET defines a standard for optical interfacing and signaling which enables the interconnection of optical equipment from different vendors. SONET specifies a standard synchronous multiplexing scheme which allows the transport of synchronous and asynchronous signals (i.e., DS1, DS3, or SYNTRAN DS3).

The primary attractions of SONET, in addition to standardization, is its ability to allow networks to be more flexible, easier to reconfigure, and easier to control than existing networks. With its standard optical interface and synchronous multiplexing scheme, SONET allows new services such as broadband ISDN (B-ISDN) to be possible. Existing services may also be provided more efficiently.

SONET – Acronyms

OC-*N*	–	Optical Carrier level *N*
STS-*N*	–	Synchronous Transport Signal level *N*
STE	–	Section Terminating Equipment
LTE	–	Line Terminating Equipment
PTE	–	Path Terminating Equipment
SPE	–	Synchronous Payload Envelope
VT	–	Virtual Tributary
VT*x*	–	VT of size *x* (currently *x* = 1.5, 2, 3, or 6)
DCC	–	Data Communication Channels
BIP-*N*	–	Bit Interleaved Parity *N*
APS	–	Automatic Protection Switching

Standard OC Rates

OC Level	Line Rate (*M*bit/s)
OC-1	51.840
OC-3	155.520
OC-12	622.080
OC-24	1244.160
OC-48	2488.320
OC-192	9953.280

SECTION OVERHEAD

Framing (A1, A2). Two bytes are dedicated to each STS-1. The pattern shall be F628 Hex (1111011000101(These bytes shall be provided in all STS-1 signals within STS-*N* signal.

Section Trace (J0)/Section Growth (Z0)/STS-1 Identification (STS-1 ID) (C1). This byte is only p defined. The J0 byte of STS-1 Number 1 shall be used fo section trace function. This byte is used to repetitively tr a one byte fixed length string. This is done so that a rece terminal in a section can use this value to verify its cont connection to the intended transmitter. If the section tra tion is not supported, or if no value has been programm 01 Hex shall be transmitted. The Z0 byte of STS-1 Numb through *N* is reserved for future use. The J0 and Z0 byte previously utilized for an STS-1 Identification (C1) fun provide interworking with older equipment at rates at STS-48, the J0 and Z0 bytes shall be capable of provid STS-1 ID codes. To provide this function, each J0 and Z shall be capable of being set to a binary number corres to its order of appearance in the STS-*N* frame (i.e. the J shall be set to 00000001, the first Z0 byte shall be set t 00000010, the second Z0 byte shall be set to 00000011 For STS-192 signals, the Z0 bytes shall be set to the val Hex.

Section BIP-8 (B1). One byte is allocated in each S a section error monitoring function. This function shall b interleaved parity 8 code using even parity. The section calculated over all bits of the previous STS-*N* frame afte bling. The computed BIP-8 is placed in the B1 byte of S Number 1 before scrambling. This byte is defined only f Number 1 of an STS-*N* signal.

LINE OVERHEAD

STS-1 Payload Pointers. Provides a method to allo and dynamic alignment of the STS SPEs within the STS Capacity, independent of the actual contents of the env Dynamic alignment means the STS SPE is allowed to flo the STS Envelope Capacity. Thus, the pointer can accom differences in phases of the STS SPE and Transport Ove well as in the frame rates.

Bit Interleaved Parity *N* (BIP-*N*). A method of e itoring. If even parity is used, an *N*-bit code is generate transmitting equipment over a specified portion of the the first bit of the code provides even parity over the firs all *N*-bit sequences in the covered portion of the signal. second bit provides even parity over the second bits of sequences within the specified portion, and so on. Even generated by setting the BIP-*N* bits so there are an eve of 1s in each of all *N*-bit sequences including the BIP-*

Pointer (H1, H2). Two bytes are allocated to a point indicates the offset in bytes between the pointer and fi of the STS SPE. It shall be used to align the STS-1 Tran Overheads in an STS-*N* signal, as well as to perform fr justification. These bytes shall be provided in all STS-1 within an STS-*N* signal.

Pointer Action Byte (H3). This byte is allocated f frequency justification purposes. Depending on the poi value, it is used to adjust the fill of input buffers. In th of a negative justification, it carries valid information. shall be provided in all STS-1 signals within an STS-*N* When not used to carry valid information, the value in is not defined, and the receiver shall ignore the value within it.

Line BIP-8 (B2). One byte is allocated in each STS a line error monitoring function. This function shall be interleaved parity 8 code using even parity. The Line B calculated over all bits of the Line Overhead and STS- Capacity of the previous STS-1 frame before scrambli computed BIP-8 is placed in the B2 byte of the STS-1 scrambling. This byte shall be provided in all STS-1 s within an STS-*N* signal. The *N* Line BIP-8 bytes in an signal are intended to form a single error monitoring f capable of measuring error rates of up to 10^{-3}, indepe of the value of *N*.

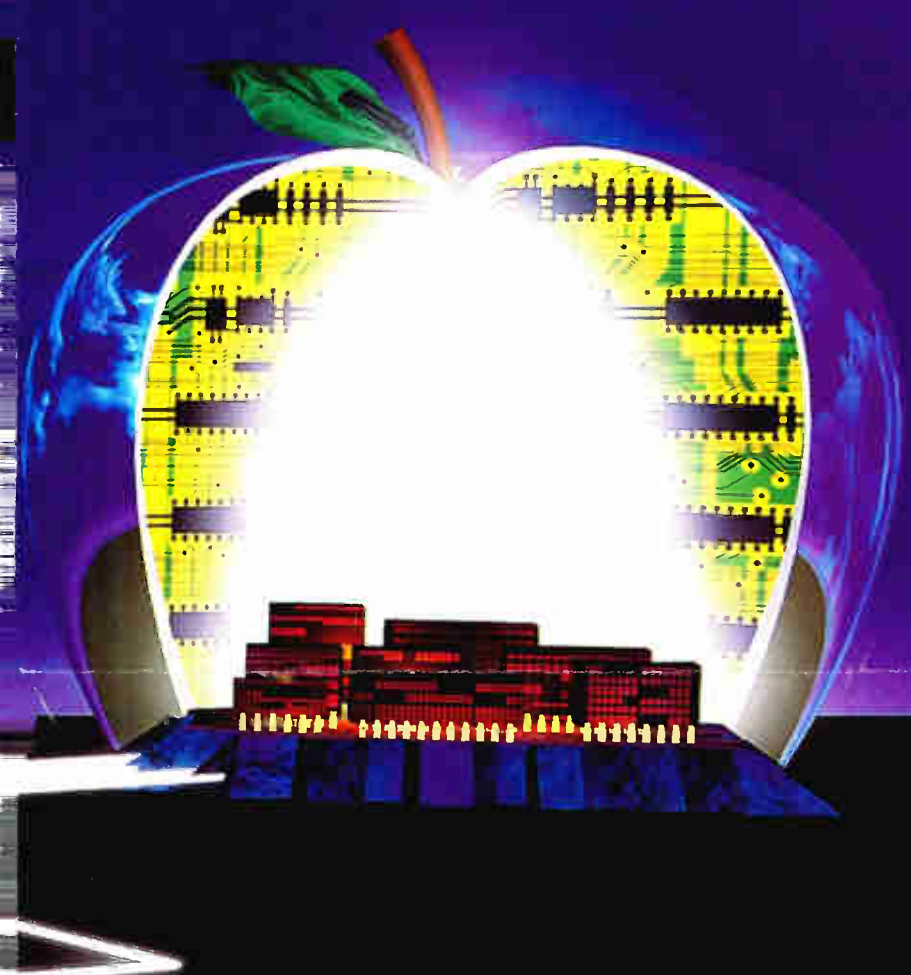
Parity errors detected by the *N* BIP-8 detectors, o single BIP-8*N* detector, should be accumulated into a error count for the OC-*N* line.

APS Channel (K1, K2). Two bytes are allocated f Automatic Protection Switching (APS) signaling betw Line level entities that use line level protection switch The two types of line level protection switching are lin and bidirectional line switched rings. The K1 and K2 only defined for the first STS-1 of an STS-*N* signal. T also used to detect Line AIS (AIS-L) and Line Remote Indication (RDI-L).

tellabs

We gratefully acknowledge Tom Ranick, Development Manager, Systems Engineering; Jim Brede, Senior Member, Technical Staff; Jenniter Dunn, Member of Technical Staff; Digital Systems Division, Tellabs Operations, Inc. and Howard Altman for their contributions and assistance in developing this poster.

SONET to the Core.



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Optico

OC-3
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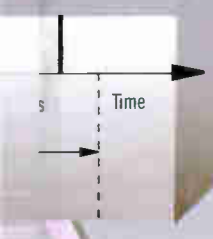
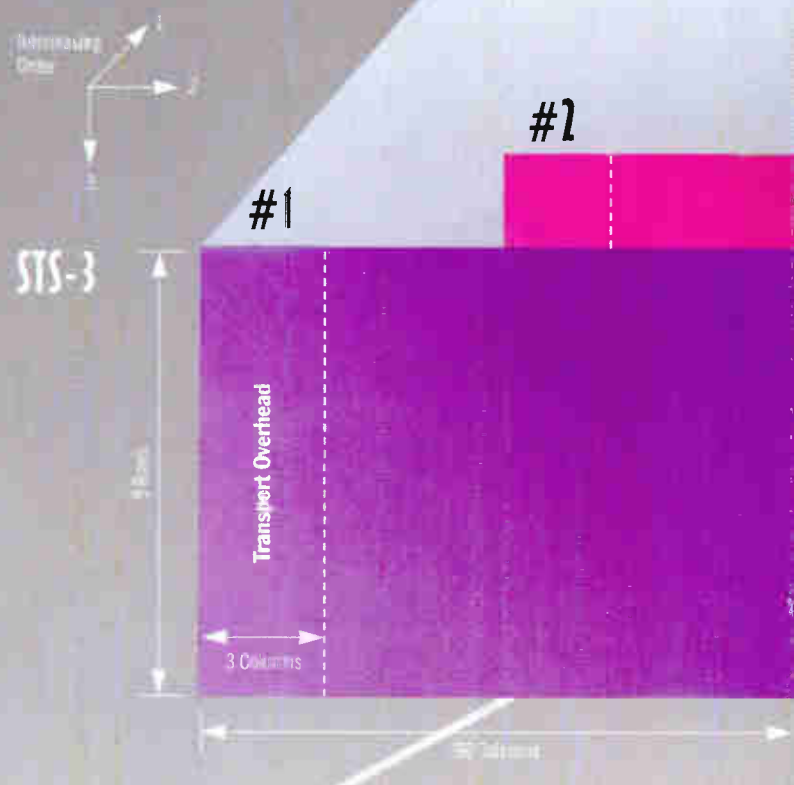
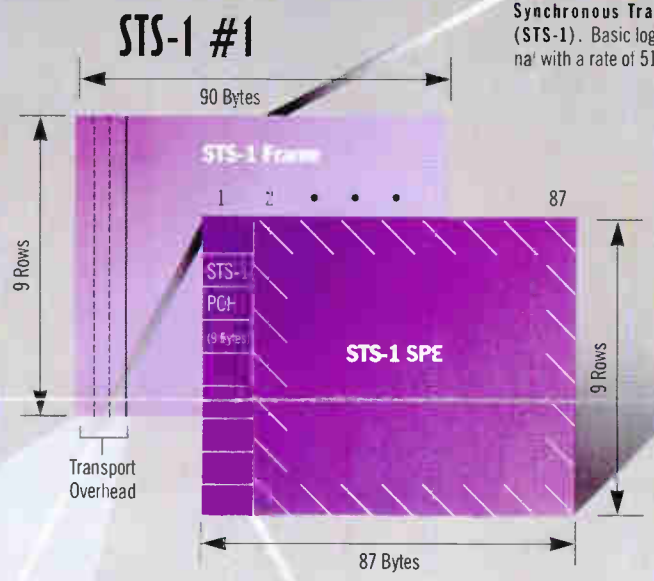
result from an



jitter on DS3 payload signals of SONET networks shall be than 1.3 UI P-P given the st pointer test sequence is lied to the final PTE.



Synchronous Transport Signal level 1 (STS-1). Basic logical building block signal with a rate of 51.840 Mbit/s.



Orderwire (E1). One byte is allocated to be used as a local orderwire channel that shall be used as a voice channel. It is reserved for communication between STEs, hubs, and remote terminal locations, and it is only defined for STS-1 Number 1 of an STS-*N* signal. Signaling on the E1 byte is for further study. This is an optional function.

Section User Channel (F1). One byte is set aside for user purposes. This byte shall be passed from section to section within a line and shall be readable, writable, or both at each STE in that line. This is also an optional function. The F1 byte is defined only for STS-1 Number 1 of an STS-*N* signal.

Section Data Communication Channel (DCC) (D1-D3). Three bytes are allocated for Section DCCs and should be considered one 192-kbit/s message-based channel for alarms, maintenance, control, monitor, administration, and other communication needs between STEs. This channel is available for internally generated, externally generated, and manufacturer-specific messages. These bytes are defined only for STS-1 Number 1 of an STS-*N* signal.

Section DCC Utilization. STEs and LTEs in an application requiring communications over the SONET interface shall support the Section DCC. (It should be noted that the Section DCC is the only DCC which can be accessed by all types of terminating equipment: STE, LTE, and PTE.)

SECTION OVERHEAD	Framing A1	Framing A2	Trace J0
	BIP-8 B1	Orderwire E1	User F1
	DCC D1	DCC D2	DCC D3
LINE OVERHEAD	Pointer H1	Pointer H2	Pointer Action H3
	BIP-8 B2	APS K1	APS K2
	DCC D4	DCC D5	DCC D6
	DCC D7	DCC D8	DCC D9
	DCC D10	DCC D11	DCC D12
	Sync Status/ Growth S1/Z1	FEBE/Growth M0/Z2	Orderwire E2

SECTION OVERHEAD

LINE OVERHEAD

Line Data Communication Channel (DCC) (D4-D12). Nine bytes are allocated for Line DCCs and should be considered as one 576-kbit/s message-based channel for alarms, maintenance, control, monitor, administration, and other communication needs between LTEs. This is available for internally generated, externally generated, and manufacturer-specific messages. These bytes are defined only for STS-1 Number 1 of an STS-*N* signal.

Synchronization Status Messaging (S1)/Growth (Z1). This byte is allocated for transporting synchronization status messages. These messages provide an indication of the quality level of the synchronization source of the SONET signal. Currently, only bits 5-8 of this S1 byte are defined for synchronization status messages. Bits 1-4 of this byte are reserved for future use. This byte is only defined for STS-1 Number 1 of an STS-*N* signal. For STS-1 Numbers 2 through *N*, this byte is reserved as a growth byte (Z1).

STS-*N* Line FEBE (M0 or M1)/Growth (Z2). For OC-1 or STS-1 electrical signals, the M0 byte is allocated for a Line FEBE function. Bits 5-8 of the M0 byte are used to convey the count of errors detected by the line BIP-8 (B2) byte. This count has valid values of 0-8. Bits 1-4 of the M0 byte are reserved for future use. For OC-*N* or STS-*N* signals ($N \geq 3$), the M1 byte is allocated for a Line FEBE function. For values of *N* below 48, the conveyed error count shall be a binary number from zero to 8*N*. For *N* equal to 48 or higher, the conveyed error count shall be truncated at 255. The M1 byte is only defined for STS-1 Number 3 of an STS-*N* signal. For all STS-1s except STS-1 Number 3, this byte is reserved as a growth byte (Z2).

Orderwire (E2). One byte is allocated in this layer for an express orderwire between Line entities. This byte is defined only for STS-1 Number 1 of an STS-*N* signal. Use is optional. Signaling on the E2 byte is for further study.

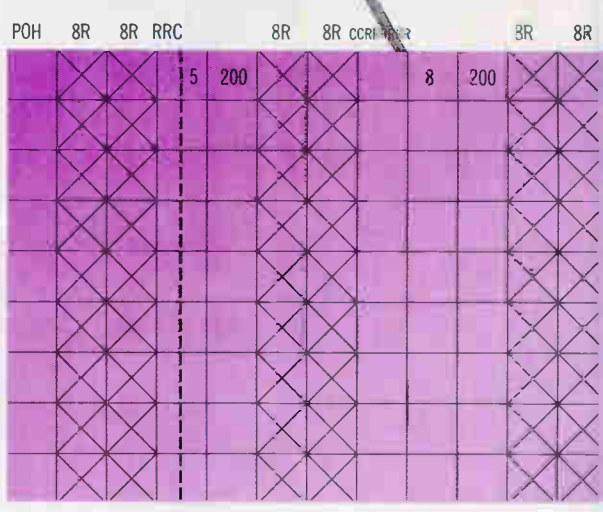
Remote Defect Indication (RDI). An indication returned to transmitting equipment upon receipt of specific defects on the incoming signal.

Far End Block Error (FEBE). An indication returned to a transmitting node (source) that an errored block has been detected at the receiving node (sink).

Path Layer Overhead

Trace J1
BIP-8 B3
Signal Label C2
Path Status G1
User Channel F2
Multiframe H4
Growth Z3
Growth Z4
Tandem Connection/ Path Data Channel Z5

DS3 Mapping



STS PATH OVERHEAD

STS Path Overhead (STS POH). The STS POH shall be assigned to, and remain with, the payload until the payload is demultiplexed and shall be used for functions necessary in transporting all STS SPEs. For Super Rate Service, only one set of POH is required and is contained in the first STS-1 of the STS-*N*c. The STS POH supports these classes of functions:

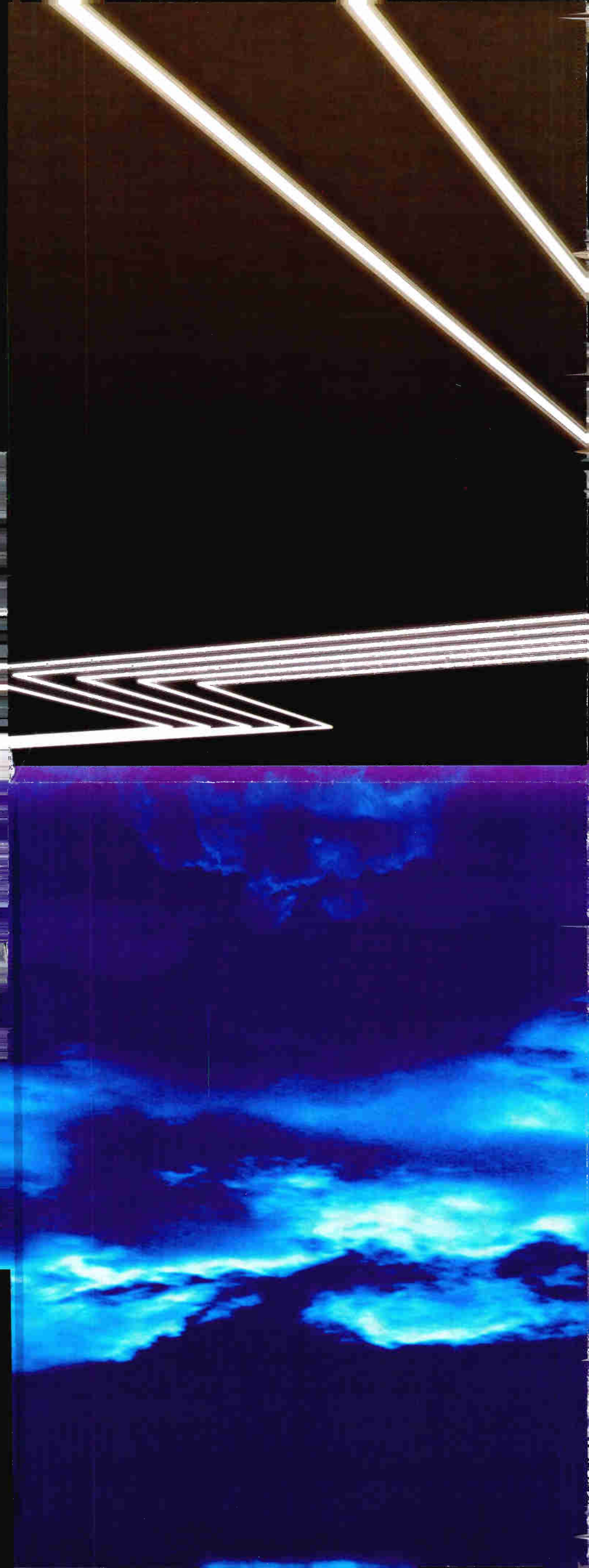
A. Payload independent functions with standard format and coding. Functions shall be required and shall be read, interpreted, or modified by all PTEs.

B. Mapping dependent overhead functions with standard format and coding that are specific to the type of payload. These functions are needed for more than one type of payload but not necessarily for al are read, interpreted, or r appropriate PTEs.

C. Application-specific over Format and coding for th specified in the standard- interpreted, or modified b

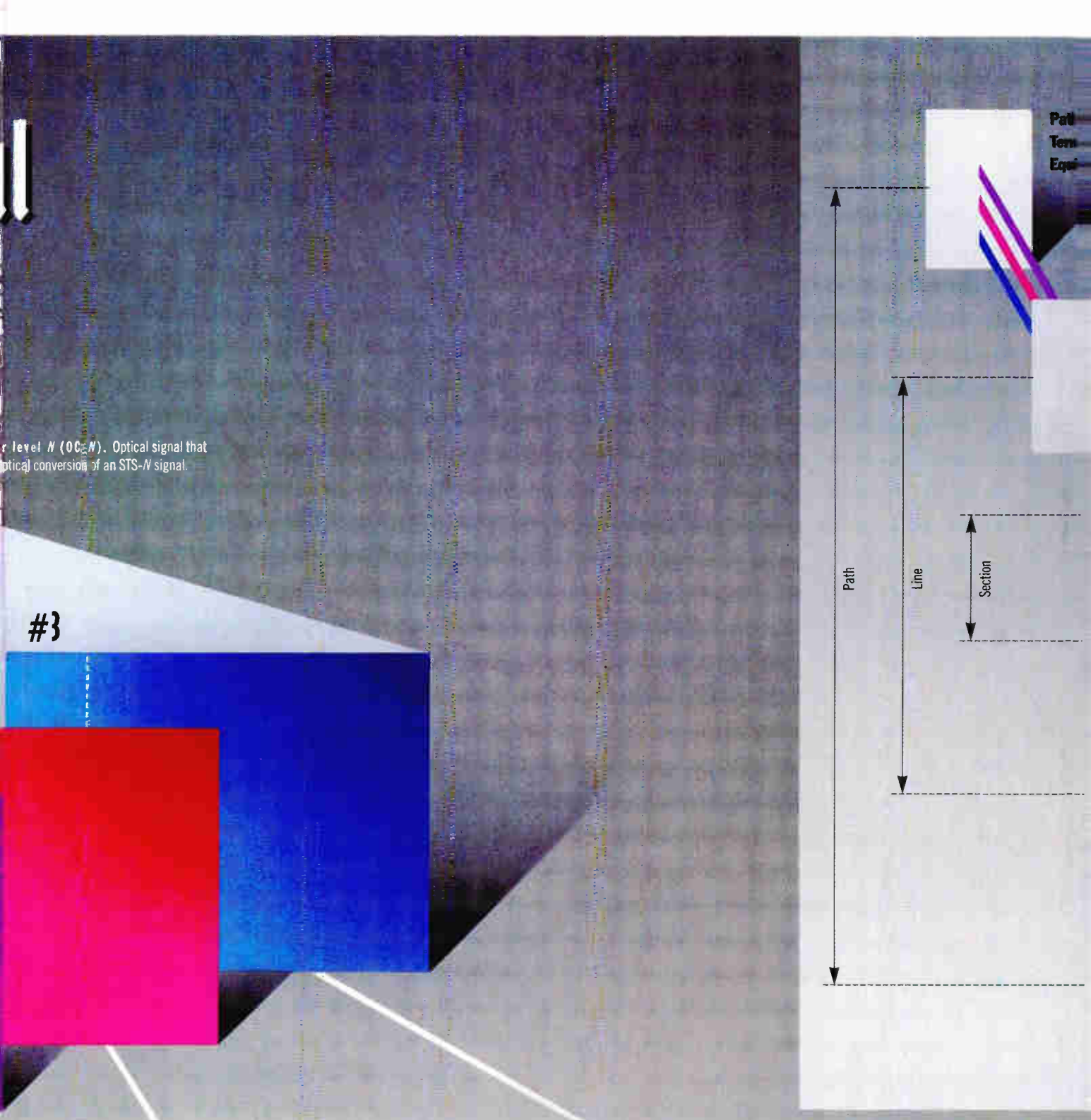
D. Undefined overhead func reserved for future use fo functions in class A, B, o shall have priority over ch

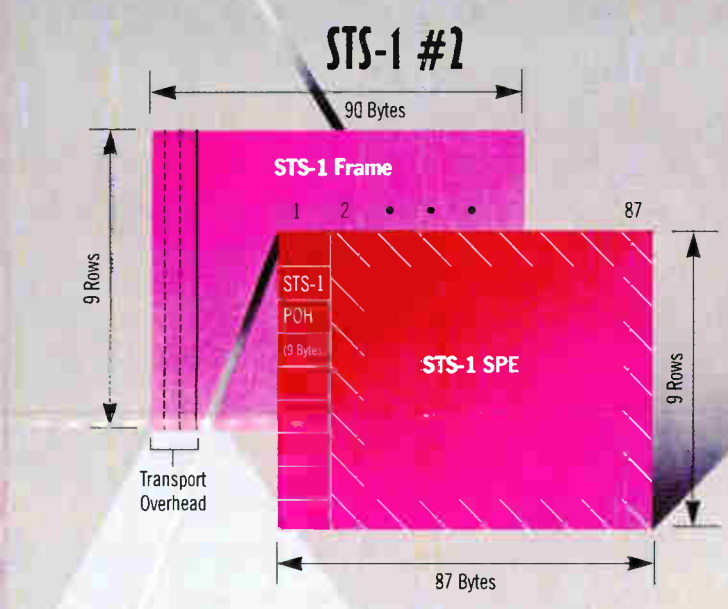
These classifications do allocation of other overhead specific mappings (such as mapping asynchronous DS3 overhead bytes shall be allo Payload Capacity.

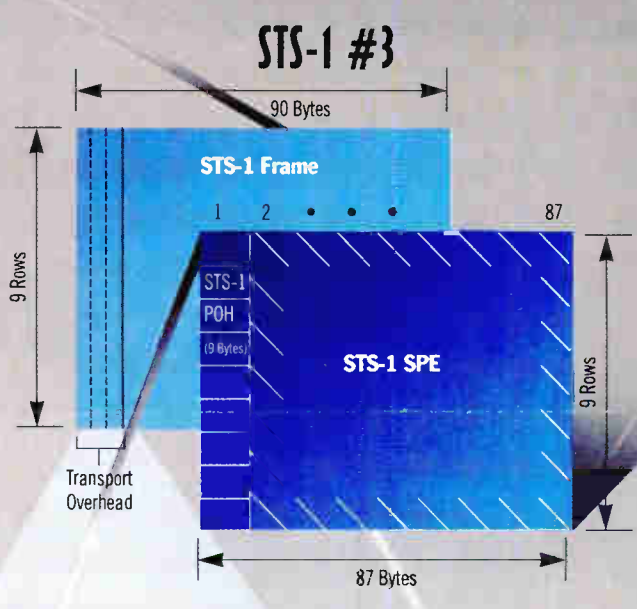


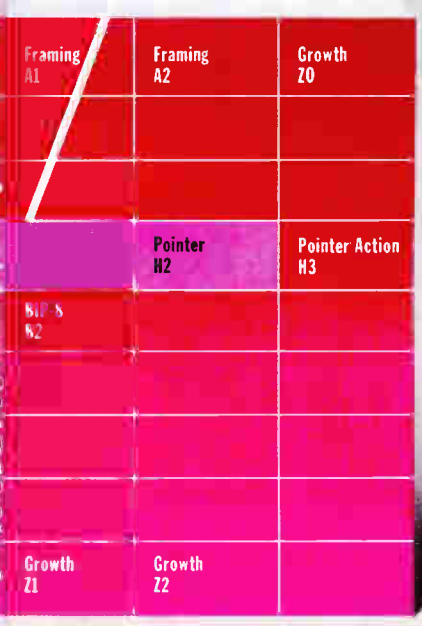
r level *N* (OC-*N*). Optical signal that
ptical conversion of an STS-*N* signal.

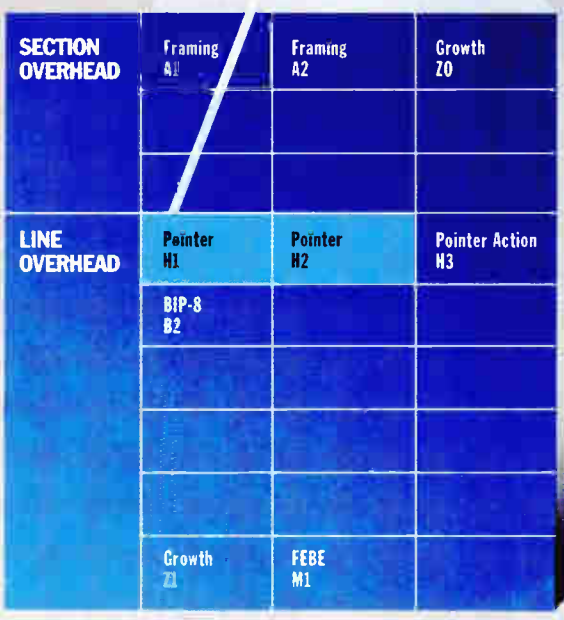
#3











CCRROORS

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payloads. Functions
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Functions are read,
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ions. Overhead bytes
r the support of
C. Class A functions
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bytes for payload
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). These other
ated in the STS

STS Path Trace (J1) – Class A. This byte is used to repetitively transmit a 64-byte, fixed-length string so that a receiving terminal in a path can verify its continued connection to the intended transmitter. Content of the message is not constrained since it is assumed to be user programmable at both the transmit and receive ends. It is suggested that a 64-by-8 bit ASCII Common Language Location Identifier (CLLI) code, padded with NULL characters and terminated with CR/LF, would be a suitable trace message. If no message has been loaded, then 64 NULL characters (Hex 00) shall be transmitted.

Path BIP-8 (B3) – Class A. One byte is allocated for a path error monitoring function. This function shall be a bit interleaved parity 8 code using even parity. The path BIP-8 is calculated over all bits of the previous STS SPE before scrambling.

STS Path Signal Label (C2) – Class A. One byte is allocated to indicate the construction of the STS SPE, and for STS Payload Defect Indication (PDI-P). PDI-P is an application specific code that indicates to downstream equipment that there is a defect in one or more directly mapped embedded payloads in the STS SPE. For PDI-P, the count of VT-x Payload Defects shall be based on a count of defective services. Therefore, a VT1.5 payload defect shall be assigned the same priority as a VT2, VT3, or VT6 payload defect. Of the 256 possible binary codes (00-FF Hex), only codes defined in the table have been defined, and the remaining codes are reserved for future use.

Code (Hex)	Payload Type
00	Unequipped
01	Equipped-Nonspecific
02	Floating VT Mode
03	Locked VT Mode
04	Asynchronous Mapping for DS3
12	Asynchronous Mapping for 139.264 Mb/s
13	Mapping for ATM
14	Mapping for DQDB
15	Asynchronous Mapping for FDDI
E1-FC	STS-1 Payload with 1 to 28 VT-x Payload Defect(s). For non-VT Payload Defects (DS3, FDDI, etc.), the code FC shall be used.

Path Status (G1) – Class A. This byte is allocated to convey back to an originating STS PTE the path terminating status and performance. This permits the status and performance of the complete duplex path to be monitored at either end or at any point along that path. Bits 1-4 convey the count of interleaved bit blocks that have been detected in error by the Path BIP-8 code (B3). This count has nine legal values (0 to 8 errors). The remaining seven possible values represented by these four bits shall be interpreted as zero errors. Bit 5 provides the old STS Path Remote Defect Indication (RDI-P). Bits 6 and 7 provide an enhanced RDI-P. This enhanced RDI allows differentiation between payload, connectivity, and server defects. Bit 8 is not defined at this time, and is reserved for future use.

Path User Channel (F2) – Class C. One byte is allocated for user communication purposes between Path elements.

Multiframe Indicator (H4) – Class B. This byte provides a generalized multiframe indicator for payloads. Currently, this indicator is only used for VT-structured payloads.

Tandem Connection Maintenance/Path Data Channel (Z5) – Class C. This byte is allocated to support tandem connection maintenance and the path data channel. Bits 1-4 of the Z5 byte are used to provide the tandem connection Incoming Error Count (IEC). Bits 5-8 of the Z5 byte are used to provide the path data channel. The path data channel is an optional 32 Kb/s data channel available to applications or services (e.g., tandem connection, security, etc.) that span more than one LTE-LTE connection, but may be shorter than a PTE-PTE connection. As a result, the B3 byte must be recalculated at each point where this channel is altered. The path data channel can exist independently of tandem connection maintenance.

Growth (Z3-Z4) – Class D. Two bytes are allocated for future purposes. These bytes have no defined value. The receiver is required to ignore the value contained in these bytes.

VT PATH OVERHEAD

VT Synchronous Payl
500-µsec. frame structu
POH and bandwidth for
within and can have any
Envelope Capacity. The
VT3, and VT6 SPEs.

VT Path Overhead (V
are allocated for VT Path
byte of a VT SPE. This by
VT Paths as B3, C2, and
error checking, signal la
ments of the V5 byte are

Bits 1 and 2: Error
scheme is specified. Bit
odd-numbered bits (1, 3
SPE. Bit 2 is even parity
bits. Calculation of BIP-
excludes VT Pointers.

Bit 3: VT Path FEBE
on originating VT PTE if
the BIP-2.

Bit 4: This bit is res
tions. Currently, it is onl
DS1 mapping, in which
Failure Indication (RFI-V

Bits 5-7: VT Signal
ble in these three bits.

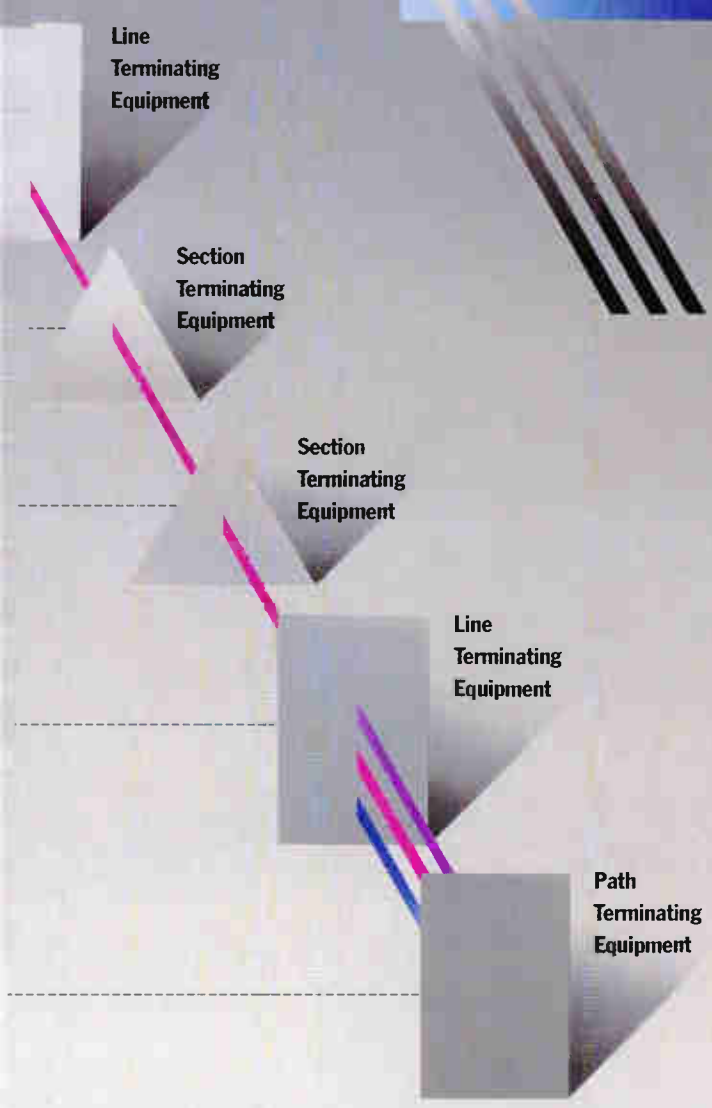
The table summari
Signal Label in conjunct
6 of the VT payload poin

Bit 8: VT Path Rem
indicates to transmittin
detected which affects

VT Path Trace (J2).
Path Trace function. Ho
are for further study. Th
considered undefined.

VT Path Growth (Z6
allocated for future gro
the enhanced RDI-V ind
between payload, serve

NETwork



Line Terminating Equipment (LTE). Network Elements (NE) that originate and/or terminate line (OC-*N*) signals. LTEs can originate, access, modify, or terminate the transport overhead, or can perform any combination of these actions.

STS Path Terminating Equipment (STS PTE). NEs that multiplex/demultiplex the STS payload. STS PTEs can originate, access, modify, or terminate the STS POH necessary to transport the STS payload, or can perform any combination of these actions.

VT Path Terminating Equipment (VT PTE). NEs that multiplex/demultiplex the VT payload. PTEs can originate, access, modify, or terminate the VT POH necessary to transport the VT payload, or can perform any combination of these actions.

Section. Portion of a transmission facility, including terminating points, between (1) a terminal NE and an LTE, or (2) two LTEs. A terminating point is the point after signal regeneration at which performance monitoring is (or may be) done.

Line. Transmission medium, together with the associated equipment, required to provide the means of transporting information between two consecutive NEs, one of which originates the line signal, while the other terminates the line signal.

Path. Logical connection between the point at which a standard frame format for the signal at the given rate is assembled, and the point at which the standard frame format for the signal is disassembled.

Designations: (Applies to all VTs)

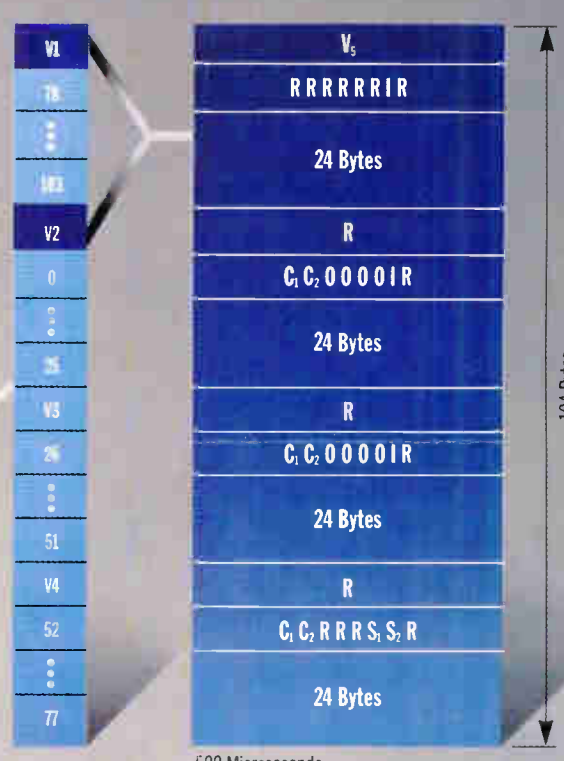
V1	VT PTR1
V2	VT PTR2
V3	VT PTR3 (ACTION)
V4	VT RESERVED

Virtual Tributary (VT). Structure designed for transport and switching of sub-STS-1 payloads. There are currently four sizes of VT.

VT Group. A 9-row by 12-column structure (108 bytes) that carries one or more VTs of the same size. Seven VT groups (756 bytes) are byte-interleaved within the VT-organized SPE.

VT SIZES

Size	Designation	VT Pointer Range (in 500 µsec)
00	VT6	0 – 427
01	VT3	0 – 211
10	VT2	0 – 139
11	VT1.5	0 – 103



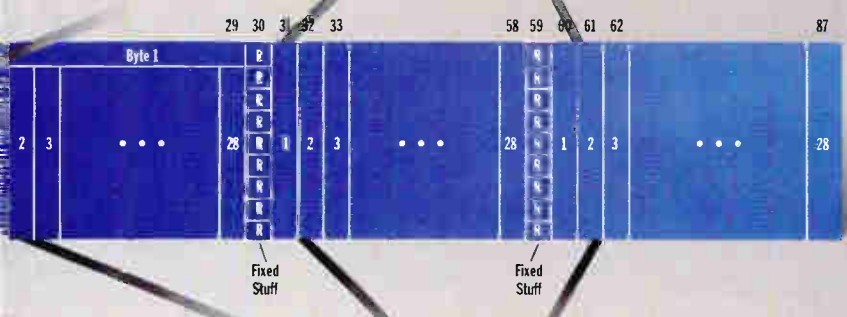
500 Microseconds

Floating Asynchronous DS1 Mapping

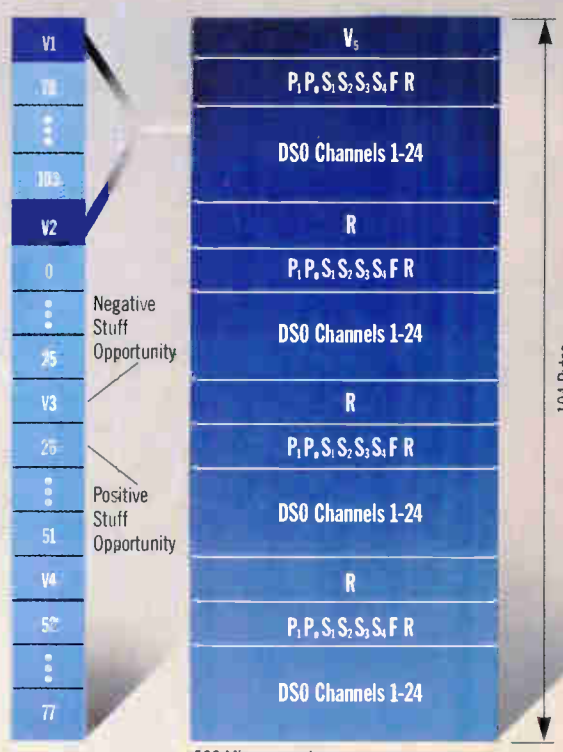
I – Information (Data)
O – Overhead
C – Stuff Control
S – Stuff Opportunity
R – Fixed Stuff

VT1.5 #1

T1.5s



VT1.5 #2



500 Microseconds

Floating Byte-Synchronous DS1 Mapping

F – DS1 Frame Bit
$P_1 P_2$ – Signaling Phase Indicator = ØØ on the first signaling byte of the superframe
S – Signaling
R – Fixed Stuff

VT Signal Label – Byte V5(5-7)

VT Size	Signal Label	Assigned VT Identification
11	000	Unequipped VT1.5
11	001	Equipped Nonspecific VT1.5
11	010	Asynchronous Mapping for DS1
11	011	Bit Synchronous Mapping for DS1
11	100	Byte Synchronous Mapping for DS1
11	101	Unassigned VT1.5
11	110	Unassigned VT1.5
11	111	Unassigned VT1.5
10	000	Unequipped VT2
10	001	Equipped Nonspecific VT2
10	010	Asynchronous Mapping for 2.048Mb/s
10	011	Bit Synchronous Map for 2.048Mb/s
10	100	Byte Synchronous Map for 2.048Mb/s
10	101	Unassigned VT2
10	110	Unassigned VT2
10	111	Unassigned VT2
01	000	Unequipped VT3
01	001	Equipped Nonspecific VT3
01	010	Asynchronous Mapping for DS1C
01	011	Unassigned VT3
01	100	Unassigned VT3
01	101	Unassigned VT3
01	110	Unassigned VT3
01	111	Unassigned VT3
00	000	Unequipped VT6
00	001	Equipped Nonspecific VT6
00	010	Asynchronous Mapping for DS2
00	011	Unassigned VT6
00	100	Unassigned VT6
00	101	Unassigned VT6
00	110	Unassigned VT6
00	111	Unassigned VT6

ıad Envelope (VT SPE). A
e carried by the VT, composed of VT
ayload. The envelope is contained
alignment with respect to the VT
m generically refers to VT1.5, VT2,

, J2, Z6, and Z7). Four bytes
)verhead. The V5 byte is the first
provides the same functions for
1 provide for STS Paths, namely:
l, and path status. The bit assign-
pecified below:
formance monitoring. A BIP-2
is even parity calculated over all
, 7) in all bytes in the previous VT
lculated over the even-numbered
ncludes VT POH bytes but

ı indication sent back towards
e or more errors was detected by

ed for mapping-specific func-
efined for the byte-synchronous
it is used for a VT Remote

l. Eight binary values are possi-

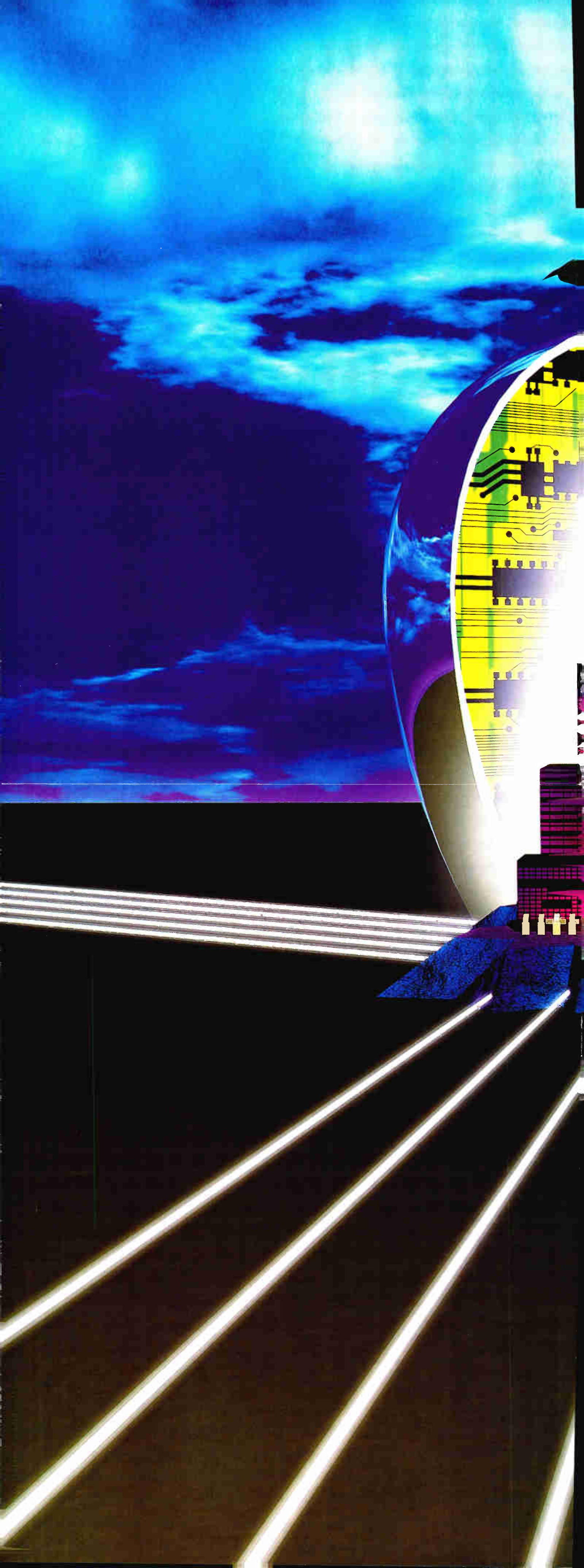
he current assignments for VT
vith the VT Size field (bits 5 and

efect Indication (RDI-V). This bit
ıipment that a defect has been
T Path.

byte is allocated for a VT
, the details of this function
e, this byte is currently

. These two bytes are
its 5-7 of the Z7 byte provide
n. This allows differentiation
connectivity defects.

1-800-445-6501



✔ The OS system must integrate operations processes from one end of the network to the other. It must relate all the equipment and procedures involved in taking an order for new service and provisioning it–from the server end to the subscriber end. It must coordinate and correlate alarms, test systems, asset databases, customer databases, network elements and the work force.

✔ It must be built on industry standard hardware and open middleware platforms that give the network operator flexibility in selecting and sizing equipment to match business needs.

For example, the MSO may want to locate certain functions centrally at first, and then move those functions out into the network as the network grows, or consolidate work centers from outlying locations into fewer, larger ones.

The MSO may also prefer a certain hardware platform, need to integrate existing systems with new ones, or want to deploy the OS in a phased approach.

The OS platform must be modular, so that service providers can choose capabilities that fit a given network

✔ The OS platform itself must be modular, so the service provider can choose the capabilities that best fit the needs of a given network or set of services and customers. It should also be scalable, so that the MSO can buy the capacity needed at present–and be able to expand rapidly to meet market demand and introduce new services.

✔ An integrated OS should also promote customization and flexibility, especially in supporting customer care. For example, it can incorporate expert systems that include rule-based task models. Such models describe the company's procedures for setting up service or resolving a problem.

This model guides the customer service representative through customer care processes, presenting appropriate next questions on the CSR's screen based on customer responses. If the provider changes task flows, network equipment, or operations system modules, the task model is easily changed to incorporate the changes.

✔ The OS must be built around standard interfaces and designed to include gateways to content providers. Then, if future regulation dictates walls between delivery or transport providers and content providers, the network operator will be prepared.

✔ The integrated operations system should support traditional cable television services, as well as interactive video, telephony, data communications and other services. The OS should also be capable of managing equipment from multiple vendors.

Interoperability confers greater manageability on the network, and also gives greater flexibility to the MSO.

Benefits for multiple services networks

MSOs have a great competitive opportunity. They aren't burdened by numerous legacy OSs, so they can build a streamlined opera-

The OS solution cannot any longer be thought of as only a billing system and a headend manager

tions solution from the ground up and do it right. They can install integrated systems optimized for efficiency and effectiveness now, and add functionality in an integrated fashion as their networks and service offerings grow. The integrated OS can help MSOs compete against competitors who are spending billions to expand their own networks, and who are already experts in managing complex networks.

Once installed, the integrated OS can create new revenue opportunities by collecting and managing the vast amount of data available in a broadband network. For example, it can identify Spanish-speaking subscribers who have recently shopped in an interactive auto mall, so auto advertisers can target a car ad in Spanish–and then deliver that ad to only those specific people.

The ability to identify subscriber preferences and offer targeted advertising opportunities will generate greater advertising revenues for MSOs.

The integrated operations system can also support new business opportunities–for example, managing gateways to other service providers or interexchange carriers who want to use an MSO's access network–and handle the billing accurately.

More than a billing system

But the MSO will realize these benefits only if it chooses the right OS solution. The OS solution cannot any longer be thought of as only a billing system and headend manager. MSOs must choose an integrated system built on a platform that's designed to support whatever comes along in the future. CED

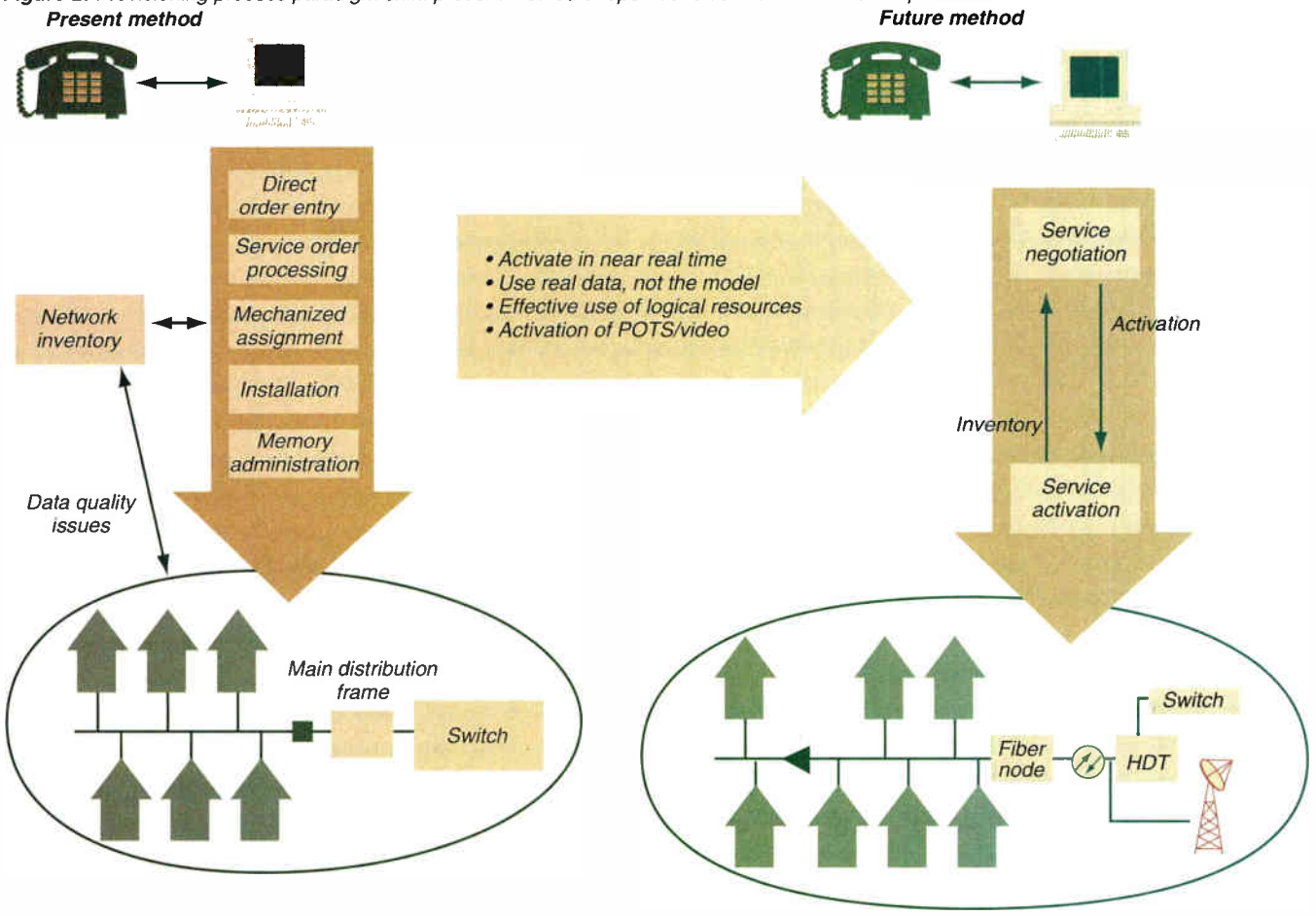
Vendors line up to offer OSS, network management

As little as six months ago, operators were contemplating this mysterious, black magical thing called an Operational Support System and wondering where they could get more information on OSS, not to mention actual product. Suddenly, vendors are lining up with announcements of integrated OSSs to handle multiple services, as well as network management systems that will evolve into full-fledged operational support systems.

At the NCTA convention in Dallas last month, Antec announced its Integrated Network Management Strategy, a portion of which includes a partnership with Superior Electronics Group to market the company's Cheetah status monitoring system, and future versions of it.

The next step, Antec's Element Management System, will be available for general deployment later this year, and provides for the integration of status monitoring and portions of the network includ-

Figure 2: Provisioning process paradigm shift: present method of operations vs. future method of operations



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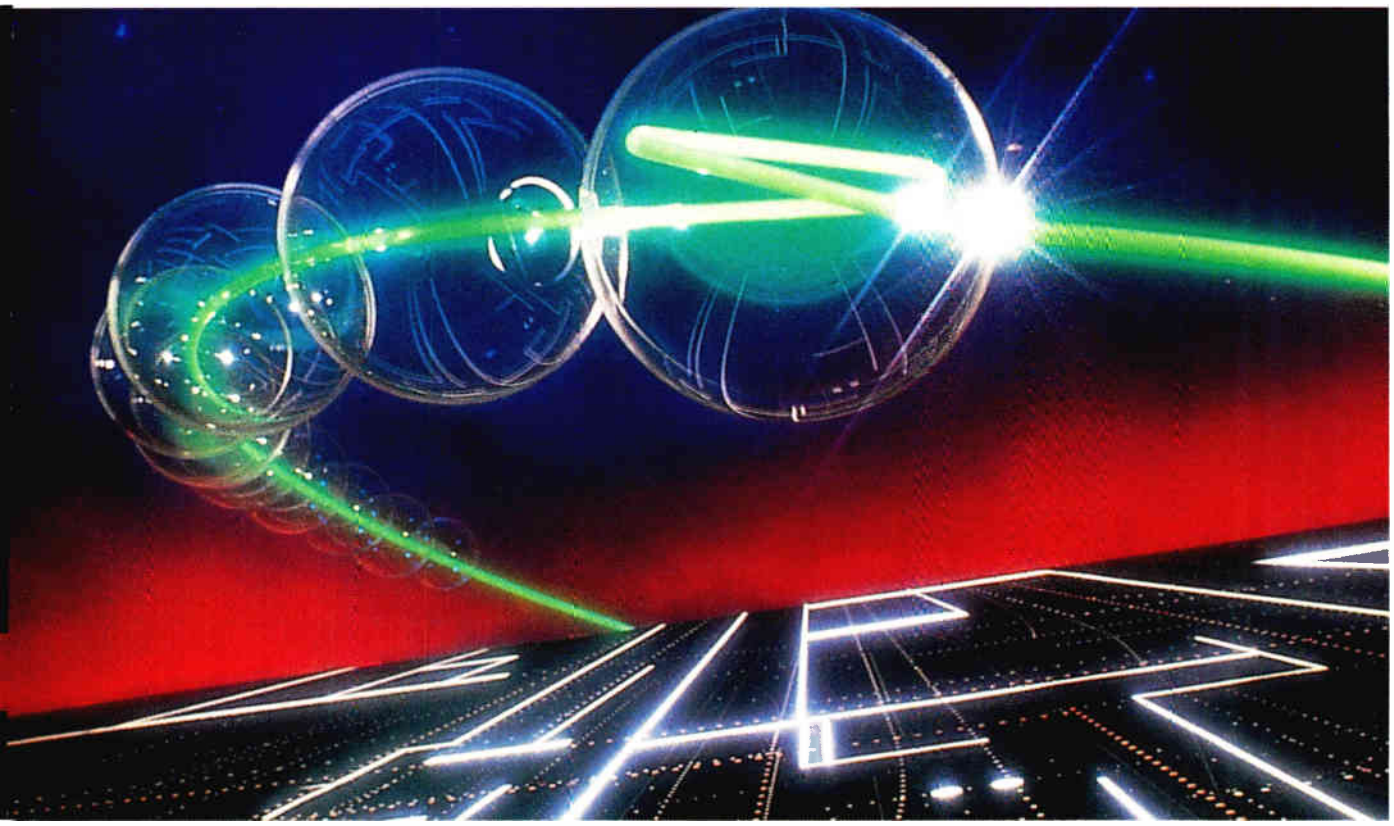

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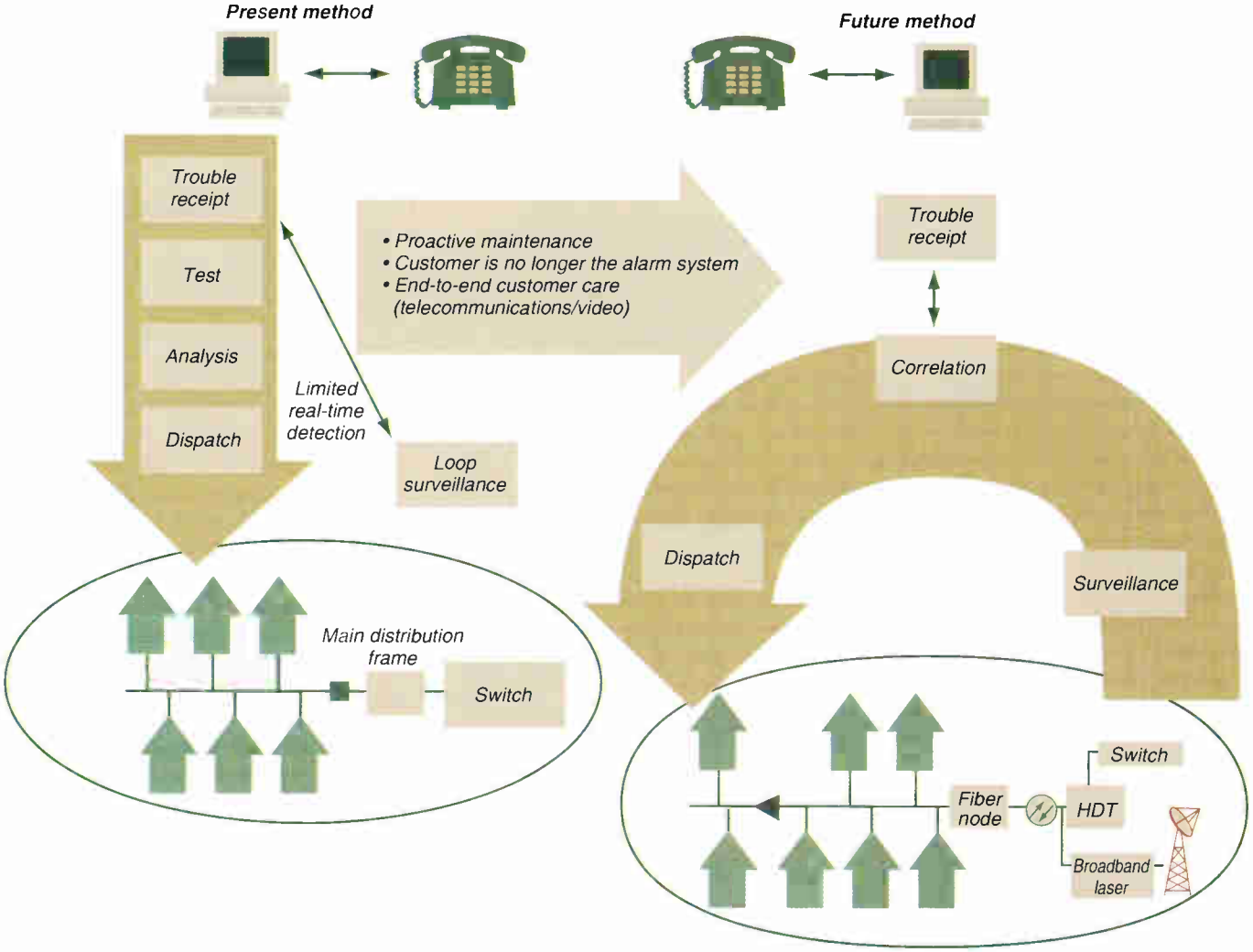
Figure 3: Maintenance process paradigm shift: present method of operations vs. future method of operations



ing headend, distribution plant and interconnect equipment.

Eventually, Antec will migrate its Network Management System to the Service Management layer, which will allow operators to link billing, customer service and fleet management into the network management function as a whole.

The company's system is based on the International Standards Organization (ISO) hierarchy, an open platform.

AT&T has announced its Advanced Services Operations System (ASOS) platform, which is specifically geared to handle broadband networks as they take on the provision of multiple services. Because it is modular, the system can be customized, depending on an MSO's specific requirements. ASOS includes seven separate modules: one for Integrated Business Management, Process Management, Workforce Management, Integrated Surveillance, Configuration Management, a Transaction Interface, and a Network Engineering Design and Creation module.

The business management module will allow CSRs to immediately provision new services, as well as allow customers access to "real time" billing, so that they can receive bills according to a preselected schedule. The system's Workforce Management module provides for vehicle tracking, as well as automatic dispatch of technicians to new assignments.

Objective Systems Integrators (OSI), which became highly visible to the industry as a result of its involvement in Time Warner's Full Service Network trial, has just launched HFC/loopMASTER, an OSS for cable operators offering video, as well as telephony, and other future services. Scheduled to be rolled out in third quarter '95, "the loopMASTER will integrate management of the entire HFC environment," says Terry Poindexter, OSI's program manager, Cable Telephony Solutions, "including both video transport and telephony, as well as status monitoring."

OSI's system incorporates network equipment from multiple vendors; the first release works with products from ADC Communications, AM Communications and Superior Electronics. The loopMASTER product has also been integrated with Arrowsmith Technologies' Fleetcon system.

Other companies which have announced plans to enter the OSS/network management fray include General Instrument, Nortel, Scientific-Atlanta and Motorola. For its part, Nortel is working on a product to integrate broadband video and telephony which should be available later this year. GI, S-A and Motorola are currently offering either portions of, or complete element management systems.

–DC

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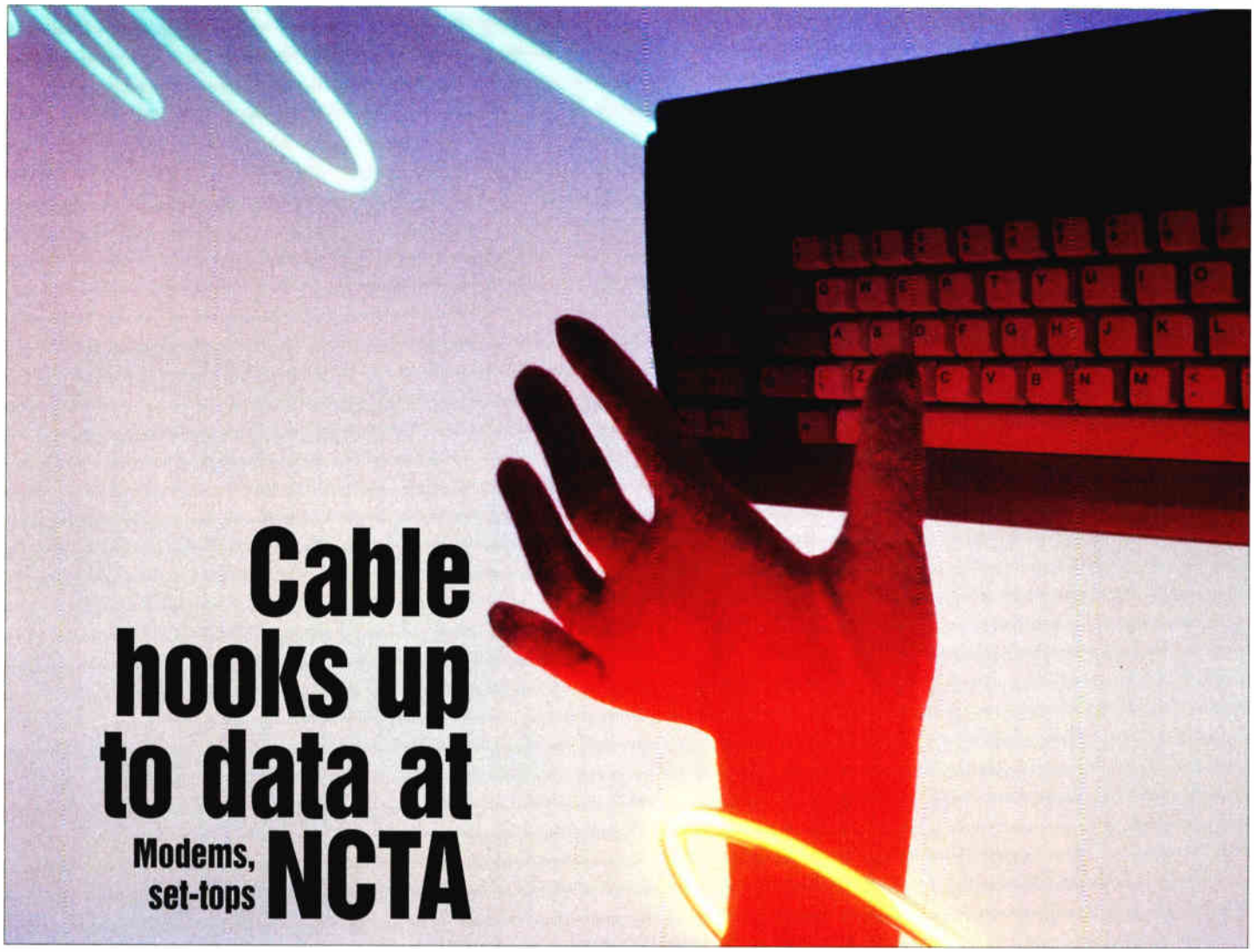

PHOTO BY CHARLY FRANKLIN, FPG INTERNATIONAL

Cable hooks up to data at Modems, set-tops NCTA

By CED *staff*

Hoping to capitalize on the incredible popularity of the Internet and on-line services like America Online, Prodigy and CompuServe, the cable TV industry's technical community arrived in Dallas last month for the NCTA National Show shopping for high-speed cable modems, file servers and digital set-tops, among other things.

While many said the prices for modems are still too high, several said they were encouraged by the amount of progress made by manufacturers since last December's Western Cable Show. By last count, there were no fewer than 10 companies showing modems, or promising to develop one in the near future.

First out of the gate with new products were LANCity and Zenith Electronics, both of whom brought new, third-generation cable modems to the Dallas show floor.

Zenith announced its new Homeworks Universal modem, which sends data at symmetric speeds of either 4 Mbps or 500 kbps in each direction. Rogers Cablesystems, which at the Western Show announced a work-at-home trial that uses its broadband networks to connect workers within IBM Canada, said it will use Zenith's new gear for the trial.

The external modem connects to the home PC via an industry-standard Ethernet card, said Bill Luehrs, senior vice president of operations for Zenith Electronics.

Meanwhile, LanCity brought its $595 external modem boasting bi-directional speeds of 10 Mbps, and Motorola debuted its "Cybersurfr" model, which sends data at 10 Mbps toward PCs, and 768 kbps upstream.

Zenith's Homeworks Universal modem

The LANcity modem will cover 200 miles. According to Rouzbeh Yassini, LANcity's president, the unit is being tested by at least three cable operators. He said the fixed-frequency unit can overcome noise and distortion increases of up to 5 dB off the floor without having to shift frequencies.

Other companies that promised to have product soon include: General Instrument, Hewlett-Packard, Hybrid Networks, Intel, Nortel, Philips Broadband Networks and Scientific-Atlanta.

GI talked about its new PCLinX networking concept, which is based on ATM technology. The unit will use 64 QAM digital modulation to support up to 27 Mbps speeds to the home over a single video channel.

The goal is to offer a production-level unit

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by the middle of 1996, according to Ed Zylka, director of marketing for GI's data networking systems division. Zylka declined to talk specifically about costs, noting that the modems will be cost-competitive with other units.

Hewlett-Packard plans to offer an asymmetrical unit that offers 30 Mbps speeds downstream, and 3 Mbps upstream, according to Jeff Hornung, marketing manager for interactive broadband products at H-P. The return signals will occupy between 1 MHz and 2 MHz of spectrum that can be dynamically or manually shifted to "clean" portions of the spectrum.

Hornung added that H-P expects to offer the standalone modem for about $400 each, excluding the Ethernet card that needs to be resident in the PC for the modem to talk to it. Product should be available in the second quarter of 1996, he added.

Meanwhile, operators like TCI are also considering RF modems which include a telephone jack for the reverse path as an interim strategy while they get the troublesome 5-40 MHz band up and running. In a recent informal poll, most of the vendors planning new modems said they are either considering or already providing a telco return.

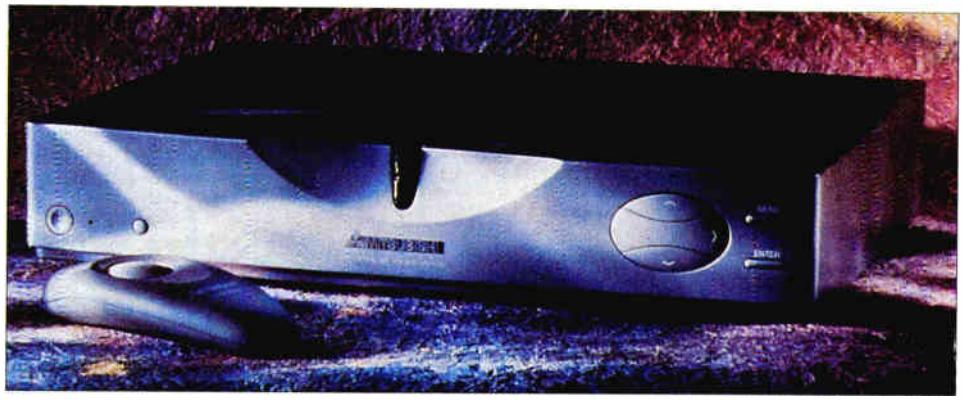
Digital Equipment Corp. said it plans to concentrate its efforts further up the network, rather than develop a standalone modem for cable networks. Instead, DEC will sell LANCity's products.

DEC instead unveiled a comprehensive architecture that includes its Channelworks bridges, DEChub switches and Internet brouters to develop communitywide networks. The enVISN (enterprise Virtual Intelligent Switched Networks) architecture distributes intelligence throughout the network to where it's needed. Networks can be built to support Ethernet, Token Ring and FDDI, and later, will include ATM and 100 Mbyte Ethernet.

AT&T Network Systems joined the high-speed data frenzy when it signed agreements with Intel Corp. and Hybrid Networks to collaborate on the different network elements needed to deliver broadband computing services.

Intel and Hybrid Networks are already providing RF modems and the associated network hub equipment needed to link into the Internet and other information providers to Viacom Cable's broadband computing test in Castro Valley.

Last month, AT&T signed separate contracts with both Intel and Hybrid Networks. AT&T officials described the Intel deal as a teaming to develop network and customer premise elements. AT&T will provide components and integration, while Intel will bring its "CablePort adapters" that link home or business PCs with cable networks.



Mitsubishi's STB-1000 set-top

In its AT&T deal, Hybrid Networks said it will integrate its "point of presence CyberMaster" and associated network management elements into AT&T's offerings. "We see this as a new opportunity for AT&T to bring further enhancements to the marketplace...to enable households to utilize PC interactive data services, interactive TV and telephones, simultaneously," said Marcy Garriott, vice president of visual/multimedia communications for AT&T.

Thirteen companies will design interactive content to run on Intel's CablePort modem, augmenting Intel's existing agreements with information providers like Computer Curriculm Corp., eShop Inc., Ingenius, Intuit, Netscape, TEAM Software and Wells Fargo Bank.

The spate of new info providers includes The Entertainment Connection, HSN Interactive Inc. and ShopperVision for electronic commerce; IVS/DWANGO and NetGame for entertainment; and Citiescape, Compton's New Media, The McGraw-Hill Companies Inc., Newsweek Interactive, Softkey International, Vicarious and ZCI Publishing for news, information and education.

Intel hopes to blast those services and others over broadband networks to run on home PCs, with results as good or better than current CD-ROM technology.

Set-tops

Other product news of note relates to the coming first-generation digital set-tops. Mitsubishi and Sony both showed set-tops for the first time, and new entrant NEC had one on display in the Microsoft booth. Hewlett-Packard announced that orders for its Kayak digital set-top had reached the 1 million mark, and a battle shaped up over operating systems that will control the inner workings of these digital workhorses.

H-P got to the million order milestone by announcing TCI had upped its order to 750,000 units, and by selling 150,000 units to Cox Communications. Those numbers, combined with Comcast's purchase of 150,000 boxes, provides the magical sum.

Meanwhile, Mitsubishi and Sony were looking for input from operators regarding their set-tops. Mitsubishi was publicly showing the ADSL unit it developed for Bell Atlantic for the first time and announced its intentions to enter the worldwide set-top market. The hybrid analog/digital STB-1000 that was on display featured Microware's OS-9 and DAVID operating systems and a Motorola 68000 microprocessor, and supported MPEG-1 audio and video decompression.

However, Mitsubishi officials said the box could be configured in a variety of ways to support HFC and ATM-based systems as well. The company is considering use of the PowerPC processor and will build set-tops to support either 64 QAM or 16 VSB modulation schemes, according to Dwain Aidala, VP and GM of Mitsubishi's Multimedia Center.

Mitsubishi also announced an agreement with Stellar One Corp. for the manufacture of interactive set-tops, and also that Mitsubishi is taking an equity stake in Stellar One. The two have already jointly responded to the PlatCo set-top RFP and plan to respond to others as they come along. Stellar One designs and manufactures MPEG-based digital video decoders.

Sony's new effort is dubbed "Pecchi," which means "penguin" in Japanese. Perhaps not coincidentally, "penguin" is the internal code name used by Microsoft Corp. for its set-top box operating system. In January, Microsoft signed a letter of intent with Sony to run its operating system on future Sony set-tops.

Sony showed off a pre-prototype version of

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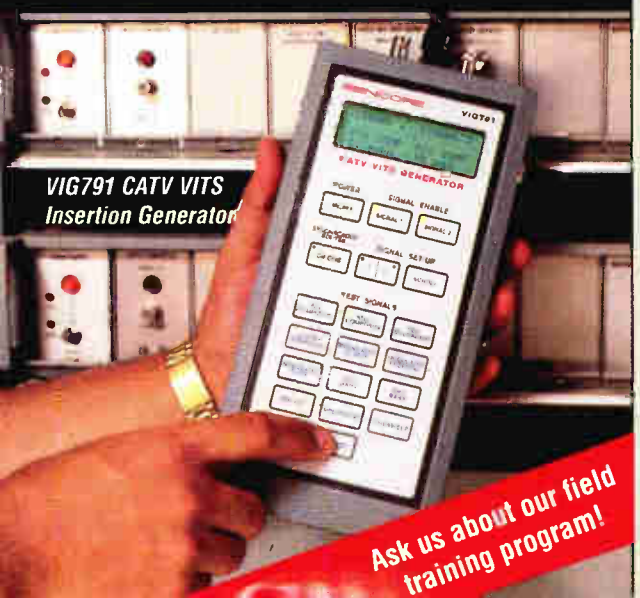

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that effort, emphasizing that the work is preliminary. The system consists of a "media unit," which packs an Intel 486 microprocessor running at 66 MHz, and 24 Mbytes of random access memory. The media unit can be located anywhere within the home, not necessarily near the TV, Sony executives said.

What does sit near the TV is a thumb-sized RF receiver, shaped and colored to resemble a tiny penguin. It receives digital pulses that are transmitted using radio frequencies, instead of traditional infrared, from a remote control that doubles as a telephone. Hard-wired connections link each tiny Penguin receiver to the media unit.

General Instrument gave operators a better understanding of its plan to develop digital entertainment terminals needed to run advanced, interactive services. GI demonstrated an early version of the terminal, which will initially center on the Microware OS-9/DAVID operating system and the PowerPC microprocessor.

The new terminals are based on a modular architecture that segments the network front-end from applications processing and presentation, as specified by the alliance of NYNEX, Bell Atlantic and Pacific Telesis.

Using the modular approach means that operators can change their network front-end while protecting their investment in the digital terminal, company executives said.

"This modular approach gives network operators a cost-effective way to migrate their networks from hybrid fiber/coax to a fiber-to-the-curb topology," said Dan Moloney, vice president of the addressable systems business unit of GI Communications. The terminal is an extension of GI's analog CFT 2200 and digital DigiCable platforms.

GI reportedly is on track to deliver test units to TCI and some other operators late this summer and intends to begin ramp-up to production units by November, according to Moloney.

ACT/Technico announced it is working with GI to develop a Microware DAVID-based MPEG-2 server and development system. The system will enable users of GI's set-tops with the aforementioned DAVID/OS-9 operating system to develop and test application programs.

Also announced at the Show was the news that NCA Microelectronics, a division of Fundy Cable, has released a PAL version of its Chameleon Scrambling System. The company is currently working with set-top manufacturers to integrate the Chameleon decoder chipset into a combination convertor/decoder for PAL systems.

Virtual channels

Among other things, several set-top vendors displayed the capability of "virtual channels" in their advanced analog devices.

GI said it will license an interactive software module from Wink Communications to add interactivity to traditional TV programs, and enable data displays of weather reports, traffic updates and local community information. In the deal, GI licensed a small software component, called the "Wink Engine," that fits into its CFT-2200 series set-tops. The engine interprets applications created with an associated software development tool, called "Wink Studio."

The Wink Engine uses less than 128 kbytes of ROM, and can display graphical applications with no more than 32 kbytes of RAM, Wink executives said. The system will work in all GI set-tops, including cable, satellite and wireless.

Scientific-Atlanta showed a family of tools designed to help content providers and cable TV system operators develop applications for such "virtual channels" available through the company's 8600X set-top box. In all, 16 different applications were shown.

Three software tools are scheduled for release later this summer: Virtual Builder, a Windows-based package designed to help build content such as school menus, theater schedules, traffic info, lottery numbers, etc.; Virtual Display, which allows content providers to develop virtual channels for S-A's headend gateway; and Virtual Link, which handles translation and communication of application data to the gateway and to transmit data files for interactive program guides.

Pioneer teamed up with Home Information Television Inc. to provide a two-way system that uploads information into a behind-the-TV unit to provide information and on-screen point-and-click functions. The system also provides a back channel and transaction processing system using existing telephone lines.

The two will jointly provide equipment to Coaxial Communications of Columbus, Ohio, which plans to deploy the technology this fall. An adapter unit that attaches to new and existing Pioneer set-tops will be available in 1996.

Set-top operating systems

The battle between software companies to provide the de facto operating system for digital set-top boxes and other digital media devices was raised to a new level at the Show this year, with each of the major players enjoying momentum gains.

Operating systems are a critical component in the future interactive TV and digital set-top world, because they are charged with decoding, decompressing and routing millions of incoming bits at near-warp speeds, to create a picture and sound on the TV.

Microware announced agreements with a total of 10 different companies, including General Instrument and Mitsubishi for set-tops. Other Microware boosters announced during a press conference at the show included: Sybase, Novell, IBM, C-Cube Microsystems, ACT/Technico, Motorola, Concurrent Computer and Stellar One.

Meanwhile, PowerTV, which is developing the operating system for Scientific-Atlanta's set-tops, took a high profile position as a key member of the "Power Alliance," an open consortium that was announced for the express purpose of providing a unified voice to the world's interactive TV standards-making bodies.

Eight hardware and software companies said they will work together to share information and promote standards work through the formation of the alliance.

The member companies include Argonaut Technologies Ltd., which makes three-dimensional software; C-Cube Microsystems, manufacturer of MPEG-2 chips; PowerTV Inc.; Scala Inc., a multimedia authoring and tools company; Scientific-Atlanta Inc.; Software Development Systems Inc., which makes programming and debugging tools; Sybase Inc., maker of video server, authoring and deployment software; and 3DLabs, which makes three-dimensional accelerator silicon.

More participants are anticipated, said an Alliance spokesman.

The alliance will be operational by July 15, when it establishes a World Wide Web site (http://www.power_alliance.org) to contain technical information from member companies, technical resources and "pointers" to areas of interest to the developer community.

"By logging into the Power Alliance web site, users will be able to easily compare and obtain information from all of our partners and provide their own input on issues the Alliance should be addressing," said Jeana Toney, acting chairperson of the coalition and market development manager for PowerTV.

Executives present at a briefing emphasized that the Alliance doesn't plan to compete with standards groups like DAVIC, but instead plans to "work with them."

Microsoft looms with its "Interactive Broadband Network," an end-to-end software solution that connects set-tops and servers. Microsoft said it will add new partners and expand its "Insight" program, and form a similar collaborative program called "Microsoft

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Interactive Television" (MITV) for digital content providers.

At the show, manufacturers including Hitachi Ltd, OKI Electric Industry Co. Ltd., and LG Electronics Inc. signed up for the Insight program, which provides for intensive training—through a series of two-week sessions at Microsoft's Redmond, Wash. campus—as well as pre-release software and exposure to Microsoft's broadband trial in Redmond.

Also joining the Insight program: the Platco consortium of Bell Atlantic, NYNEX and Pacific Telesis, as well as Telecom Italia.

And, systems integrators AT&T Corp. and Samsung Electronics have signed on with the Insight program, joining Alcatel SEL, Andersen Consulting, Lockheed Missiles & Space Co., NTT Data Communications Systems Corp. and Olivetti SDA.

Microsoft also added an "information" layer to Insight, targeted at network operators, systems integrators and original equipment manufacturers. Insight Information partners get updates on MITV technology; access to "Insight Online," a private forum on The Microsoft Network related to issues and strategy; and invitations to participate in some Microsoft events.

Early participants on the network operator side include Prime Cable, SNET Multimedia Services, Austrian PTT, Frontier Corp., Wharf Cable and Swiss Telecom.

Takers for the MITV program thus far include: CUC International Inc., Discovery Communications Inc., ESPN Enterprises Inc., Foote Cone & Belding, HSN Interactive Inc., Interfilm Technologies Inc., The Lightspan Partnership Inc., Medio Multimedia Inc., Starwave Corp., Time Warner Interactive, Tribune Interactive Network Services and the U.S. Postal Service.

Microsoft hopes to have about 100 content providers in the MITV program by the end of the year.

"We recognize that the range and quality of interactive programming services that can be offered by network operators will be crucial in determining how well the system attracts and retains users," said Laura Jennings, senior director of business development for Microsoft's Advanced Consumer Technology group.

Content development

So much for just whipping up some digital content in the garage. Apple Computer and nCube Corp. said they have a toolkit designed for multimedia application developers, research institutes, and anyone else interested in making digital content for use in future digital TV applications—but it costs $229,000.

For that sticker price, developers get an unspecified amount of nCube's media server hardware and network components, and Apple's set-top boxes. The system is scalable to as many as 200 video streams, and "offers the ability to simulate large-scale multimedia trials for a fraction of the price of a high-end interactive TV solution," said Robert Goldberg, vice president of marketing for nCube.

The so-called "nVision" solution includes a 10 Gbyte media server, with 16 I/O channels, a CT3 interface for T-1 streams, and an ATM interface for E-1 streams, nCube officials said.

IBM will add to the groundswell of digital content developers through the opening of an interactive media center, as part of its Multimedia Consulting & Solutions. The center will develop content spanning multimedia consulting to video compression, testing and CD-ROM titles, according to execs.

"By knitting together a unique group of technologists and artists, IBM has broken down some artificial business barriers," said Bruce Culbert, business unit executive for IBM Interactive Media. IBM's media team includes creative designers, graphic artists, software engineers, application architects, film and video producers and animators, Culbert said.

IBM will also establish an interactive TV lab to create applications and media for Microware Corp.'s DAVID operating system.

Digital content developers seeking an inroad to the Time Warner Full Service Network now have access to software tools made by Interactive Digital Solutions, the joint venture company of AT&T Network Systems and Silicon Graphics Inc.

Time Warner recently staked out a 10 percent chunk of IDS.

At the show, IDS executives detailed three configurations: Unity 1, 4 and 8, targeted at service and content development. Unity 1 includes a graphics workstation and set-top box; Unity 4, a server, three workstations for team-based development, tools and a user interface; and Unity 8 resembles a "mini-FSN" with ATM switching, eight set-tops and content from the Time Warner FSN.

Prices range from $50,000 to $1.5 million, IDS executives said.

Cable and telco operators eyeing the digital interactive wave have long expressed a need for local content to augment and even supersede applications like games and video on demand. Medio Multimedia answered the call by debuting its prototype for local interactive TV content, like sports, restaurants, news, entertainment and shopping.

Medio showcased its efforts in Microsoft's booth, as a partner in the Microsoft Interactive TV (MITV) program.

Steve Podradchik, president of Medio, said that the company's background in CD-ROM titles coupled with local content will create a compelling environment for users to watch clips of upcoming movies at local theaters, then reserve tickets, or to find out when and where local sports teams are playing. Or, users could view a list of local restaurants, watch an interview with the chef, scan the menu and book a reservation, he said.

Servers and storage

And to store all of this new content, several manufacturers announced new, or enhanced servers, as well as other storage systems.

Pioneer Electronics Corp. and nCUBE announced a joint marketing and development agreement under which the companies will integrate technologies and products for the interactive multimedia market. Pioneer's optical disc technology will be combined with nCUBE's digital-media server products to create new video-on-demand systems.

Digital Equipment Corp. said it has picked Vela Research and Probita Inc. to provide technologies for its Mediaplex ad servers. Probita will provide its "Proclaim" multicast distribution and management software, designed to handle network management for microwave, satellite, PSTN and other transport networks.

In the deal, Digital will use Vela's MPEG-2 encoder to digitize and squeeze ads for subsequent cable delivery. The DEC system will also use Vela's audio/video decoder board designed for CATV headend decoding in near video-on-demand and ad insertion applications.

In its debut appearance at NCTA, Sony Electronics demonstrated disk-based products for the cable industry, including its VideoStore digital ad insertion system.

The VideoStore system, designed to replace tape-based ad insertion, can help increase the operating efficiency of small cable systems, or automate the feeds of larger interconnects and MSOs, Sony execs said.

For example, one server system equipped with seven media units can provide near instantaneous access to 31.5 hours of video, or about 3,800 commercials. The system is based on RAID (Redundant Array of Inexpensive Disks) technology, and combines random access, large storage capacity and high quality compressed video in an integrated, multi-channel video transmission system.

Channelmatic demonstrated the VideoStore. The unit also features redundant and hot swappable disk drives, circuitry, power supplies and fans.

Channelmatic already offers products based on MPEG-1 and MPEG-2 gear from Optivision, Optibase, Scientific-Atlanta and Vela Research, the company said.

Sony also displayed a new NVOD movie playout concept aimed at medium to large cable operators. Major components of the prototypical system are a high capacity, high data-rate magneto-optical (MO) drive and a multi-channel MO disc changer.

The demo compressed video into an MPEG-2 stream to a data rate of 3.55 Mbps, including stereo audio. The data is recorded on the eight-inch, single-sided MO disc, which has a capacity of 3.2 GB, producing a play time of two hours.

Hewlett-Packard reported that BellSouth will be the first H-P MediaStream Server customer to install the manufacturer's real-time encoding system as an enabling technology in an upcoming field trial. The RBOC is currently building a broadband network that will pass 12,000 homes in the Atlanta area.

BellSouth will receive additional channels of broadcast entertainment via satellite at its headend, digitize them using H-P's real-time encoding system and combine them with video-on-demand output from the MediaStream Server onto an optical fiber for direct digital broadcast over its ATM network.

H-P officials say that telcos and cable operators will be able to increase the number of channels available to consumers up to tenfold by coupling the manufacturer's real-time MPEG encoding system with the MediaStream Server.

And Pioneer New Media Technologies debuted its new Digital LD System that allows high capacity compact storage of video on digital discs. Digital LD is a family of new digital products from Pioneer, including a real-time MPEG-2 encoder, a digital LD discWriter, a digital LD VideoDisc Drive, a four-head player, an MPEG-2 decoder, an autochanger and disc cart machine designed to provide quick and easy access to digital video material.

The system uses a write-once, read-many disc that can safely store large video libraries. Each 19-gigabyte disc can record up to two hours of D2 quality material.

The system compresses video through the encoder, while the DiscWriter "writes" the information on a double-sided disc. These discs can then be stored in the autochanger (which holds up to 252 discs) or the cart machine for automated viewer access. The four-head player is used in applications that require more than one simultaneous video output channel from a single disc, such as near video-on-demand.

Distribution equipment

Electroline Equipment Corp. made a number of product announcements, including the development of an eight-way configuration of its DROPAmp subscriber amplifier that boosts the strength of signals pumped into high-rise apartment buildings and other multiple dwelling units. As a result, video network operators will benefit from reduced installation time and lower connector and jumper cable costs, as compared to the four-port units.

The new DROPAmp can support multiple outlets and devices inside a home, up to at least 16 TVs or VCRs. It features greater than 1 GHz bandwidth, 15 dB gain, a noise figure of less than 3 dB, port-to-port isolation greater than 22 dB and filter options for 30 MHz or 40 MHz return bandwidth.

Cable system operators can save 15 percent to 25 percent on MDU addressability with a new Compact Addressable Tap developed by Electroline Equipment, according to company officials.

Electroline displayed a variety of taps

By putting an extra connector port on the tap, up to three additional switchbanks can be connected without the need for extra control or powering circuitry. As a result, a single tap can control up to 64 drops, company executives said. Previously, a controller was required for every four to 16 ports.

The new tap is available in a variety of configurations that allow operators to use network or premise powering. It automates on/off control of service activation and passes two tiers of service.

The new AC power-passing tap from Electroline Equipment is now being field tested, according to company executives. The SuperTap is designed to deliver AC power and RF signals over a standard coaxial drop or twisted pair wire, as well as control addressability.

Existing SuperTaps can be upgraded from passive to addressable or from power-blocking to power-passing without disrupting services, simply by changing a face plate. The 1-GHz device can be used as a passive multi-tap, an addressable tap, a power-blocking or power-passing unit. It comes in three versions: a simple four-port unit; a four-port A/B configuration that adds on-off control of a basic and premium tier; and an eight-port on-off unit.

Eagle Comtronics launched a new line of split-tuned negative traps which attenuate both video and audio, for use with addressable descramblers that normally permit audio to come through. Suited for low-volume applications, the traps can be installed indoors or outdoors.

The company has also announced that its Tier Traps are available at 1 GHz, for compatibility with its 1 GHz single-channel traps.

C-COR Electronics announced at the show a new 90-volt powering option for its entire line of transport electronics, including trunk, bridger and line extender amplifiers as well as the company's AM fiber optic nodes.

Powering options

Increasingly, cable system operators are eyeing a move from traditional 60-volt powering schemes to a 90-volt solution to increase reach and centralize the powering architecture. This becomes even more important as MSOs consider offering telephony and other services.

Additionally, C-COR is introducing a new series of 3.1 Gigabit-per-second digital optical terminals. The new Series 3700 Comlux gear, which is used to transport high-quality video, supports up to 32 8-bit coded channels in a single optical wavelength, twice the capacity of earlier equipment. When used with optical multiplexers, the gear can transport up to 64 channels per wavelength.

Finally, C-COR demonstrated its new Cable Network Management System, which monitors the company's digital fiber, AM fiber and RF electronics. Key features of the CNM include fault prediction and automatic inventory/provisioning management by tracking network elements and installation and repair data.

Channell Commercial Corp. announced that it has adopted a means to identify the correct load handling grade-level box for a given application in the field. Specifically, trademarked graphic signs molded into the exterior of all underground and grade level boxes the company supplies will indicate the recom-

WARNER CABLE COMMUNICATIONS, CINCINNATI, OH ||| **IN THE** CONTINENTAL CABLE ADVERTISING OF NEW ENGLAND ||| **NEXT FEW** COMCAST CABLEVISION, FT. WAYNE, IN ||| CONTINENTAL **HOURS,** CABLEVISION, JACKSONVILLE, FL ||| MACLEAN-HUNTER CABLE **WE'LL** TV, UNION, NJ ||| COX CABLEREP, GREATER PHOENIX **HELP** INTERCONNECT, PHOENIX, AZ ||| GREATER DAYTON **THESE** CABLE ADVERTISING **COMPANIES** ||| COX CABLEREP, SAN **PLAY** DIEGO ||| TIME WARNER **MORE** CITYCABLE ADVERTISING, NEW YORK CITY ||| COX CABLEREP, **DIGITAL TV** NEW ORLEANS ||| COLONY COMMUNICATIONS OF LOWELL, MA **COMMERCIALS** ||| TCI/CABLE ADNET OF PITTSBURGH ||| CONTINENTAL **THAN ANY** CABLEVISION OF DETROIT ||| WARNER CABLE, HOUSTON ||| TKR **OTHER** CABLE CO., WARREN, NJ ||| COX CABLEREP, HARTFORD, CT **TECHNOLOGY** ||| CONTINENTAL CABLEVISION OF CHICAGO, IL ||| COLONY **SUPPLIER** COMMUNICATIONS, WAPPINGERS FALLS, NY ||| **HANDLES** CONTINENTAL CABLEVISION OF FRESNO, CA ||| TIME WARNER **IN THE** CABLE, BIRMINGHAM, AL ||| CONTINENTAL CABLEVISION, **ENTIRE** RICHMOND, VA ||| TIME WARNER CABLE, ALBANY, NY ||| **WEEK.**

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mended placement of each unit per application. Included will be all grade-level boxes (GLB) manufactured by Carson-Brooks Plastics Inc., or Christy Products Inc., and distributed by Channell Commercial.

Test equipment

Sadelco announced at NCTA that its handheld Minimax meters are ready for shipping. Equipped with built-in calibrators and having the ability to tune all picture and audio carriers from 5-862 MHz, the meters offer high-end features at installer prices. Full keypads simplify operation, with no hidden menus. Automatic attenuators, digital tuning and digital readouts eliminate operator errors.

Maxdata meters, available to 1 GHz, can perform the FCC 24-hour tests unattended. A scan mode automatically checks the entire cable system, stopping at out of tolerance channels.

Headend equipment

Lighthouse Digital debuted a new digital video matrix switching system called the DCV. The new unit, which is non-protocol dependent and offers 400 Mbps bandwidth, starts as an 8x8 and is expandable to 16x16. All common I/O connector configurations are available for either copper or fiber optic cables.

Vela Research Inc. launched its Encoder 2000 MPEG-2 Frame only Encoder (FOE), described as a lower-cost alternative to its Adaptive Field Frame (AFF) Encoder. The frame-only encoding solution digitizes and compresses analog or uncompressed digital video for applications requiring MPEG-2 compressed data streams.

The company's 2000 FOE is based on the C-Cube Video Risc processor architecture and can produce MPEG-2 Packetized Elementary Streams, Program Streams or single program Transport Streams in real time. The encoder includes a graphical user interface and uses computer industry standard networking and storage systems, Vela execs said.

The new encoder is best suited for applications such as low-motion video or film which do not require adaptive field/frame coding efficiency, according to Vela Research President Scott Cooper.

Management systems

Antec Corp. and Superior Electronics Group, manufacturer of the "Cheetah" status monitoring system, said at the Show that they will partner to bring that product and future iterations of it to market.

Antec executives described Superior's "Cheetah" system as a first phase of its own work on integrated network management software.

Based on the International Standards Organization's network management hierarchy,

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☐ b. Engineering Mgmnt ☐ d. Engineering ☐ f. Other _____

❷ **Please check the category that best describes your firm's primary business.** (please check only one)

☐ 1a. Independent Cable TV System
☐ 1b. MSO (two or more Cable TV Systems)
☐ 2. Cable TV Contractor
☐ 3. Cable TV Program Network
☐ 4. SMATV or DBS Operator
☐ 5. MDS, STV, or LPTV Operator
☐ 6a. Microwave Company
☐ 6b. Local Telephone Co.
☐ 6c. Regional Bell Operating Co.
☐ 6d. Long Distance Telephone Co.
☐ 6e. Cellular Telephone Co.
☐ 7. Commercial Television Broadcaster
☐ 8. Cable TV Component Mfg
☐ 9. Cable TV Investor
☐ 10. Financial Institution, Broker or Consultant
☐ 11. Law Firm or Government Agy
☐ 12. Program Producer, Distributor, Syndicator
☐ 13. Advertising agency
☐ 14. Educational TV Station, School or Library
☐ 15. Telecommunications Consulting Firm
☐ 16. Local Area Network End-User
☐ 17. Local Area Network Equipment / Services Supplier
☐ 20. Satellite Communications Services/ Common CarrierFirm
☐ 21. Telephone Equipment Mfg/Distributor
☐ 18. Others Allied to the field _____ (please specify)

❸ **Are you a member of SCTE?** ☐ Yes ☐ No.

❹ **In the performance of your job, check the product categories you authorize, specify or purchase.** (check all that apply)

☐ a. Subscriber Equipment
☐ b. Fiber Optic Equipment
☐ c. Test Equipment
☐ d. Distribution Equipment
☐ e. Headend Equipment
☐ f. Contractor/Construction Svcs
☐ h. Telephone Equipment
☐ j. Advanced Networking Eqmt
☐ k. Data Equipment
☐ l. Production Equipment
☐ g. Other (please specify) _____

❺ **What is the approximate dollar value of the annual budget you are responsible for?**

☐ a. over 1,000,000
☐ b. 500,000 - 1,000,000
☐ c. 250,000 - 500,000
☐ d. 100,000 - 250,000
☐ e. 50,000 - 100,000
☐ f. less than 50,000

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Antec's plan is to provide a three-tier structure for network management system deployment.

The first tier is Superior's system; subsequent second and third versions include added functions like network and service management.

Andy Paff, executive VP of strategic planning and technology for Antec, called network management "one, if not the most, important issue facing broadband operators.

"As the broadband network evolves from a forward-only, broadcast video network to an interactive voice, video and multimedia-capable infrastructure, the need to quickly bring new services to market and ensure network performance becomes even more critical," Paff said.

The current Cheetah system works by locating frequency-agile RF modems in all field devices, so that operators can manage return path frequencies and monitor remote equipment, as well as conduct FCC proof of performance tests.

An accompanying software system schedules monitoring and testing of both headend and distribution components.

In the headend, a controller manages communication between the software and status monitoring gear in the field.

When the "next generation" Antec/Superior system comes out later this year, operators "will simply need to convert to new software," according to a statement. Field elements will not need to be replaced, the statement said.

Management software

New from Cadix International Inc. is its Cadix FX-7001 Series of cable management software designed to deliver decision-making information for fiber optics or RF information management to all segments of a cable company's operations. The system merges fiber or RF design and analysis data with business application files and also provides the tools to manage an integrated, enterprise-wide database.

The new FX-7001 Series is a client/server implementation which uses local area network technology to allow file sharing across an entire organization. For example, company execs said, design data elements found on maps, drawings and bills of material can be shared throughout a company and included in the business reports used for construction, finance, marketing, trouble-shooting and management decisions.

In addition, existing designs that were developed using the CX-2001 CATV Design System, or that are in other DXF or IGES formats, are converted to construct fiber and RF management information. A record is created in the database for every piece of equipment in a network. Also included is a multimedia database to attach up to 250 field photographs to a single graphic element. The FX-7001 Cable Management server operates on a Hewlett-Packard RISC workstation, while client platforms are hardware and software independent.

Cadix has also enhanced its CX-2001 CATV Design System in arenas including fiber capability, distortion analysis and drafting functionality.

Ericsson Raynet introduced two new Craft tool software packages, LCI and BCI, which are designed to lower Craft training costs, while boosting productivity in narrowband LOC-2 and broadband RVS fiber optic communications environments.

Compatible with Microsoft Windows 3.1 software, LOC Craft Interface (LCI) and Broadband Craft Interface (BCI) replace cryptic MML commands with a GUI that visually displays all of the components of a comm network in color-coded icons, pull-down menus, and dialog boxes.

Cable telephony

First Pacific Networks Inc. announced at NCTA that it has enhanced its FPN1000 cable telephony product to fit the U.S. market, and that the technology is now available for domestic trials.

In essence, the manufacturer has outfitted its U.K. cable telephony product with a TR-008 interface to adapt it to operate in the United States. The product should be available for general deployment some time this fall, according to company officials.

To manage the complexity of the return path in cable telephony applications, FPN has filed more than seven patents on technologies which allow it to conquer the challenges inherent in the upstream, according to Jim Hirschy, FPN senior vice president.

In the realm of trials, TeleWest will initiate a three-phase test of an integrated telecommunications/cable system made by Tellabs Operations, with the hopes that it can deploy the system to residences in London, Newcastle and Edinburgh in the United Kingdom.

Currently, TeleWest uses a separate digital overlay network, independent of its cable TV network, to deliver phone services. With the test of Tellabs' Cablespan gear, Telewest wants to collapse those two separate deliveries into one, which will deliver entertainment and telephony on a single, hybrid fiber/coax network.

"Cable operators in the United Kingdom have demonstrated their ability to provide an attractive alternative for those seeking residential or business telephony," said Jon Grimes, vice president and general manager of Tellabs' Network Access Systems Division.

The first phase of the trial is a lab evaluation of the Cablespan system. In a second phase of the test, integrated cable and phone service will be sent to a limited number of subscribers using multi-line remote terminals, designed for curbside installation.

A later phase will test a family of single and multiple line terminals, designed for installation on the outside of single-family homes.

Fiber optics

A new family of optoelectronics was debuted by General Instrument at the NCTA Show. Dubbed "OmniStar," the suite of headend products includes a universal chassis, laser modules, network monitoring and power supplies.

The new platform was specifically designed for networks that use small node sizes and less optical splitting, which increases the laser density in the headend. The new chassis houses up to eight laser modules in a five-rack high space.

A new family of seven DFB lasers is also being introduced, with power ranges from 3 dBm to 12.5 dBm in 2 dBm increments.

Ortel Corp. used the Show to debut its answer to the 5-40 MHz reverse spectrum used for home-to-headend transmissions: low-cost, distributed feedback (DFB) lasers.

"The industry wants a breakthrough product for two-way communications," said Larry Stark, vice president, business management for Ortel. "All the existing ones were too expensive, and the amount of power they offer is overkill in the reverse direction."

Ortel's new reverse laser was developed for operators eager to add two-way services, like telephony, PCS and data communications, without having to worry about ingress and noise bursts associated with the reverse spectrum, said Stark.

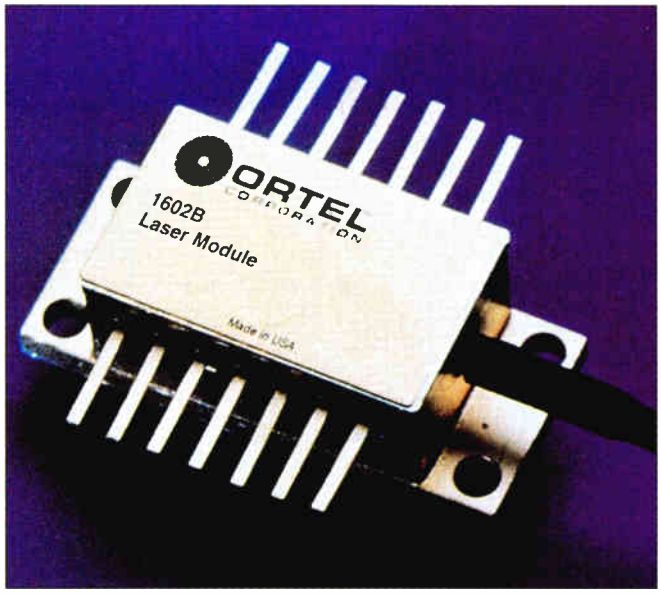
MSOs like Tele-Communications Inc. and Time Warner have said they need a low-cost, lower power laser as they migrate toward narrowcasting and full service network deployments.

Stark said pricing schedules for the new reverse laser haven't been nailed down, but stressed that the return path laser and photodiode enable cost-effective, small node networks—because return path products can be designed into the architecture to offer higher performance at prices "a lot less" than forward-path DFB lasers.

The new Ortel laser, called the Model 1602, features a DFB chip, internal optical isolators and thermo-electric coolers to provide consis-

tent signal quality, Stark said. "This is the first cooled DFB that's really optimized for the reverse path, and nowhere near as pricey as forward path lasers," Stark said.

The reverse lasers carry 200 MHz of traffic — "enough to stack up several reverse path channels on a single laser," said Stark.



Ortel's return path laser, model 1602

Long-haul video

Harmonic Lightwaves has introduced a new fiber optic transmission system for 1550 nm-based applications. The new "MAXLink" was designed for long-haul video applications and is well suited for new transport architectures, such as redundant rings, broadcast layer transmission and hub interconnects. The system consists of two plug-in modules for the company's broadband fiber platform, including a dual output optical transmitter and an erbium-doped fiber amplifier with adjustable output power.

The 850 MHz transmitter features dual optical outputs, allowing for redundancy and doubling the number of available links per transmitter. The externally modulated transmitter uses linearization to allow network providers to extend the reach of their systems.

New from Ipitek is its IMTRAN line of uncompressed digital fiber delivery systems, designed so that cable operators can optimize fiber performance and throughput in applications such as TVRO-headend, headend-headend, off-air feeds, must-carry hand-offs and event links.

But will it work?

With the plethora of new technology announcements at the show came the news that digital video is being tested to ensure that the equipment of different vendors will indeed be compatible.

Digital video system conformance testing has begun at the Cable Television Laboratories facilities in Colorado. The tests are intended to help verify the compatibility and interoperability of different vendors' compressed digital bitstreams and decoders.

Although the plan for the testing was approved last December, CableLabs staffers have been creating the computer software and hardware configurations necessary to perform the tests, according to Dr. Rich Prodan, vice president of engineering at CableLabs.

Currently, half of 104 different transport stream elements, and 75 percent of some 71 video stream elements, are verified in the tested bitstreams. The video parameters are checked to comply with the main profile/main level definition of the MPEG-2 compression standard.

Preliminary tests have been conducted on several GI bitstreams, and CableLabs has verified several of the syntactic and semantic elements. A suite of encoded bitstreams will be compiled for extensive testing, which is presently being defined.

A voice of dissent

Not everyone was enthralled by all of the HFC-related technology announcements at the Show. Nicholas Negroponte, author of "Being Digital" and a founder of MIT's Media Lab, reiterated his stance against hybrid fiber/coax networks during a breakfast meeting hosted by Nortel. Negroponte said that "every time I hear about people putting in HFC networks, my heart sinks...our grandchildren are going to kill us for taking this path."

A better strategy, said Negroponte: fiber-to-the-home, with symmetric data rates travelling to and from residential PCs.

Not surprisingly, the crowd of cable and telco executives present for the breakfast meeting chortled at Negroponte's view.

"If elements like bandwidth and memory are free, then why are stocks like TCI's and Time Warner's plummeting as we pay to install these high capacity networks?" asked one executive.

Negroponte countered that current economic models will have to change to support "per content" costs, instead of per-bit or per-mile costs currently charged by network operators.

"Five years from now, at some industry breakfast, you'll be talking about how the majority of bits you send down your pipe have nothing to do with digital video—and your major profits will come from services other than video," Negroponte said.

Those services will revolve around the Internet, which will attract a billion users by the year 2000. And, said Negroponte, the major draw for Internet users is community-oriented exchanges, like chats and e-mail. "This is your thing—it's entertainment," he said.

People

Besides serving as a platform for new product launches, the Show also served as a means to honor prominent figures in the cable industry.

The NCTA awarded its Vanguard Award for Science and Technology to William Riker, president of the Society of Cable Television Engineers (SCTE), in a ceremony held during the closing general session and luncheon.

Riker was chosen for the honor for "transforming the Society into a far more relevant and important institution within the industry," according to the NCTA. Under Riker's direction, SCTE training programs and materials, technical expositions and seminars, and regional chapter development have become the primary source for job-related enrichment for the majority of the industry's technical community. The SCTE now has more than 13,000 members.

Riker, who has been president of the SCTE since 1984, is a member of the Board of Directors for the National Cable Television Center and Museum, the NCTA Engineering Committee, the SMPTE, the Cable TV Pioneers and the IEEE.

In addition, Shellie Rosser, vice president of interactive systems at Antec Corp., received a Vanguard Award for Young Leadership. She was cited for her two decades of service to the industry, including coordination of projects that assisted cable systems in communicating to legislators about new technology deployment; working with CTPAA to launch a national effort by technology suppliers to benefit the industry's PR initiatives; and for launching Women in Cable and Telecommunication's Women Directors Initiative.

Rosser is an active member of SCTE, CTAM, the Illinois Cable TV Association and Women in Cable and Telecommunications. CED

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User-perceived availability of HFC networks

Quantifying reliability

By David J. Large, Principal, Media Connections Group

Much attention has been focused recently on network reliability in both the telephony and cable television industries. CableLabs' Outage Reduction Task Force has formalized the modeling of distribution systems and suggested approximate component failure rates. Rogers Cable, in an extension of that work, analyzed several architectures and compared their performance.

This paper extends that work by predicting actual and perceived service availability to individual users, including the effects of drop and terminal equipment. The availability of a reference architecture is calculated, along with attainable improvements. Using the modifications suggested, the user-perceived availability of a video service is calculated to be nearly 0.9999, including the effects of headend, distribution system, drop cable and convertor.

While it is intuitively apparent that the reliability of hybrid fiber/coax (HFC) networks is much greater than long cascades of coaxial amplifiers in conventional trunk-feeder plants, it is important to quantify that improvement, as it must compare favorably with other alternatives for provision of both entertainment and non-entertainment services.

The FCC was so concerned about this issue that it asked the Network Reliability Council to reconstitute itself for the primary purpose of studying the effect of new distribution technologies on the reliability of the nation's telephone system.[1] While wireless and satellite distribution will also be considered, HFC networks will be a primary area of emphasis because of their near-universal planned deployment by multiple industries.

How good is good enough?

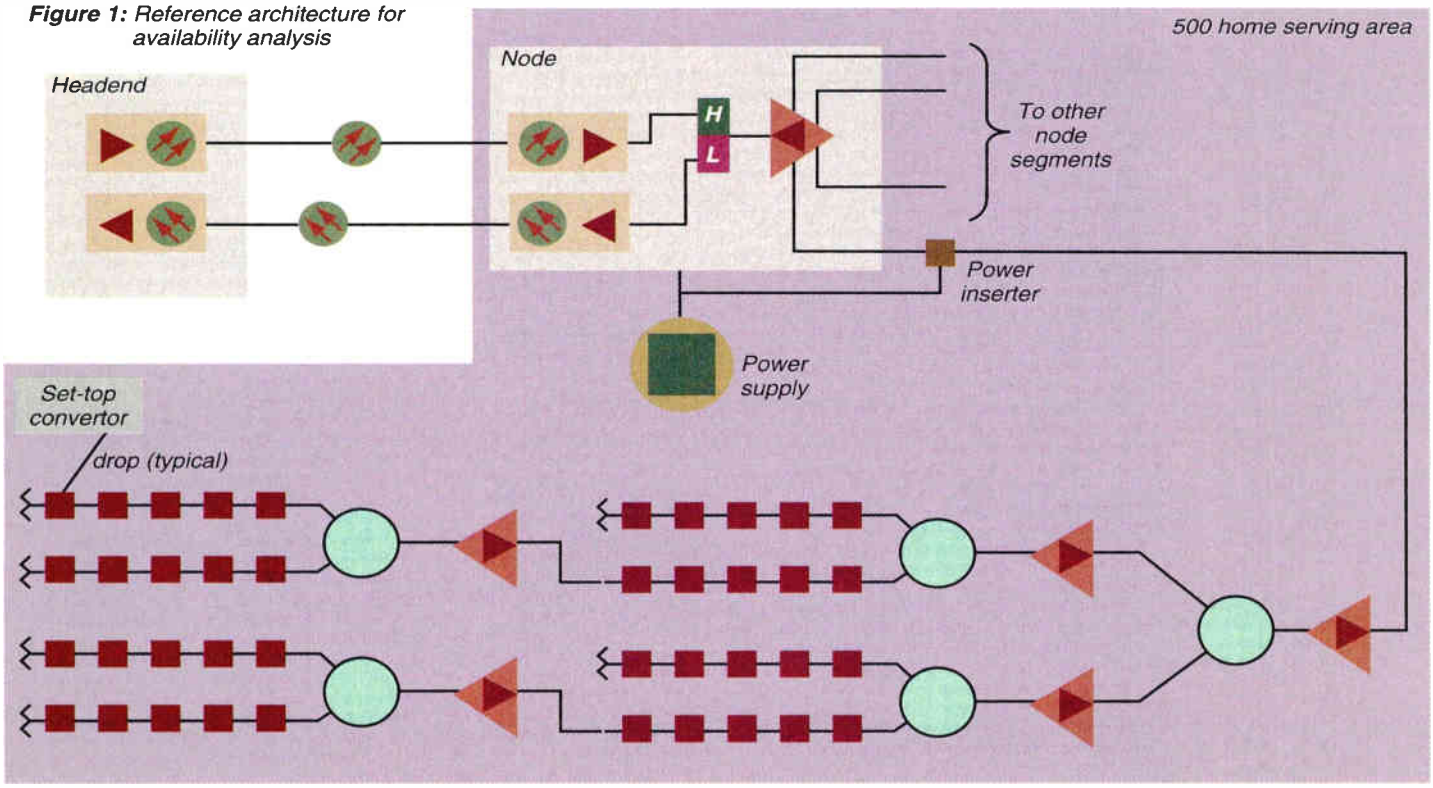
Before analyzing how reliable the new networks are, it is worthwhile to set realistic goals. The widely quoted availability[2] of local telephone service is 99.99 percent, corresponding to a yearly outage time of about 53 minutes. That figure, however, does not include subscribers' telephones or in-house wiring (which is no longer the responsibility of the telephone company) and may not include the physical cable between homes and central switching offices.

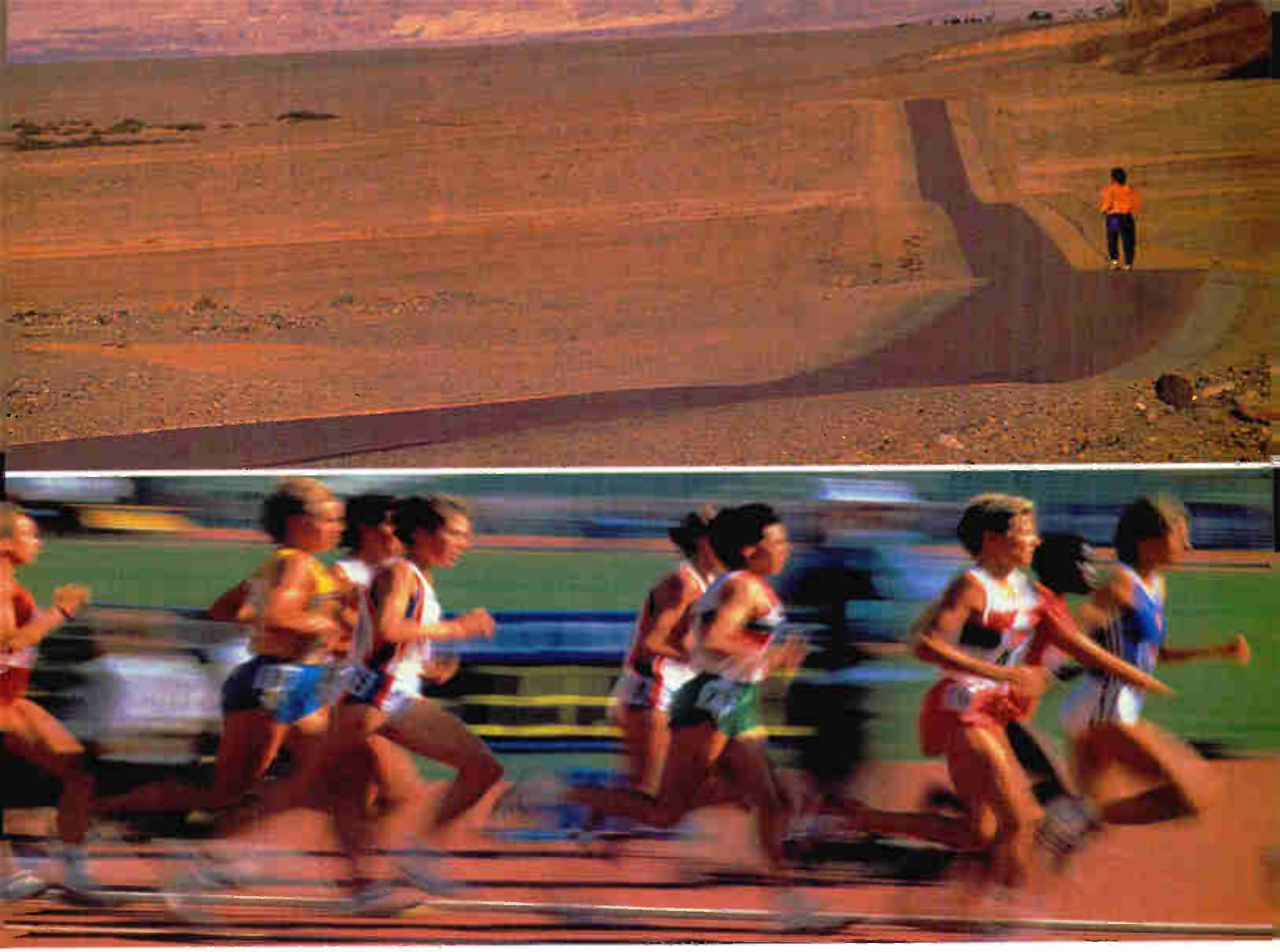
A recent paper has proposed considerably more modest requirements for long-haul data circuits: 99.84 percent availability, with a predicted 99.96 percent availability of the local exchange carrier circuits on each end.[3]

Within the cable television industry, one of the few studies of viewer tolerance of failures was undertaken by CableLabs' Outage Reduction Task Force. Its principal report, Outage Reduction,[4] was published in 1992 and included sections on customer expectations, methodology for tracking outages, reliability modeling methods, techniques for improving the reliability of network powering and system restoration techniques.

Based on a number of studies of customer reactions, CableLabs found that there was a sharp knee in customer perceptions of reliability at about 0.6 outages per month. In other words, customers who experienced less than

Figure 1: *Reference architecture for availability analysis*





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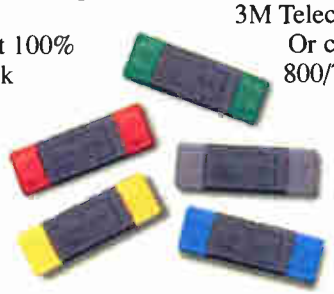

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about two outages every three months found the service to be acceptably reliable, while those experiencing more outages had a negative opinion of the cable system's reliability. Based on a mean time to repair (MTTR) of four hours, CableLabs translated 0.6 outages/month into a minimum acceptable availability of 99.7 percent.

Even given the different nature of the services provided over the public switched telephone network (PSTN) vs. cable television systems, the difference in acceptable availability is very large. User perception of failures should be even greater.

Standard telephone circuits are affected by many more outages than users perceive, both because of the low percentage of time the telephone is in use and because of how customers react to problems. For instance, if a call is interrupted because of an outage, the parties simply stop talking, and one of them re-dials to re-establish the connection. Because the vast portion of the average telephone call is handled over shared facilities, there is a high probability that an alternate path will automatically be established by the network around any failed element. While the callers may be irritated by the call interruption, they are unlikely to identify the cause as an outage.

Since both parties are immediately aware of the failed connection, no loss of information occurs. Furthermore, since the average telephone user has the phone "off-hook" for less than 30 minutes per day, outages occurring during the other 23.5 hours do not affect perceived availability. Of course, as usage of the network for extended-duration data connections increases, subscribers are exposed to many more failures.

The situation for classical cable systems is radically different, both from network design and subscriber usage. In existing cable television systems, little if any of the network is redundant, so that circuits interrupted by failure cannot be re-established until the failed element is replaced. Furthermore, the desired programming that is not viewed generally represents irretrievably lost data. Finally, the average household watches television about five hours per day, so the exposure to outages is much higher than for voice telephone.

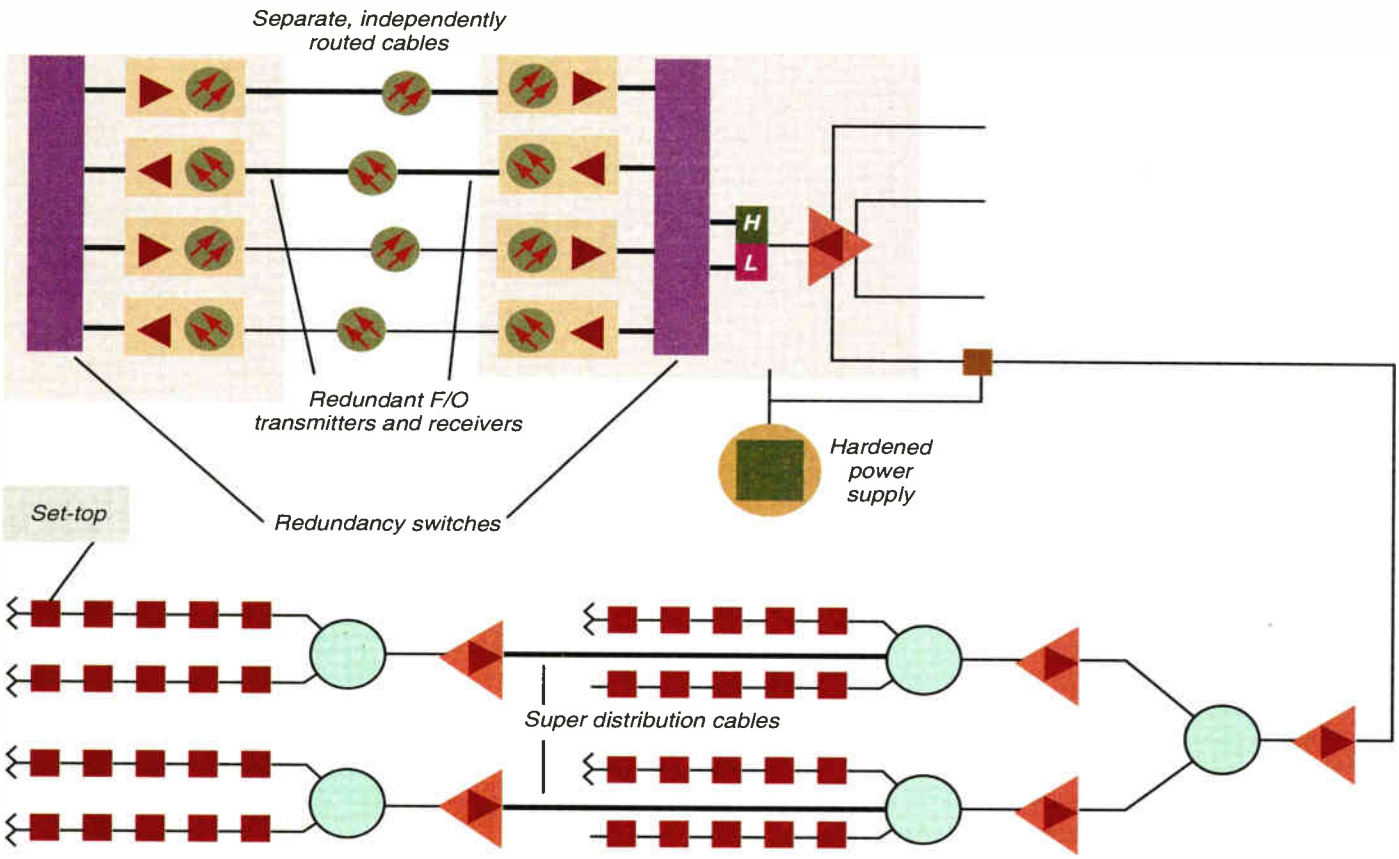
Taking these factors together, it is surprising that cable customers are willing to accept an availability as low as 99.7 percent. Clearly, this will not represent acceptable performance for the provision of switched voice, data circuits or PCS base station interconnect.

CableLabs' member companies wishing to enter not only the telephone business but also the switched video market were concerned about the lack of perceived reliability of cable systems. They needed to quantify current network performance and develop tools for modeling the availability of systems in a systematic way so that different architectures could be compared quantitatively.

Given the historic lack of communication links among regional cable systems, the task force limited its studies to headends and local distribution networks. A key decision was to study only outages affecting two or more subscribers, and thus eliminate the effects of individual drop cables and convertors. Given that about half the individual subscriber outages in a typical cable system arise from drop and convertor problems,[5] CableLabs' results do not accurately reflect customers' perceptions of availability. On the other hand, the analysis tools developed are valuable in comparative analysis of various distribution architectures.

CableLabs' method was to gather data from participating companies on actual outages and their causes. From this data, the task force calculated average failure rates of various compo-

Figure 2: *Improvements in reference architecture*



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nents involved. These failures rates were applied to a reference coaxial system architecture and classical reliability analysis techniques used to predict performance as a function of such parameters as the number of amplifiers and the reliability of various component types.

To check on the model's applicability, the results were compared with actual recorded failure rates for systems with similar characteristics, and the results compared with what the participants felt was adequate accuracy.

The Outage Reduction report was distributed to CableLabs' member companies and highlighted at the Cable-Tec Expo, among other technical gatherings. The computer model, in a generalized form, was distributed as a spreadsheet along with the study so that systems could apply it to their own situations.

Despite the tremendous effort put in by members of the Outage Reduction Task Force, the accuracy of the results are limited by the original data. In most, if not all, cable systems, outages are manually logged, and accurate failure analysis and documentation are second in importance to restoring service. Thus, outage durations, the number of affected customers and the cause analysis are all of limited accuracy.

A final factor that must be mentioned is that the modeling and field data were taken on all-coaxial systems, so that the effect of fiber optics on overall reliability was not determined.

A key finding of the group was that system powering problems dominated all other outage causes in most systems unless adequate standby powering was employed. Given that, the task force extensively analyzed utility power systems and techniques for minimizing utility outages and damaging transients. Many cable systems that are less than rigorous in deploying or maintaining standby power supplies might want to study this part of the document.

Nick Hamilton-Piercy and Robb Balsdon of Rogers Cable, in July 1994,[6] used CableLabs' techniques to evaluate the theoretical availability of several HFC architectures. They found that various configurations had theoretical availabilities ranging from 0.9994 to 0.99985.

A reference HFC model

For purposes of calculating the effects of various reliability-enhancing techniques, the reference system architecture shown in Figure 1 was used. This is typical of many modern cable systems where a central headend is connected by fiber to independent nodes, each containing small, non-interconnected coaxial distribution systems.

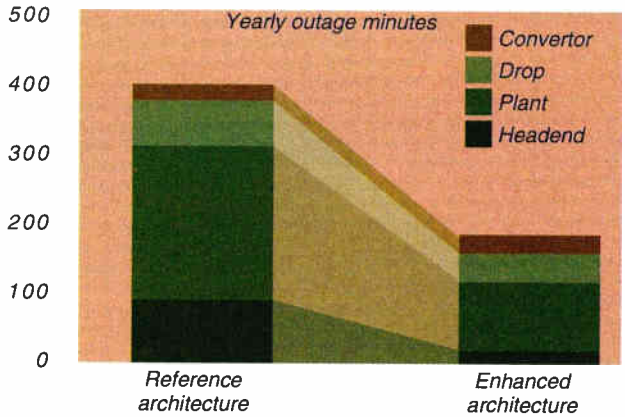
This is a scalable model whose variables may include the number of cascaded amplifiers and other components, differing numbers of homes passed and different fiber interconnection options with the headend.

For modeling purposes, the following parameters were assumed:

✔ 500 homes per node
✔ Five strand-miles of fiber between headend and node
✔ One power supply per node serving area
✔ Four coaxial trunks from each node
✔ 160 four-port subscriber taps per node (78 percent tap efficiency)
✔ Three-amplifier cascade past the node
✔ 100 homes per mile density.

Unlike the CableLabs and Rogers models, availability calculations included headend, plant, drop and convertor failures and, therefore, true subscriber-perceived network availability. The algorithm also allowed for different average repair times (mean time to repair or MTTR) in the headend vs. plant, which more closely resembles typical field situations.

Figure 3: Predicted outage improvement with enhancements



For the reference model, it was assumed that the MTTR for plant failures was four hours (based on CableLabs data). It should be noted that this is much less than the seven-hour MTTR found in an NRC study of telephone system fiber cuts; however, the telephone cables cut were much larger, on average, than typical cable TV cables, so the difference was expected.

One hour MTTR was assumed for headends, based on their proximity and accessibility to repair personnel. Actual headend MTTR will vary widely. Large urban system headends may be manned part or all of the day, while small rural headends may be unmanned and remote from on-call personnel. This is one of the factors that is leading to consolidation of small headends into larger regional centers connected by fiber to large distribution areas.

Component failure rate assumptions

An important component of headend reliability is its effect on viewers; e.g. if a subscriber is not watching a channel, he is unaffected by its failure. For modeling purposes, it was assumed that the average viewer would be affected by 10 channels in one viewing session. In this respect, the model used was more liberal than that used by CableLabs, which counted any single channel failure as an outage.

In the author's model, headend failure rate was predicted by counting the number of pieces of equipment required to process 10 channels, then multiplying that by average equipment failure rates. The average yearly failure rate for equipment was assumed to be five percent–the same rate used by CableLabs in their analysis.

The headend equipment configuration is not shown in Figure 1; however, it was estimated that generating 10 channels would require three satellite antennas, 10 microwave receivers, five satellite descramblers and 10 RF modulators. The mathematical model also includes three series-connected headend amplifiers (required to provide sufficient isolation between node-specific signals fed to individual fiber optic transmitters), each with a three percent annual failure rate. Although CableLabs assumed a seven percent failure rate for trunk amplifiers and five percent for line extenders, it was felt that the lower rate was reasonable for an indoor mounted unit.

This combination results in a failure rate per year of 149 percent. With a one-hour MTTR, the resultant availability of the headend is 0.99983. This failure rate correlates reasonably well with actual recorded outage data from a recently-built headend where the average failure rate among 189 pieces of equipment was 6.3 percent per year.

The distribution plant includes everything from the input of the headend optical transmitter to the subscriber tap port, but no drop components. The yearly component failure rates assumed for the initial analysis are as shown in Table 1. The numbers shown in Table 1 generally follow the CableLabs recommendations with some exceptions:

✔ Fiber optic transmitters and nodes were each assumed to have a reliability, based on complexity and heat generated, similar to trunk amplifiers.
✔ Rogers' data was extrapolated to predict

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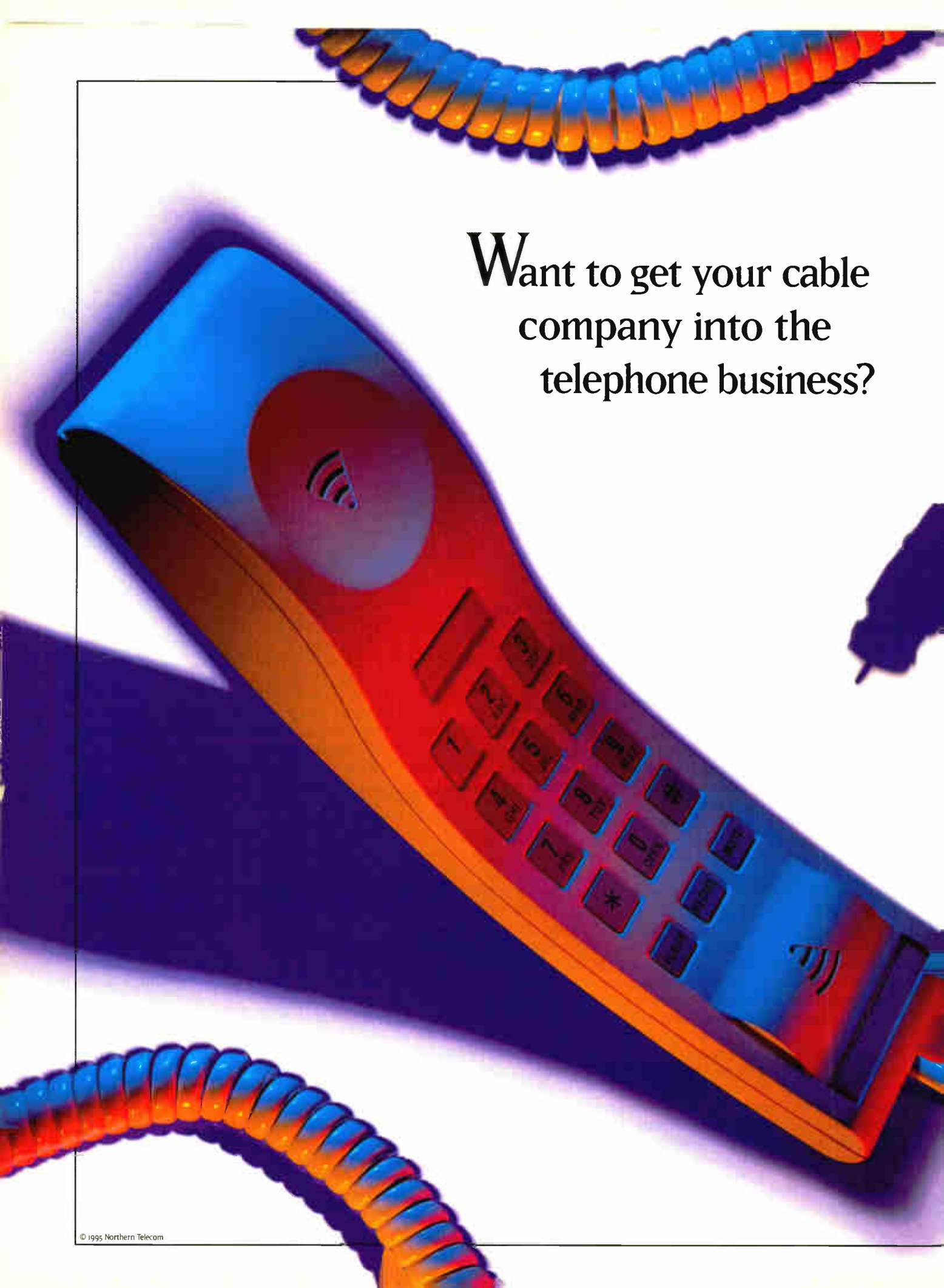

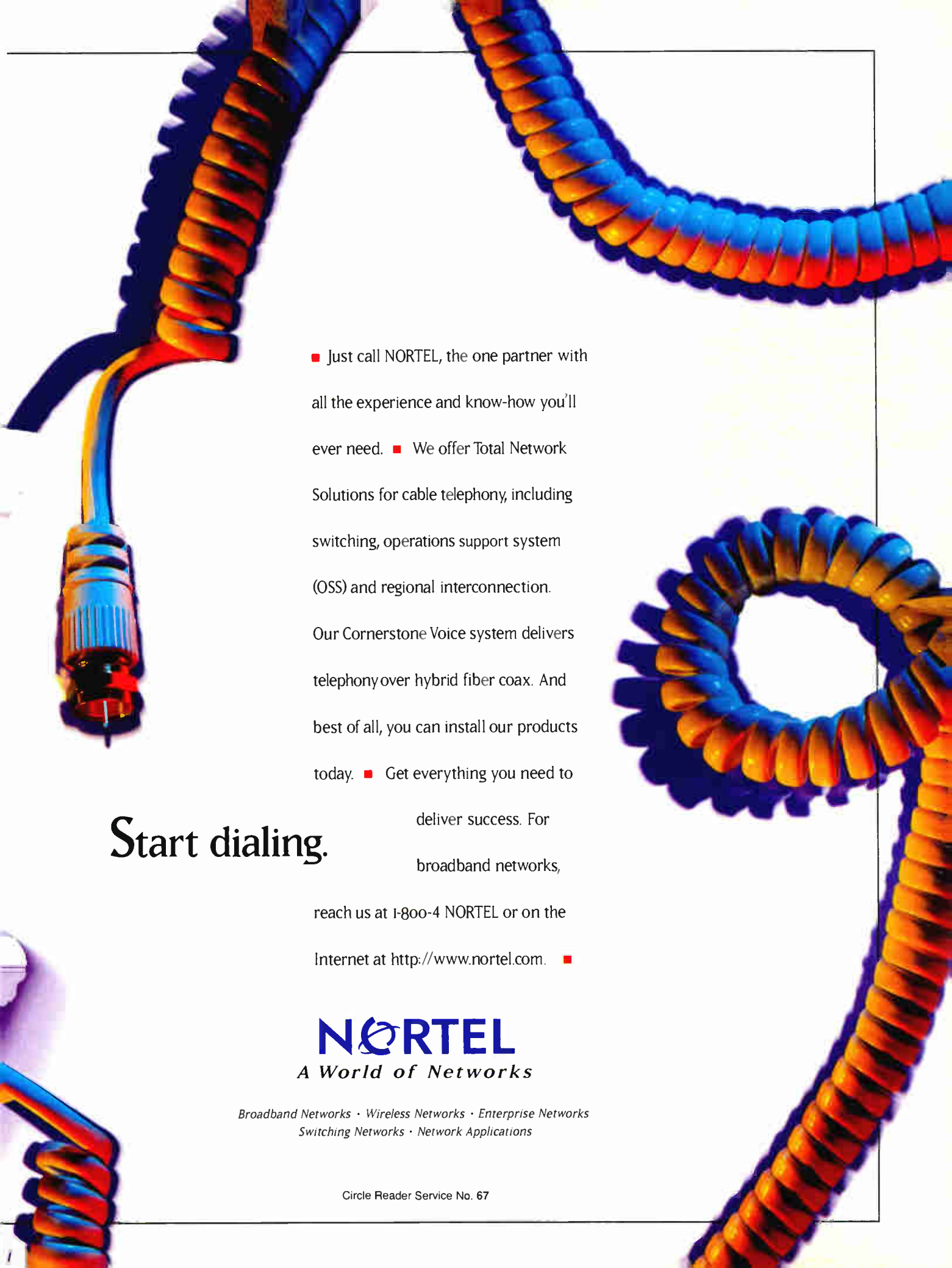

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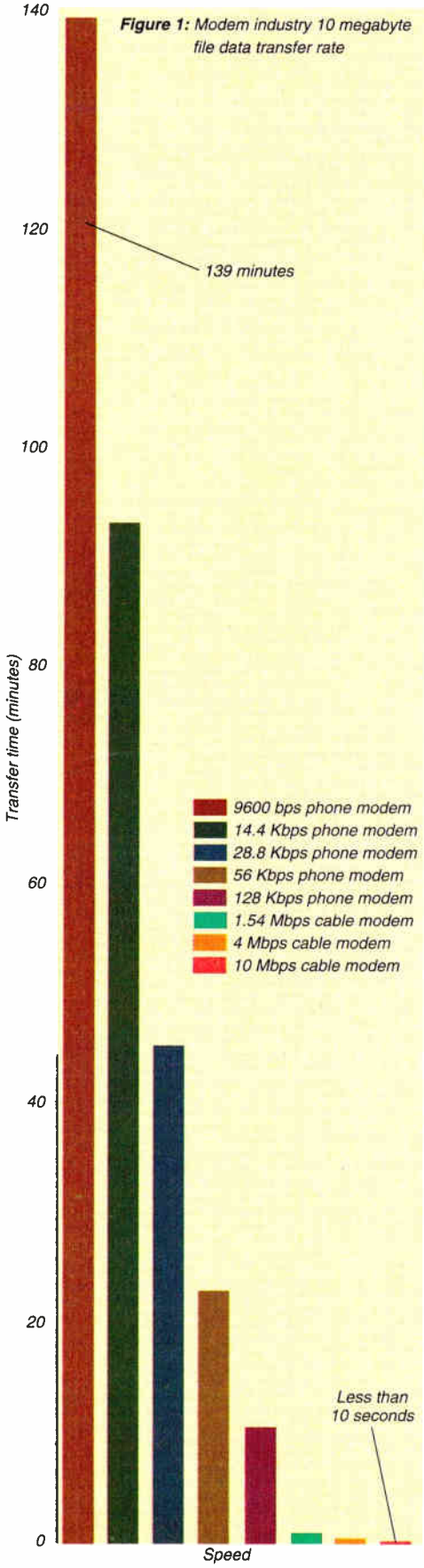

Figure 1: *Modem industry 10 megabyte file data transfer rate*

areas, says another senior executive, who asked not to be named.

The range of opportunities

The range of services under development in East Lansing offers some measure of why MSOs are viewing data links as a major growth area. The Michigan State connection, which supports medical imaging and data transfer projects, has contributed to better coordination and speed in medical research and has cut back office processing time by 30 percent, Clark says.

The telecommuting service, which began with a single link to the home of Ron Choura, a commissioner with the state Public Service Commission, has drawn tremendous response in the weeks leading up to commercial introduction, Clark adds. Moreover, Choura, as a leading voice in the National Association of Regulatory Utility Commissioners, has influenced awareness about the cable data possibility far beyond East Lansing borders, notes John Lisky, director of government and public affairs in TCI's North Central office.

This is because Choura is using the 10 Mbps data channel to download FCC files from the Internet. "He downloads material, selects what he wants and distributes it to colleagues all over the country in a matter of hours, where once it took days just to download the raw data," Lisky says.

Other projects under development include use of TCI's World Wide Web site in East Lansing to spawn local commercial ventures, starting with a real estate posting service that might be tied in with the system's classified ad channel, and use of the system server's hard disc as a storage space for backing up data transfers by large companies. "Disaster recovery is an important revenue opportunity," Clark notes.

The system is also supplying data links to two elementary schools and is in discussions with the districts about expanding the service. "This is a very fast service, unlike dialup or ISDN (integrated services digital network)," Clark says. "Many schools are interested in our ability to provide interconnection of schools over a large area. And we have a waiting list on the telecommuting and business sides."

One of the notable things about the East Lansing system foray into data is that it is being accomplished over plant that was upgraded long before fiber to 500-home nodes and 750 MHz became the accepted template for delivery of such services. Officials recognize that, with 550 MHz capacity and fiber to 2,000-home nodes, the system will hit data use overload faster than a more advanced upgrade would, but they report the ChannelWorks technology, which supports multiple service expansion through a suite of open-architecture tools known as "enVISN," is allowing them to offer a wide mix of services without further plant upgrades.

"What we're doing here is trying things out and clearing the way for TCI to undertake these types of services throughout its territories," Clark says. "We'll learn a lot more about network performance and capacity now that we're moving to commercial offerings."

Cox Communications, which last year purchased the Phoenix cable system from Times Mirror, has a similar story to tell respecting its deployment of ChannelWorks. For the past year and a half, the system has been supplying data links to connect manufacturing concerns with high-speed transfer of designs and other material crucial to remote collaboration in commercial projects.

"We've been offering a 10 megabit-per-second Ethernet connection from the headend to each customer, and our experience shows high-speed data on cable works," says Marty Weiss, multimedia networks director for Cox Communications. Now, he adds, Cox is expanding the data operation to include telecommuting, which it intends to introduce system wide by sometime next year, assuming it can clear unusually tough regulatory barriers.

"Over the 16 months we've been operating, we've averaged 99.4 percent availability with a minimal support staff," Weiss says. "Our conclusion is, this is a business we can get into by offering a new kind of product over a high-speed shared superhighway."

Cox and TCI are teamed with Comcast and Continental Cablevision in still another approach to the use of data links–a venture known as Cable Utility Communications (CableUCS), which was launched in January to foster utility interest in use of broadband networks to improve customer service and overall power use efficiency. Venture tests with power utilities announced so far involve TCI and Pacific Gas and Electric in Walnut Creek, Calif.; Comcast affiliate Garden State Cable and Public Electric and Gas Service in New Jersey; and Cox and Southern Cal Edison in Irvine, Calif.

"We're going to see more trials, and we're going to see more than trials in the near future as power utilities position themselves for competition," says Paul Spaduzzi, energy management consultant for Cox. While some utilities, including Entergy in Louisiana and Houston Industries of Texas, have talked about using savings generated by broadband networks to justify building the facilities and moving into delivery of

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a rush among on-line services to capitalize on widescale availability of ISDN for data connections.

Prodigy is available over 64 kilobit-per-second links in four markets, with modems supplied by IBM carrying a price tag of only $495. This is about half the typical retail price of ISDN modems.

"We now have the beginnings of consumer pricing and market availability that will make ISDN the next step in bringing the advantages of high-speed connections to our customers," says Ross Glatzer, president and CEO of Prodigy. Cities with Prodigy ISDN service are San Jose and Woodland Hills, Calif.; Boston and Nashville.

ISDN basic rate service, consisting of two 64 kbps channels plus a 16 kbps data channel, now costs an average of $54 per month nationwide, according to research conducted by Primary Rate Inc. of Salem, N.H. By year's end, the firm says, National ISDN-1, the standardized version of ISDN, will be available to 68 million circuits representing 60 pecent of the national local line infrastructure, with nearly 100 percent of the larger metro areas included in the total.

Telephone companies report that standardization of hardware allowing ISDN users anywhere to communicate with each other has broken the market barrier to penetration, with residential business users coming on strong as a primary demand sector. In California, for example, Pacific Bell, which charges just over $20 per month for residential connections, is registering a 30 percent per month increase in ISDN subscriptions, half of which are residential users, according to Mary Hancock, a company spokesperson.

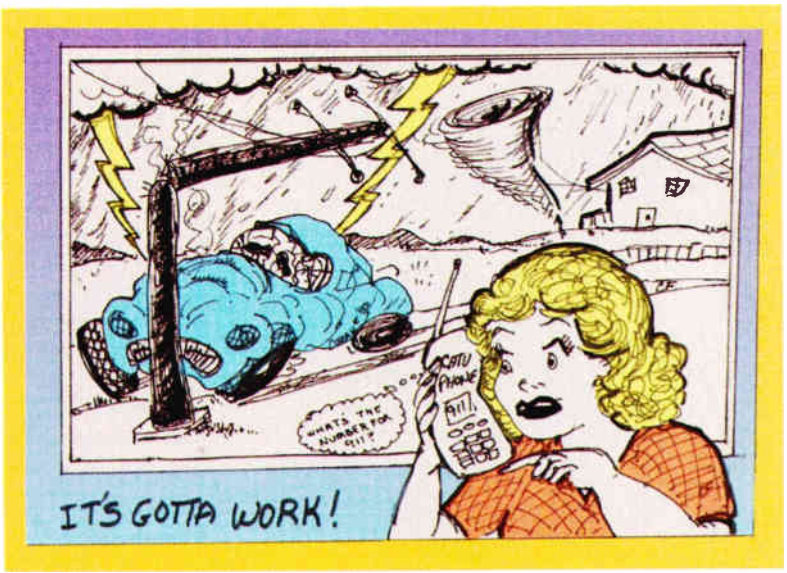
But the penetration surge is at the mere beginning point with under 400,000 ISDN circuits of all types (including the corporate primary rate interface) in use nationwide, 29,000 of which are in California. As a result, Prodigy's plans for expansion beyond the four initial cities are still forming, depending on how the market responds, Glatzer says.

Later this year Prodigy will experiment with opening the full 128 kbps ISDN pipe for even faster access via the IBM modem, giving customers a choice between using ISDN for both standard phone service and on-line service, or solely as a high-speed modem connection, says Tom Isaacson, director of network services.

At the same time, he adds, the company plans to begin implementing a 28.8-baud connection over standard analog lines, which would double the highest analog line rate now available to Prodigy users.

While Prodigy is continuing its experiments with Cox and other cable concerns, Glatzer says it remains to be seen how soon this type of service will be possible on a commercial basis. Availability of cost-effective cable modems to support such a service is "the $64-million question," he says, adding, "It's an easy thing to say we'll be able to do it in two years, but that's what I would have said two years ago."

Glatzer may be overlooking the most recent developments on the cable modem front, but, clearly, the cable industry is in a horse race now that ISDN is beginning to take off. Cable has the advantage of higher speed service, but it will have a far easier time of winning customers if service can be launched before the customer base has invested in a new generation of modems tied to telephone, rather than cable lines. CED



Return path reliability

Two-way activation for telephony

By Fred Rogers, President, Quality RF Services

The two-way return path of many cable TV systems will be activated in the near future in an attempt to add the extra revenue generated by telephony, high-speed data, interactive and other emerging services. As a result, reliability of the return path will become imperative if cable network operators are to effectively compete in the local telephone service arena.

To achieve return signal amplification, hybrid integrated circuits such as the Motorola MHW1224, Philips BGY67 or TRW CA4418 have been the industry standard with bandwidths up to 200 MHz. This family of hybrids was developed for local area network (LAN) applications, known in the cable industry as mid-split systems.

Motorola now offers 50 MHz low-current "L" series push-pull hybrids with a current drain of approximately 100 mA. This new family of hybrids is available with gains of 18, 22, 25 and 30 dB ratings. Philips has introduced a similar line of hybrids. A new, lower current substitute with the same footprint as sub-low CATV hybrids has also been developed. The reduction of approximately one-half to three-fourths the current, compared to a sub-low hybrid, will reduce heat within the cable TV amplifier, which increases reliability and minimizes additional system powering when the return path is activated.

The TRW hybrid IC is a 5 MHz to 200 MHz device with push-pull circuitry and 200mA typical current draw. A new discreet printed circuit board is single-ended and requires 50 milliamps current at 24 volts DC. Both have the same "footprint" and are designed for use in a cable TV amplifier.

The most controversial issue for the low current substitutes may be push-pull vs. single-ended technology. When dealing with a 5 MHz to 30 MHz, or a 5 MHz to 40 MHz return path, the question becomes, what format of signals will really be carried? In the early 1980s, analog TV signals were the only kind that were going to be amplified, making push-pull technology appropriate.

Today, most network plans call for digital signals, and few if any standard TV carriers, to be amplified in the return path. This type of signal plan is custom made for single-ended technology. The low-current single-ended return amplifier in line extenders will reduce current consumption and should cost less than its hybrid

Figure 1: Scientific-Atlanta System Amplifier I/II, reverse modules. Specifications for European discrete amp.

Specifications

Module part no.		*463312*	*463310*	*463720*	*463718*	*466040*
Pass band	*MHz*	*5-30*	*5-30*	*5-50*	*5-50*	*–*
Amplifier	*Type*	*Transistor*	*Transistor*	*Transistor*	*Transistor*	*Jumper*
Gain	*dB*	*9*	*19*	*9*	*19*	*–*
Channel loading		*4*	*4*	*7*	*7*	*–*
Frequency response	*dB*	*±0.5*	*±0.5*	*±0.5*	*±0.5*	*±0.5*
Min full gain	*dB*	*12.5*	*22.5*	*12.5*	*22.5*	*–*
Typical operating gain		*9*	*19*	*9*	*19*	*–*
Auto slope and gain (change at upper freq.)	*dB*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
Internal station tilt (0 dB EQ)	*dB*	*0*	*0*	*0*	*0*	*0*
Noise figure, high channel	*dB*	*7.5*	*7.0*	*7.5*	*7.0*	*–*
Noise figure low channel	*dB*	*7.5*	*6.5*	*7.5*	*6.5*	*–*
Thermal compensation (at upper freq.)	*dB*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
Hum modulation (at max current passing of 12 amps)	*dB*	*–*	*–*	*–*	*–*	*–*
Output level (reference)	*dBmV*	*37*	*37*	*37*	*37*	*–*
Operational tilt (true tilt)	*dB*	*Flat*	*Flat*	*Flat*	*Flat*	*–*
Cross modulation (per NCTA std.)	*dB*	*85*	*85*	*82*	*82*	*–*
Composite Triple Beat (carrier to avg. CTB, unmodulated carriers on any channel)	*dB*	*–*	*–*	*–*	*–*	*–*
Composite Second Order	*dB*	*76*	*76*	*76*	*76*	*–*
Return loss	*dB*	*16*	*16*	*16*	*16*	*16*
Max AC thru current	*Amps*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
Typ. current requirements (@ 24 V DC)	*Amps*	*0.10*	*0.10*	*0.10*	*0.10*	*–*
Test point (±1.0)	*dB*	*-20*	*-20*	*-20*	*-20*	*-20*

Figure 2: Hybrid specifications for low current amplifiers. To 50 MHz hybrids, V_{CC} = 24 Vdc, class A.

			Maximum distortion specifications					
Device	Hybrid gain (nominal) dB	Channel loading capacity	Output level dBmV	2nd order test(30) dB	Composite Triple Beat dB 4 Ch	Cross modulation dB 4 Ch	Noise figure @ 50 MHz dB	Package/ style
Low current amplifiers								*Source: Motorola RF Products Division*
MHW1184L	18	4	+50	-70	-73	-64	5	714/1
MHW1224L	22	4	+50	-70	-72	-63	5	714/1
MHW1254L	25	4	+50	-70	-70	-62	4.5	714/1
MHW1304L	30	4	+50	-70	-66	-57	4.5	714/1

counterpart, while satisfactorily amplifying the return path.

Although there has been little fanfare surrounding the subject, some of the most modern 750 MHz amplifiers now use a discreet single-ended return amplifier for 5 MHz to 40 MHz return amplification while obtaining adequate distortion specifications. Prime Cable in Anchorage, Alaska plans to activate its existing line extender return paths using the 50 mA discreet amplifier with the hybrid footprint, instead of using high-current hybrids.

Trunk return amplifiers will use push-pull hybrids–not single-ended. Many more issues than just activating the return path have to be addressed when contemplating telephony or other revenue-generating, emerging technology services via a CATV plant.

In a cable TV environment, when the customer loses the main power (AC voltage) to the house, it is not known if the cable is functioning because the TV will not operate (no power to operate the TV unless an emergency power generator is available). In most cases, when the main power is out, the customer has no way of knowing if the cable TV is operating.

By comparison, customers have come to expect the telephone to function even when the power does not. Telephony or other services offered by cable TV system operators must provide the same reliability. One possible solution would be leasing the telephone line as a backup to the cable TV supplied telephone service. Another solution could be redundant signal paths through the system's fiber architecture. The methodology is less important than the basic point: the telephone must operate even when the power to the subscriber ceases to function.

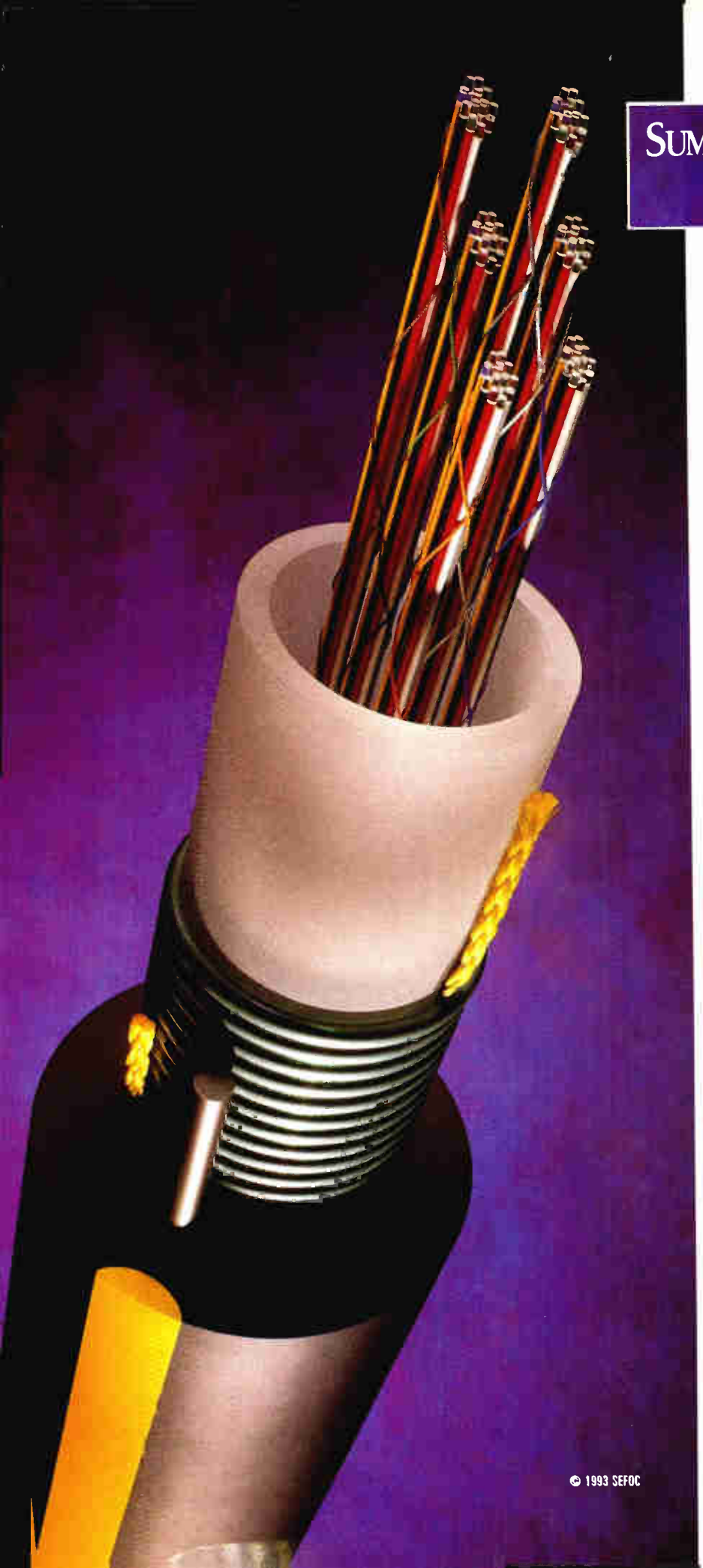
An interesting story concerning cable TV reliability occurred several summers ago. One Florida resident said, "Boy, what a storm last night! It was so bad, even the cable was out!" This statement indicates high cable TV plant reliability can be achieved even in the hostile storm environment of south Florida.

The use of fiber optic cable to reduce cascades of amplifiers will improve reliability. This may be a good time to define reliability. It is the probability of a device or network to perform its purpose adequately for the period of time intended under the operating conditions encountered. As the number of active devices between the headend and the customer decreases, the reliability increases.

As stated by Michael D. McCombs of TRW Semiconductors, "Reliability not only can be accurately defined, but it can be calculated, measured and designed into a piece of equipment (or plant). So, for engineers, reliability is not an abstract concept. It ranks on the same level with the performance of equipment, and often is more important." Reliability may well be the one parameter that determines success or failure for cable telephony.

Attempting to compare cable TV and telephony as they exist today often resembles the apple and orange comparison. When a person attempts a phone call and receives a busy signal, the response often will be to try again later. If a television picture locks up (a potential failure anticipated with digital signals) or just disappears, it will outrage the viewer and probably generate a trouble complaint.

Television channels will be viewed many more hours per day than the telephone will be operated. The use of lower current return amplifiers will have less impact on increased system powering, while maintaining reliability. Cable TV plants will need good reliability to be a player in telephony, as well as maintain the interactive services of the future. CED



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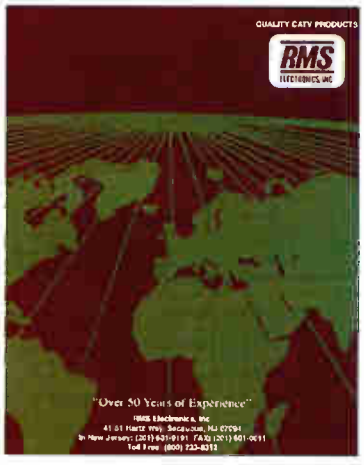

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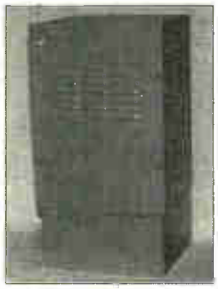

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The issue: Training and education

As the Society of Cable Telecommunications Engineers moves into Las Vegas this month for its annual Cable-Tec Expo and Engineering Conference, the spotlight will once again be thrown upon the value of certification, standards and training. Many say education will become increasingly important as the industry moves forward and begins to deploy new, complex network systems. What do you think?

The questions:

1. Does your system offer formal, in-house training in customer contact skills for installers and technicians?

❑ Yes ❑ No ❑ Don't know

2. Does your system offer formal, in-house training for installers and technicians to actually sell cable services to customers?

❑ Yes ❑ No ❑ Don't know

3. If you chose to enroll in an outside course teaching these subjects, would your company reimburse you for the tuition cost?

❑ Yes ❑ No ❑ Don't know

4. Does your system offer formal, in-house training for (check all that apply):

❑ Installers ❑ Service techs

❑ Headend techs ❑ Line techs

5. Does your system offer in-house training in fiber optics?

❑ Yes ❑ No ❑ Don't know

6. Does your system offer in-house training in digital technology?

❑ Yes ❑ No ❑ Don't know

7. If you enrolled in an outside course in cable TV technology, would your company reimburse you for the tuition cost?

❑ Yes ❑ No ❑ Don't know

8. If you chose to pursue college or vocational training in electronics, would your company pay at least a portion of the tuition?

❑ Yes ❑ No ❑ Don't know

9. Does your system allow you time away from your job to attend SCTE meetings?

❑ Yes ❑ No ❑ Don't know

10. Does your system pay the cost of SCTE BCT/E certification exams?

❑ Yes ❑ No ❑ Don't know

11. Do you believe you've received adequate formal training to do your job effectively?

❑ Yes ❑ No ❑ Don't know

12. Is there a dedicated, full-time trainer at your system?

❑ Yes ❑ No ❑ Don't know

13. Do you think there's a need to overhaul your system's training program?

❑ Yes ❑ No ❑ Don't know

Your comments:

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RESULTS

The issue: DBS competition

Over the past 12 months, DBS has exploded into the multichannel video marketplace, becoming the most popular consumer electronics device faster than anything else–ever. Already, DirecTv is coming up on its one-millionth subscription sold. Meanwhile, cable operators are forced to wait to implement digital technology until some time next year. What impact has this had on local cable systems?

The results:

Cable operators say DBS has so far had little success in stealing away customers, but the advent of new competition has hastened systems to upgrade service and bandwidth for new programming services, according to those who responded to this survey.

The audience was split when asked when DBS will have a measurable impact, with most saying it would be two to five years before that happens. However, 41 percent said DBS has affected their system's rebuild schedule "a lot," and 25 percent more said it affected the schedule "some." Furthermore, 41 percent said it is "very likely" their systems will add more channels or interactivity because of the success of DBS. Interestingly, 41 percent said that success would have no effect on their rebuild schedules.

Three-quarters of the respondents said they'd implement digital compression technology today if it were available, to increase their channel counts.

According to the respondents, fewer than 10 percent of cable subscribers have made the jump to DBS, and most believe it's the high upfront hardware cost that is DBS' weak link.

In spite of DBS' exceptional success in the marketplace, most cable operators say it's the telephone companies that remain their biggest foes over the next three years.

1. How well would you say DBS is doing at taking away customers who reside in your cable system?

Excellent	Good	Poor
8%	**16%**	**75%**

2. How soon do you think DBS will have a measurable impact on your system, in terms of number of subscribers served?

Already has	Within 2 years	2-5 years	6 years or more
8%	**25%**	**41%**	**25%**

3. Do you think consumers see DBS as a better investment than cable TV over the long run?

Yes	No	Don't know
8%	**66%**	**25%**

4. To what degree has the launch of DBS affected your system's rebuild or upgrade schedule?

A lot	Some	Very little
41%	**25%**	**33%**

5. In your opinion, what is DBS' "weak link" when compared to a cable system?

Hardware cost	Programming cost	
58%	**0%**	
No return path	Broadcast-only	Other
8%	**25%**	**8%**

6. What percentage of your former subscribers have already switched to DBS services?

10% or less	10%-20%	More than 20%
91%	**8%**	**0%**

7. How likely is it that the success of DBS will hasten your system to upgrade to more channels and/or interactivity?

Very likely	Somewhat likely	Not at all
41%	**16%**	**41%**

8. Do you think most DBS subscribers are rural residents who haven't been wired for cable?

Yes	No	Don't know
75%	25%	0%

9. Which do you think is a more formidable competitor to your system over the next three years–DBS or the telcos?

DBS	Telcos	Don't know
41%	**58%**	**0%**

10. Has your system either lowered prices or offered any special promotions to ward off DBS competition?

Yes	No	Don't know
25%	**75%**	**0%**

11. If it was available, would you implement digital compression today to increase your channel count?

Yes	No	Don't know
75%	**16%**	**8%**

12. Is any portion of your system's franchise area currently being served by an MMDS operator?

Yes	No	Don't know
41%	**58%**	**0%**

Your comments:

"If I lived in an area where I could receive off-airs, I would probably opt for Primestar over cable for the digital quality. I've never been happy with scrambled analog quality."

– Ron Peterson, Post-Newsweek Cable, Bisbee, Ariz.

"I know of some systems that are being heavily affected by DBS. This is forcing them to take a hard look at themselves. In the long run, the industry will improve by having competition."

– Mason Mullins, Adelphia Cable, Staunton, Va.

"We've lost only 25 customers to DBS."

– Dennis Younker, Cox Communications, San Diego, Calif.

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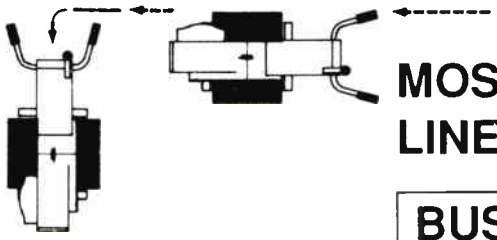

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5 Fundamentals of ATM, presented by the International Engineering Consortium. Location: Chicago, Ill. Call (312) 938-3500; or fax to (312) 938-8787.

5-7 Fiber Optics 1-2-3: Installation–Maintenance–Design, produced by The Training Division of The Light Brigade Inc. Location: Doubletree, Albuquerque, N.M. Call Valerie Johnsen (206) 251-1240.

5-7 Digital World '95, produced by Softbank Exposition and Conference Co. Location: Los Angeles Convention Center and Los Angeles Biltmore Hotel. Call (800) 488-2883; or fax to (415) 525-1099.

5-8 Fiber Optics System Training (FOST), produced by Antec Fiberworks. A four-day overview. Location: Denver, Colo. Call (800) 342-3763.

5-8 Fiber Optic Installation & Splicing, Maintenance & Restoration for CATV Applications, produced by Siecor Corp. Location: Hickory, N.C. Call (800) 743-2671.

6 Fundamentals of the Hybrid Fiber/Coax Network, produced by the Scientific-Atlanta Institute. Location: Philadelphia. Call (800) 722-2009 (press 3) for registration between 8:30-5:30 Eastern time, Monday-Friday, or register by fax (404) 903-6331.

7-9 1995 International Conference on Consumer Electronics (ICCE). Location: The Westin Hotel O'Hare, Rosemont, Ill. Call Diane D. Williams, conference coordinator (716) 392-3862.

Trade Shows

14-17 SCTE Cable-Tec Expo '95, produced by the Society of Telecommunications Engineers. Location: Las Vegas Convention Center, Las Vegas, Nev. Call Anna Riker of the SCTE at (610) 363-6888.

18-22 NFOEC '95. Location: Boston, Mass. Call Joseph Scianameo of Nynex at (914) 644-5223.

26-30 EFOC/Networks '95. A trans-European conference that addresses practical aspects of broadband and multimedia technology and applications. Location: Brighton, England. Call Information Gatekeepers Inc. (617) 232-3111; fax (617) 734-8562.

7-9 Fiber Optics 1-2-3: Installation–Maintenance–Design, produced by The Training Division of The Light Brigade Inc. Location: Radisson South, Denver, Colo. Call Valerie Johnsen (206) 251-1240.

8 SCTE Satellite Tele-Seminar Program. Topic: Convergence (Part II), and advances in system architectures (Part I) from Expo '94 in St. Louis, Mo. To be transmitted on Galaxy 1R, Transponder 14, 2:30-3:30 p.m. EDT. Call SCTE National Headquarters (610) 363-6888.

8 Music City SCTE Chapter, Testing Session. BCT/E certification exams to be administered. Location: Nashville, Tenn. Call Kenny Long (615) 244-7462, ext. 392.

8 Lincoln Land SCTE Chapter, Technical Seminar. Topic: "Construction practices & technology for coax and fiber." Location: Best Western Suites–Eastland, Bloomington, Ill. Call Richard Rohm (309) 467-5107.

11-16 Building the Corporate Internet: Engineering Strategies and Tactics for Public, Private & Hybrid Networks, sponsored by the International Communications Association. Location: University of Colorado campus, Boulder, Colo. Call (800) 422-4636 for more information, or fax credit card registration to (214) 233-2813.

13-15 Cable Television Technology. Produced by C-COR Electronics Inc. Location: Indianapolis, Ind. area. Call the Technical Services Department (814) 231-4422; (800) 233-2267.

13-15 Fiber Optics 1-2-3: Installation–Maintenance–Design, produced by The Training Division of The Light Brigade Inc. Location: Green River Training Center, Kent, Wash. Call (206) 251-1240.

14-16 Installing Fiber Optic Systems, produced by EESCO Communication Systems. Location: LAN Training Center, Oak Brook, Ill. Call (800) 366-3638.

26-29 Fiber Optics System Training (FOST), produced by Antec Fiberworks. A four-day overview. Location: Denver, Colo. Call (800) 342-3763.

27-29 Broadband Applications Engineering Training, produced by General Instrument. This three-day training course includes technical instruction on distribution networks, architecture, fiber optic transport systems, headends, addressable systems, digital compression techniques and emerging technologies. Location: Atlanta, Ga. Call Lisa Nagel, GI at (215) 830-5678.

28-29 Hybrid Fiber/Coax Test and Measurement, produced by the Scientific-Atlanta Institute. Location: Atlanta, Ga. Call (800) 722-2009 (press 3) for registration between 8:30-5:30 Eastern time, Monday-Friday, or register by fax (404) 903-6331.

Alpha Technologies to power Ameritech net

BELLINGHAM, Wash.–Alpha Technologies has been selected as the power vendor for Ameritech's $4 billion broadband network building project. As part of that contract, Alpha will provide power supplies and related services for Ameritech's new two-way video network.

Using an HFC architecture as the platform, Ameritech will deploy a 750 MHz video overlay system that will deliver interactive programming, home shopping and games. Alpha's XM Series CableUPS uninterruptible power supplies will be used to power the video system. Additional products to be provided by Alpha include enclosures that will integrate special status monitoring and surge protection equipment. Aerial plant products will be acquired directly from Alpha, while ground-mounted units will be shipped and installed in node cabinets supplied by ADC Telecommunications.

Ameritech has already begun construction on the network, and expects it to be operational in some midwestern communities by the end of 1995. The company plans to provide the expanded video services to six million homes by the year 2001.

Trilogy receives ISO-9001 certification

STAMFORD, Conn.–Trilogy Communications Inc. has met the requirements for ISO-9001 certification. According to Trilogy President and CEO S. Shinn Lee, ISO-9001 certification is a key to future growth in international and domestic markets, and is also fundamental to making sure that all manufacturing operations conform to high quality standards. The company's manufacturing facilities are located in Pearl and Flowood, Miss.

AT&T Engineering Services achieves ISO-9002

MORRISTOWN, N.J.–AT&T Network Systems Engineering Services is one of the first full-service telecommunications engineering organizations to achieve registration to the ISO-9002 quality standard.

This registration distinguishes NS Engineering Services as a stand-alone, full-service provider of engineering services. It assures customers that the Network Systems' global engineering processes meet the highest standards for operations, and eliminates the need for them to conduct their own audits of the group's engineering services.

The registration achieved was national in scope, but benefits customers globally who receive these services. Registered sites for NS Engineering Services are in Atlanta, Cockeysville, Md.; Ballwin, Mo.; Rolling Meadows, Ill.; and associated satellite locations such as Santa Clara, Calif.; Houston and Denver.

The International Organization for Standardization is a non-governmental organization with 89 member countries, which provides international guidelines for quality management and assurance systems. The ISO-9000 standards have become a global benchmark for industrial companies, having been adopted by more than 70 countries representing 90 percent of the world's industrial capacity. Independent auditors register qualified companies to the standards and conduct semi-annual audits to make sure that companies are maintaining their quality systems.

GI acquires stake in Next Level

CHICAGO–General Instrument Corp. has acquired an equity interest in Next Level Communications, a company engaged in the development of broadband access systems providing switched-digital solutions for the integrated delivery of video, voice and data over fiber-to-the-curb networks. The two companies have also entered into a technical cooperation agreement to jointly develop network components, including set-tops, supporting a range of switched-digital services.

Next Level's switched-digital network is an ATM-based architecture that extends fiber optics from the switching office to points close to home, allowing for the delivery of advanced services such as interactive video and telecommuting that require large amounts of two-way information capacity.

General Instrument has also announced that Continental Cablevision is upgrading its Michigan franchise areas with GI's CFT-2000 series addressable convertors.

The Michigan systems will purchase approximately $25 million in basic CFT-2000 convertors, with on-screen programming, and enhanced CFT-2200 convertors with the capability of being modularly upgraded to handle interactive programming and digital audio technology. The convertors will be used in the Lansing, Jackson and metro Detroit systems.

Sammons Communications will also purchase new equipment from GI–distribution electronics to be used in its 650-mile rebuild of its Glendale, Calif. system. According to the terms of the agreement, Sammons will purchase and deploy 750 MHz distribution products, including newly developed broadband telecommunications amplifiers and line extenders. Also, as part of the two-way capable system, Sammons will purchase and deploy Starblazer lasers, status monitoring and assorted taps and passives supplied by GI.

The rebuild will employ a fiber-to-the-feeder architecture down to 2,000-home nodes, according to Robert Saunders, assistant vice president of engineering for Sammons. The system will be fully two-way, as Sammons anticipates offering integrated telephony, video-on-demand and near video-on-demand programming, as well as utilizing digital compression.

GTE selects Antec taps and passives

ANAHEIM, Calif.–Antec has been selected by GTE as a supplier of broadband tap and passive products designed for use in video dial-tone networks. The recently-executed three-year contract is the result of GTE's decision to standardize the product line after completing its technical evaluation.

GTE chose the line of Regal splitters, surge-protected directional couplers, power inserters and 1 GHz taps.

GTE NMO introduces Unix NMM gateway

BOTHELL, WASH.–GTE Network Management Organization (NMO) has introduced a Unix implementation of its Network Message Manager (NMM) network mediation gateway software product. NMM is now available for Sun Solaris and Silicon Graphics (SGI) IRIX-based systems, as well as Tandem Computer's Himalaya series of non-stop computers.

The new Unix version brings the ease of use of the Motif graphical user interface (GUI) to NMM. The GUI makes it easier to configure and operate NMM. The new version also includes several other enhancements, including support for TCP/IP and Ethernet connections, an expanded application programming interface (API) and a new on-line help system.

NMM centralizes and manages the interaction between individual network elements (NEs) such as telephone switches and transmission equipment to "back-end" business and operational (BSS/OSS) applications.

The software product is designed to enable service providers to lower their application development and maintenance costs, according to GTE, by greatly reducing the time and effort needed to support new NEs or modify existing NE interfaces. It can also reduce back-end application development time, enabling a service provider to more rapidly introduce a new revenue-generating service.

Tektronix merges divisions

WILSONVILLE, Ore.–Tektronix Inc. has merged its Video Systems Division and its Network Displays Division to more rapidly develop synergies between the company's

strengths in video and networking. The new business unit, called the Video and Networking Division, is led by division President Lucie Fjeldstad, the former IBM multimedia and industry leader who joined Tektronix in January as president of its Video Systems Division.

The merged operation had combined fiscal 1994 sales of $241.8 million, and has approximately 1,100 employees worldwide.

Fjeldstad said the Grass Valley Group, the division's video disk recorder unit, and its network displays unit will all operate as discrete operations within the new division in order to ensure continued focus on current products and customers. At the same time, new central groups will be dedicated to both developing applications environments with partners, and speeding to market advanced technologies such as broadcast-quality video compression and high-speed networking.

Vision Cable completes fiber-dense NYC system

CHARLOTTE, N.C.–Vision Cable Communications has announced that its cable system in Bergen County, N.J. has completed its one-year, 360-mile network rebuild. Called Vision Cable Tri-Star, the network rebuild was designed by Vision Cable's engineering staff and is a modification of Antec's Star Star Bus-500.

The Bergen County system provides approximately 360 miles of active cable plant, which passes more than 80,000 homes. The rebuild included the installation of 152 sheath miles (11,573 glass miles) of Antec-provided AT&T AccuRibbon and central tube fiber optic cable, along with 58 of Antec's 750 MHz Laser Link II Plus transmitters.

The Tri-Star network routes fiber from the headend to regional hubs sized to 8,000 homes. From there, fiber sub-trunks feed local hubs sized to 2,000 homes down to neighborhood fiber nodes of 500 homes. Eighteen pre-provisioned fibers to each neighborhood node will allow Vision Cable to migrate to a passive broadband design of 75-home nodes, and eliminate the remaining active device that impedes delivery of broadband telephony.

CTV launches service facility

DINGMANS FERRY, Pa.–CTV Inc. has announced the opening of its new service facility, catering to the needs of companies owning RF sweep equipment and signal level meters.

Due to the rising cost of test equipment, more companies are trying to maintain their existing gear. In an effort to meet the needs of those companies, CTV specializes in the calibration, repair and preventive maintenance of RF test equipment, along with upgrades on select products.

Microware opens Technology Center

DES MOINES, Iowa–Microware Systems Corp. has opened a Technology Center in the San Francisco Bay Area, and has named Carl Suarez to manage the center, as director of business development for the Western United States.

The Technology Center provides local support for regional telephone companies, applications developers, hardware and software manufacturers and others in the interactive television market. Its focus will be supporting companies which use Microware's interactive television products, including DAVID (Digital Audio/Video Interactive Decoder), designed for interactive set-top systems. The company previously announced an East Coast Technology Center outside of Philadelphia.

3M buys grating technology

AUSTIN, Texas–3M has acquired Bragg grating technology from United Technologies in a cash transaction. Financial details of the transaction were not disclosed.

Bragg grating technology has applications in telecommunications, private networks and other communications arenas. Fiber Bragg grating elements are used in the telecommunications industry as reflectors for semiconductor and fiber lasers, low insertion loss filters and distributed taps. Gratings have also been demonstrated to be effective in dispersion compensation of the embedded base of telecommunications grade singlemode fiber.

SNET will use Homeworx for VDT

MINNEAPOLIS, Minn.–ADC Telecommunications Inc. has announced that SNET will use the company's Homeworx access platform in the second phase of its current video dial-tone deployment in Connecticut. The second phase of the telco's network deployment includes a total of 220 Homeworx system optical nodes and approximately 100 transmitters. In addition, the contract includes fiber cross-connect equipment from ADC for managing the fiber optic cable in SNET's central serving offices.

With the expansion of the network, which is scheduled to begin operating in 1995, SNET will deliver on-demand programming to 150,000 customers in Hartford and Fairfield counties. The Homeworx access platform transports both digital and analog broadband signals, as well as narrowband telephony and data services, over an HFC architecture.

Primestar customer count hits 100,000

STAMFORD, Conn.–Time Warner Cable's Primestar direct broadcast satellite venture reached the 100,000-customer mark in March, according to Daniel O'Brien, president of Time Warner Satellite Services. The watermark was hit only eight months after the service's digital launch in August of 1994.

Prior to the launch of Primestar's digital service, Time Warner served 10,000 DBS customers. O'Brien noted that the service is signing up roughly 4,000 customers per week, and by the end of the year, expects to serve more than 200,000 customers.

Time Warner Satellite Services is a subsidiary of Time Warner Entertainment Co. L.P., which owns about 21 percent of Primestar Partners L.P.

Cablevision to use Fleetcon

AUSTIN, Texas–Arrowsmith Technologies Inc. has entered into an agreement with Cablevision Systems Corp. to integrate Fleetcon into its field service operations. Under the agreement, Cablevision will initially deploy the technology in its northern New Jersey systems.

Fleetcon is an object-oriented, client-server based system which enables cable operators to improve customer service while reducing operating costs. The technology will assist Cablevision in automating its dispatch operations, managing its fleet activities and enhancing its front-end service capabilities.

Radian, Arrowsmith ink deal

AUSTIN, Texas–Radian Electronics Division has been awarded a $2 million manufacturing contract from Arrowsmith Technologies Inc. According to the terms of the contract, Radian will become the primary manufacturer of Arrowsmith's Vehicle Identification Terminal (VIT) for its Fleetcon system.

Radian will manufacture the printed circuit board and VIT controller unit, and will also provide additional resources for manufacturing operations support to Arrowsmith.

The VIT controller is mounted inside the fleet service vehicles and integrates technologies such as satellite positioning, handheld computers and mobile data communications. The unit is expandable, enabling the future use of a mobile printer, dead reckoning navigation and radio frequency leak detection systems.

Radian Electronics is a division of Radian Corp., which provides environmental, energy, mechanical, materials and information technologies and services to industry and government worldwide. CED

People on the move

Bell Atlantic and Pacific Telesis Group have appointed **Howard Stringer** as chairman and CEO of a new company to lead their recently-formed media and technology businesses, which will deliver home entertainment and information services. Stringer is the former president of the CBS Broadcast Group. The new business will offer nationally branded home entertainment, information and interactive services over the telephone companies' new video dial-tone (VDT) networks.

Ted Boyle has been appointed to the position of president of Expressvu Inc. He joins the company with 25 years of business management experience. Prior to his appointment, he was vice president of corporate development at Tee-Comm Electronics Inc.

SNET has named **Cory Mitchell** as president of its MultiMedia Services Unit. Mitchell's role at SNET will be to help chart the course of the company's multi-media ventures as it rolls out its new VDT trial to 150,000 homes, and ultimately, to 1.5 million Connecticut customers. Mitchell is the founder and president of Poseidon Entertainment, Los Angeles, a multimedia consulting practice.

Wes Schick

Antec Corp. has named **Wes Schick** as managing director-Asia Pacific. In his new position, Schick is responsible for establishing and overseeing operations for the company's new office in Singapore. For the past three years, he has served as regional vice president-sales for Antec's Central Region.

Mike Sparkman

Antec has promoted **Mike Sparkman** to senior vice president-Asia-Pacific. Based in Denver, he will be responsible for sales in the Asia-Pacific region.

Finally, **Steve Moore** has been appointed as vice president-sales for the company's expanded eastern region. He will be based in corporate headquarters in Rolling Meadows, Ill. and will be responsible for the company's regional sales offices in Atlanta, Dallas, Rockaway, N.J. and Schaumburg, Ill.

Lasertron has appointed **D. Westervelt Davis** to the newly-created position of vice president, chief operating officer. As COO, Davis assumes the day-to-day management responsibility of all the major functions of the company. He had previously served as president and CEO of Autographix and as president of General Scanning.

Tele-Communications Inc. has named **Stephen Dukes** to the newly-created position of vice president of technology for TCI's Technology Ventures Group. Dukes will be responsible for leading the development of TCI's broadband network architecture and guiding the company's technology development for interactive television, broadband online services, multimedia services, advanced set-tops and client/server based systems. Dukes joins TCI from The 3DO Company, where he was director of Advanced Network Technologies.

Augat Inc. has appointed **Sam Smookler** as vice president and general manager of Augat's Interconnection Products Division. Smookler returned to Augat in November 1994 as vice president of sales and marketing of the Interconnection Products Division. From 1992 to 1994, he was general manager for the passive and millimeter wave products area of M/A-COM Inc.

Donald Karell has been appointed vice president and general manager of Cox Cable Middle Georgia. Prior to joining Cox, Karell served as corporate director of construction for Times Mirror Cable Television in Phoenix.

Anne Schowe has been named vice president and general manager of the interactive services business at Sun Microsystems Computer Co. (SMCC). She was formerly the managing director of the visual solutions business unit of AT&T's Microelectronics Group.

ADC Telecommunications Inc. has named **Anthony Masella Jr.** as vice president of engineering and product management for its Network Services Division. Before joining ADC, Masella was vice president of engineering for Transwitch, a VLSI components manufacturer. His responsibilities in his new position include leading the product creation function within the Network Services Division.

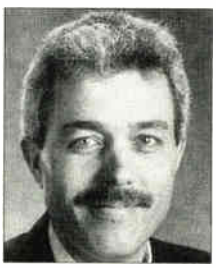
Alcatel Network Systems has appointed **Krish Prabhu** as vice president, business development and chief technical officer. The company also announced the creation of a product and marketing group devoted to positioning Alcatel's ATM products in telephone and video networks in North America. Prabhu has responsibility for the company's research and development organization and business product development lines, as well as strategic planning, marketing and product line management for ATM.

California Amplifier Inc. has named four vice presidents. In the sales and marketing department, **Dennis Schwab** has been named vice president of sales-cable & satellite products; **Chuck Uhl** has been appointed vice president of sales-wireless cable products; and **John Ramsey** has been named as vice president of advanced marketing and technology (AMAT). In operations, the company has named **Michael Malloy** as vice president of manufacturing. Schwab and Uhl will focus their efforts on sales of each of the respective product lines, and Ramsey will focus on applications for existing and new technologies in evaluating new product opportunities. Malloy will coordinate all aspects of the company's manufacturing and materials control process.

AT&T Fitel has promoted **John Rogers** to vice president, product management and marketing. In this position, Rogers will have responsibility for sales, marketing, product management and technical services. Rogers joined the company in 1989 as marketing manager, and in 1990, he became director of marketing.

Harmonic Lightwaves Inc. has added **Hugo Vifian** as vice president of research and development and has realigned its R&D organization. In his new position, Vifian is responsible for the company's new product and technology development. He joins the company with 25 years of experience at Hewlett Packard, where he most recently served as R&D manager and as chairman of HP's strategic council.

Hugo Vifian



Pete Cornish

A second addition to Harmonic's R&D team is **Pete Cornish**, who will serve as director of systems engineering. His responsibilities will include overseeing the development of systems, special customer requests and general product enhancements. Cornish joins the company from Raynet Corp., where he served as manager of systems sup-

port for broadband transport products.

As a result of the realignment, the R&D organization is now grouped by product type. Transmission systems are grouped under **Director Dr. Chien-Yu Kuo**; receiver and distribution systems are under **Director Yishai Kagan**; and overall video and data transport systems are under Director Pete Cornish.

Industry veteran **Clifford Marshall Paul,** a former secretary and director of the New Jersey Cable Television Association, has died. Paul's career in cable television included 15 years with Service Electric of New Jersey, where he was general manager. He also served as the chairman of cable programming for the Cable Television Network of New Jersey, and as president of IMA Management Association. Contributions may be made to the American Heart Association.

John Hildebrand has joined Time Warner Cable's Full Service Network as senior director-application development technology. In this newly-created position, Hildebrand will serve as the primary interface with software companies creating interactive applications for the network. He was previously COO at USA Video Corp.

Yvette Gordon, director of system software for Time Warner Cable's Full Service Network, has been named Signal Processing Engineer of the Year by the Orlando Section of The Institute of Electrical and Electronics Engineers (IEEE). Gordon is currently responsible for the management and support of FSN operations systems, as well as the integration of all of the software driving the Full Service Network.

Time Warner Satellite Services has promoted its five regional managers to the title of regional director. The regional managers have been in charge of launch and relaunch activities of the division's PrimeStar business in their respective areas. The newly-named regional directors are: **Andrew Bast**, northeast region; **Steven Everett**, midwest region; **Sal Grenillo**, northwest region; **Andrew Logan**, southeast region; and **Randall Watson**, southwest region. Each regional director is responsible for an area served by six to eight individual cable divisions, covering five to eight states.


Yvonne Jordan

Scientific-Atlanta has named **Yvonne Jordan** as director of marketing communications for the company's Broadband Communications activities. Jordan is responsible for all product marketing communications, including advertising, trade shows, product literature, public relations, promotions and special events. She previously served as manager of marketing communications for Philips Business Networks.


Victor Milani

Fiber Options Inc. has announced that **Victor Milani** has joined the company as director of technical services. Milani has more than 21 years of experience in troubleshooting telecommunications and CCTV systems.

Tektronix Inc. has appointed **Kevin Dauphinee** as product marketing director for its Digital Video Storage Systems business unit. He is charged with new product development and strategic planning for the Profile Professional Disk Recorder line. Dauphinee was most recently senior vice president for operations at Sony Dynamic Digital Sound.

Micracor has announced the appointment of **Jeff Purchon** as director of sales and marketing. His new responsibilities include launching the company's new range of Power-Link high-power 1319 nm communications sources and links targeting high-volume CATV, RF and cellular markets. Purchon has 10 years of industry experience in selling fiber optic components to world markets.

Lasertron has appointed **M. Scott Burroughs** to the position of assistant director of device engineering. In this role, Burroughs assumes the responsibility for the development and manufacture of all of Lasertron's laser diodes. He joins Lasertron from AT&T Microelectronics.

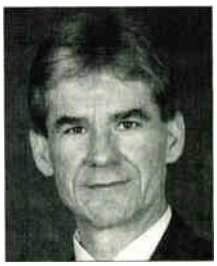
Lindsay Allen has been named senior product manager for wireless systems for the GI Communications Division of General Instrument Corp. In this position, Allen is responsible for product management for GI's wireless cable systems worldwide, including product development and system integration. Allen joins GI from F.W. Bell Inc., where he served as a product group manager.

Nancy Garner has joined Trilogy Communications Inc. as manager of customer service, responsible for domestic and international markets. Garner was previously with Comcast Cablevision Inc., where she served as customer service manager, and most recently, as GM of the Dothan, Ala. system.

Microware Systems Corp. has hired **A. Miles McNamee** as business development manager for the eastern U.S. McNamee will establish a Microware office in the Philadelphia area to provide a local presence for RBOCs, MSOs, hardware manufacturers and other firms involved in interactive television, working with Microware's DAVID system.

ATx Telecom Systems Inc. has appointed **Zee Shams** as national strategic executive, domestic sales. His most recent position was as vice president of sales and customer services for ALS American Lightwave Systems Inc., Video Transmission Division.

Dynatech Video Group has named **Mark Kazmierczak** as regional sales manager for Latin America and the Caribbean.


Mark Kazmierczak

Kazmierczak will be responsible for the sales of the Alpha Image, EMC, Utah Scientific, DP/MAX, Delta and DigitStore product lines. Before joining Dynatech, he was district sales manager, Latin America for Ampex Corp., responsible for the sale, marketing and service of Ampex products in Puerto Rico and other Latin American countries.

California Amplifier Inc. has named **Nick Pena** to the position of account manager. In this position, Pena is now responsible for sales of the company's wireless cable products to domestic customers. He reports to Chuck Uhl, vice president of sales, wireless cable products. Prior to joining the company, Pena held the position of national key accounts manager with Logicode Technology Inc.

Isowave, a division of Deltronic Crystal Ind. Inc., has promoted **Christopher Pinyan** to product manager. In his new position, Pinyan supervises the production team of Isowave's main product line of optical isolators and is the liaison between manufacturing and engineering and marketing.

Fibertron Corp. has appointed **Jeffrey Bazemore** to the position of district manager for its Southeast region. Bazemore will manage the Norcross, Ga. branch, a major stocking and sales facility for the company. Bazemore, a former process engineering manager with Siecor Corp., Telecommunications Cable Plant, was responsible for the fiber coloring and buffering processes in the production of the company's loose tube optical cables.

Aria Technologies Inc. has appointed **Carolyn Borrelli** as manager of cable assembly sales for the eastern region. Prior to joining Aria, Borrelli was a sales manager at FOCS Inc., responsible for the inside sales department, Fiber Optic Cable Assembly Division. CED

User interface

FOLSOM, Calif.–Objective Systems Integrators (OSI), a developer of network management and operational support systems, has released OSI VisualAccess, a user interface which provides NetExpert (OSI's management framework) users with the ability to display real-time information gathered by their systems in a choice of a graphic or Windows-based text format.

The interface was developed by OSI using SL-GMS, a development tool for creating interactive visual control and animation displays for real-time applications. VisualAccess allows users to define the visual characteristics of an object class in a manner similar to the way they would define a class' attributes and behaviors in the MIB.

Event and performance data reported to NetExpert can be presented dynamically in graphs, dials, bar charts, pie charts or in other useful forms within the user interface.

Circle Reader Service number 80

Fiber optic power meter

BEAVERTON, Ore.–Photon Kinetics has introduced the 7700C High Power Fiber Optic Power Meter designed specifically for CATV applications and others where it is necessary to measure the output of high power sources.

The 7700C is a rugged, field portable optical power instrument designed to measure either the absolute or relative power of light from a fiber optic cable. The meter features two-button operation, large LCD display, and a universal connector interface which allows the user to test either terminated or unterminated fiber optic cables.

The measurement range of the 7700C is +20dBm to -35dBm. The unit can operate either with alkaline batteries or with an AC adapter.

Circle Reader Service number 81

Passive splitters

CARLSBAD, Calif.–Ipitek has announced passive optical 1x3 splitters with asymmetric split ratios for CATV applications. To reduce the need for additional splitters and/or attenuators to balance the signal level, the company has developed a line of singlefuse splitters with 30/35/35 percent, 20/40/40 percent, 40/30/30 percent and 50/25/25 percent, in addition to earlier symmetrical 33/33/33 percent splitters. These splitters feature the same broad bandpass (+/-40 nm) characteristics and reliability as Ipitek's standard CATV 1x2 couplers.

Signal level meters

The company's asymmetric splitters can be delivered in non-connectorized stainless steel tube packages for fusion splicing, or in bulkhead connectorized plug-and-play modular housings. Color-coded bands on the tube help identification of the split ratio, wavelength and bandpass, while the red-colored fiber lead signifies the throughput leg.

At the NCTA show in Dallas last month, Ipitek featured the Imtran line of uncompressed digital fiber delivery systems.

Eight or 10-bit video quality is available with 10-bit options, offering RS-250C short-haul video and audio performance extension to 50 km. Four, five, eight or 10 discrete composite analog video feeds may occupy a single fiber per wavelength. Each video channel has one simplex RS-232 data path, is transparent to BTSC stereo subcarrier at 4.5 MHz and may optionally have up to four CD quality balanced audio lines. A standard Imtran frame occupies only 3RU of vertical rack space and is useful where space is limited, such as in crowded headends, curbside cabinets or vaults. The system is modular and offers a variety of personality modules including quad T-1/E-1, dual high-speed RS-449 and octal RS-232 signal options.

An option allows a single frame to act as both a transmitter and a receiver, so a fully bidirectional baseband fiber link can be established within the same physical footprint of the standard Imtran. A true digital video ring topology is supported and may be controlled and monitored from a single location using Ipitek's Node Control Processor option (NCP).

Circle Reader Service number 82

Ipitek CQ410

Fiber provisioning

HICKORY, N.C.–Siecor Corp. has introduced a new Access Provisioning Facility (APF), a

microStealth product line

Indianapolis, Ind.–Wavetek Corp. has introduced the microStealth product line, which features two new signal level meters designed for service technicians and installers. Both models have a durable, waterproof, high resolution dot matrix LCD that provides ease of measurement, with a scan display that shows multiple carrier levels at once and a comprehensive single channel display.

Other key features of the meters include multi-channel measurement displays, a Go/No-Go Quick Check function designed to ensure FCC compliance and reduce subscriber call-backs. Available with a 5 to 890 MHz frequency range, the microStealth is frequency agile and measures channel signal levels with a display similar to that of Wavetek's Stealth SAM and 3SR Sweep Receiver.

In addition to full frequency agility and FCC Quick Check features, the MS1200 can be cloned to copy user setup from unit to unit, or it can download channel plans configured in StealthWare, Wavetek's Windows-based Stealth data management package. The current measurement display can be sent to a serial printer to provide documentation of test results.

For both models, users can press the Quick Check key to conduct a fast status check based on FCC or user-defined limits. If all signals are within limits, a "pass" will be indicated. If there are signals outside the limits, a "fail" will be indicated, along with a listing of failed channels and their corresponding levels.

For international standards, channel plans are built-in. The operator can easily adapt the channel plan to an individual system by indicating which channels are active and which are scrambled. In addition to tuning by channel, the operator can also enter a specific frequency for measurement.

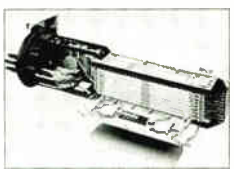
Accurate measurements can be made on NTSC or PAL format video modulated signals, including horizontal sync suppression scrambling.

Circle Reader Service number 97

fiber flexibility point for the access network, permitting cost-effective fiber deployment.

The high-count fiber organization system provides for up to six branch cables to be spliced to a main feeder or through cable and supports administration on an individual fiber basis for economic cable fill. Accepting loose tube and ribbon cables, the APF facilitates re-entry, addition of cables and rearrangement of fibers as outside plant networks grow and evolve with expanding broadband services.

The inner organizer system manages and protects fibers in up to nine provisioning modules which are organized in a shelf system; through and branch fibers are segregated, and unused drop fibers are stored separately. All fibers are clearly identified and securely routed to permit easy rearrangement without disturbing working fibers. Built-in tube strain-relief and bend radius guides are integral to module design. It is available with holders for individual fusion, mass fusion or mechanical splices. Provisioning modules store up to 216 fiber splices.



Access Provisioning Facility (APF)

Suited for above and below ground environments, the APF's outer sealing system ensures rugged and reliable protection against severe outside plant environments and is tested to be waterproof to a depth of 20 feet. A butt-end configuration simplifies handling and placing of the unit. Mechanical cable seals permit rapid installation of cables without the need for drilling, special tools or encapsulants.

The APF has been tested to comply with Bellcore fiber optic closure standard GR-771-CORE.

Circle Reader Service number 83

Matrix switch

CONCORD, Ontario–Consultronics has released an expandable matrix switch for automatic testing of 2, 4 or 6 wire trunk line testing.

When used in conjunction with the Consultronics Auto-tims III, the MX-1000 allows for a scalable system for testing from 25 to thousands of leased lines. The MX-1000 can be used in one of two modes. The first allows for end-to-end sequential selection and testing of trunk lines, and the other for selection and testing in a star configuration directly to customer premises.

MX-1000

The MX-1000 is a rack-mount device and features a redundant power supply, RS-232C remote control, and modular design. Amphenol 50-way connectors allow for easy installation, and optional punch blocks are available.

Circle Reader Service number 84

Labeling machine

Compact, portable electronic labeling system

STILLWATER, Minn.–K-Sun Corp. has introduced a compact, portable electronic labeling system, the LabelShop 2001XL. The labeling machine makes durable, pressure-sensitive polyester labels on demand for wire and cable tabbing, electrical panels, telephones, manuals and telecommunications equipment. The machine can print multi-lines in five different label widths up to one inch, in more than 60 different size and color combinations, in five different languages.

It features a standard typewriter format; 63-key keyboard; two-line, 24-character display; 136 symbols; multi-line formats; two font styles; 10 sizes and more than 150 type variations built into the permanent memory.

LabelShop 2001XL also features a label length preview function which lets the operator see the actual width and length of the label in the display before printing. Each label printed has only 3/8 inch of margin before and after the text to save money on tape waste.

Circle Reader Service number 85

Amplifier

LAKEVIEW TERRACE, Calif.–Pico Macom has announced the production of its new PDA

PDA 30 1 GHz amplifier

30 1 GHz amplifier. The amplifier has +30dB gain across the 50-1000 MHz bandwidth. In addition, the amplifier is suited for systems including SMATV, CATV, TVRO and MMDS.

A low-noise linear distribution amplifier, the PDA 30 provides high power outputs at low distortion. The wide bandwidth allows the user a single amplifier for all distribution frequency applications: VHF, mid-band, super band, hyper band, ultra band and UHF. The amplifier may also be used for all TV standards: NTSC, PAL, B/G/A/I/M/N and SECAM.

Three versions are available: forward path only, forward with amplified return path, or forward with passive return path. An external power supply allows for use with international power systems.

Also new from Pico Macom is the PFAM-550, a double heterodyne conversion audio/video agile modulator with superior sideband filtering that provides adjacent channel compatibility and FCC docket 21006 frequency accuracy, according to the company.

The modulator provides 57+/- 3 dB output from VHF channel 2 through cable channel 78, including HRC and IRC off-set frequencies, and is available in all PAL formats. The channelization configuration can be changed by resetting the DIP switches which are accessible through the front panel. High quality external modulation and RF level control assure reliable operation. The modulator is shipped with all internal adjustments pre-set, and FCC Docket 21006 off-sets are standard at no extra cost.

Circle Reader Service number 86

Fiber transmission

STATE COLLEGE, Pa.–Broadband Networks has introduced a new fiber optic transmission product that provides the ability to deliver video, voice and data one one singlemode, fiber optic cable.

The TR1000 Series product, which is also known as the Video Brick, allows baseband video and audio inputs to be delivered up to 25 miles in distance with broadcast quality performance.

The Video Brick also has the ability to deliver data ranging from fax service to 10 Mbps Ethernet networking.

Circle Reader Service number 87

MW9070A mini-OTDR, with MW0972 module

Mini-OTDR

ANAHEIM, Calif.–Anritsu Wiltron used SuperComm as a venue to announce its enhanced MW9070A mini-OTDR with an MW0972 optical module that expands the unit's dynamic range to 36 dB at 1.31 µm and 34 dB at 1.55 µm. The high dynamic range allows the MW9070A to test fiber routes longer than 100 km.

With the new module, the OTDR can be used in fiber installation applications where signal regeneration facilities, which are generally 40 km apart, are being replaced by EDFA facilities that can be as far as 120 km apart. The mini-OTDR can also be used for maintenance and monitoring of subscriber fiber lines.

The high dynamic range version is available in two configurations: a 1.3 um version and a dual, 1.3 µm and 1.55 µm version. Anritsu also has a multimode module that supports both 0.85 µm and 1.3 µm wavelengths for high-resolution fault location and loss measurements of multimode fibers in optical links, LANs, and process control.

Also at SuperComm, Anritsu introduced a BERTS, featuring the MP1763A 12.5 Gbps pulse pattern generator, and MP1764A error detector, that provides the performance necessary for testing 10 Gbps transmission systems, modules, and devices, as well as 11 Gbps optical submarine transmission systems.

In addition, the company introduced its MP1520B PDH analyzer with jitter generation and measurement capability. The analyzer is well-suited for testing jitter tolerance generation, transfer and interface jitter conforming to ITU-T standards at 2, 8, 34 and 139 Mbps.

And finally, the company announced its MP1550A compact PDH/SDH analyzer that combines a transmitter and receiver in one cabinet, allowing acceptance and maintenance tests of both PDH and SDH digital transmission signals to be made in the field.

Circle Reader Service number 88

CAD, AVL system

ALBANY, Ore.–Cable industry-specific user interfaces are now available as enhancements of CadPak, Advanced Control Technology's computer-aided fleet dispatching and vehicle tracking system.

CadPak is an expandable alternative to customized fleet management systems. New electronic work order forms for the pen-based user interfaces enable the product to respond to the specific needs of the cable industry.

The system provides fleet users with the location of service orders and the positions of

CadPak, a CAD, AVL system

fleet vehicles on a real-time geo-based color computer display. In addition to the improved pen-based electronic work order form displays, the system also features data-based records management capabilities, "point and click" dispatching of service work orders to selected fleet vehicles, and two-way digital messaging.

System components also include a dispatch workstation, cellular or Racotek communication gateways, electronic color-map displays of a user's area, pen-based mobile data terminals with radio modem and internal GPS.

Circle Reader Service number 89

Coax tester

NORTH ANDOVER, Mass.–Contact East Inc. has introduced several new products, including a coax cable tester which can be used to identify cables as well as detect shorts and opens. It may also be used as a general-purpose continuity tester, and comes complete with standard probes, RS-232 jumpers, a BNC/LED terminator and 9 volt battery. The maximum range is

2,000 feet and dimensions are 3.5 x 2.5 x 1.25 inches.

Also new from Contact East is a handheld tester with rugged ergonomic construction and an easy-to-read LCD screen. The microprocessor-based tester evaluates 1-, 2-, 3- or 4-pair cabling for shorts, opens, miswiring, reversals and split pairs.

A special FIND function identifies the pin/pair configurations as T568A, T568B, USOC, 10BaseT, Token Ring, or TP-PMD. The model can also generate a tone which, when used with the Model 200EP line-aid, can trace cables through plaster walls to find a break, or to identify cable runs in the wiring closet.

Another new offering from the company is a Network Specialist's tool kit which is used for maintaining and troubleshooting data links, LANs and WANs.

Circle Reader Service number 90

Passive optical module

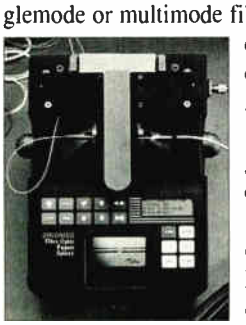
SAN DIEGO, Calif.–Corning Inc. has announced a Dispersion Compensator Module (DCM), a passive optical device designed to be integrated into a standard telecommunications equipment rack.

The DCM offers a reliable, cost-effective solution for chromatic dispersion of standard, singlemode fiber at 1.5 microns (μm). The DCM is currently being sold for 2.4 Gbps system upgrades (OC-48) and has been tested by many transmission equipment manufacturers for incorporation in next generation 10 Gbps (OC-192) systems, according to the company.

Circle Reader Service number 91

Fusion splicer

BLUE BELL, Pa.–Aurora Instruments Inc. has introduced the Fusion 2000, an automatic fiber optic fusion splicer with Power Alignment Technology (PAT). The Fusion 2000 automatically aligns, gaps and fuses fibers with low average losses and accurate estimates, on singlemode or multimode fibers with any standard color buffer coatings, typically in 35 seconds.



Fusion 2000, an automatic fiber splicer

The PAT technology guarantees core-to-core three-axis alignment and accurate estimates of splice loss, according to the company. The new technology, developed by Aurora, combines the low loss and accurate loss estimation of a LID (Local Injection and Detection) splicer with a PAS (Profile Alignment System) splicer's ability to splice all standard colors of coatings.

The Fusion 2000 has an average splice loss of less than .02 dB on singlemode fiber, a position resolution of .05 μm, and estimates extrinsic splice loss within +0.02 dB 90 percent of the time.

Circle Reader Service number 92

Dispersion comp

SAN DIEGO, Calif.–Bosch Telecom has developed the DCM-060, an integrated dispersion compensator module that overcomes the effects of chromatic dispersion when using 1550 nm wavelengths with non-dispersion shifted (1310 nm) fiber. Compensation is independent of bit rate, protocol, or transmission equipment vendor.

When used in conjunction with optical fiber amplifiers (OFAs), the DCM-060 extends the reach of high speed fiber optic telecommunications links by 60 km (further with multiple DCMs and OFAs). The module provides negative dispersion (-1020 ps/nm +/- five percent) with less than 7 dB attenuation, and reduces crosstalk when used with multiple wavelength systems on dispersion-shifted fiber (DSF).

The passive, all-optical fiber device has a high reliability factor, and is especially suited for long-haul telecommunications systems such as extended interoffice networks, CATV, AM Video, and Erbium-Doped Fiber Amplifier (EDFA) systems. The module can be located at the transmit end, intermediate site or receive end of a fiber optic link.

Circle Reader Service number 93

Optical amp

SAN DIEGO, Calif.–GC Technologies has introduced an Erbium-Doped Benchtop Optical Amplifier. The Model EDFA-1552-14 amplifier is a high-gain, double-pumped, standalone amplifier designed for 1550 nm singlemode laboratory applications. The unit is designed to deliver high performance by using two high-power 1480 nm pump lasers, in-line optical isolators, wavelength division multiplexers and erbium-doped fiber.

User-friendly interfaces allow access through both a front panel entry keypad or a remotely controlled PC. In addition, all network parameters can be displayed on the unit, giving system designers the benefit of seeing the total effect of every design modification on the network.

In operation, the light from the pump laser and an incoming optical signal are coupled onto the specially treated fiber, resulting in high fiber gain and high saturation output power over a 20 nm optical bandwidth. Inline isolators suppress optical feedback and reduce system noise, aiding system performance.

GC Technologies' amplifier is intended for use in labs where networks are being designed for longhaul telecommunications, CATV, SCM distribution, loop feeder and sensing applications.

Circle Reader Service number 94

Optical sources

ACTON, Mass.–Micracor has unveiled a series of commercially available high power optical sources and links. Two new product lines in the Power-Link series have been released: high-power 1319 nm optical sources, and RF-RF optical links.

MicraLink

The source products are targeted at the OEM CATV market, and enable systems designers to replace two to four DFB lasers with one Power-Link module. The link products incorporate lithium niobate modulators and are aimed at the high-speed RF (microwave) market. Link bandwidths of up to 20 GHz are achieved by the integral lithium niobate modulators. The core technology is a Micra-chip solid-state, diode-pumped YAG laser. The miniature size of the laser allows established semi-conductor packaging techniques, resulting in compact size and high power. The laser mirrors are directly deposited on the YAG crystal, enhancing reliability.

Circle Reader Service number 95

Fixed attenuators

LISLE, Ill.–Amphenol Fiber Optic Products has introduced its 944 Series FC and 954 Series SC Plug Style Fixed Attenuators. The devices feature dual wavelength performance capability at 1310 nm and 1550 nm and are available in attenuation values of 5 dB, 10 dB, 15 dB and 20 dB, with a +/- 10 percent attenuation tolerance. Back reflection performance of -48 dB typical and -45 dB maximum is standard. The attenuators are manufactured using Amphenol's proprietary fused fiber technology, insuring longterm reliability and stable performance over temperature extremes from -40 degrees C to +80 degrees C.

Circle Reader Service number 96

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Origins of British television

By Archer S. Taylor, Director and Senior Engineering Consultant, Malarkey-Taylor Associates

Dr. Paul Nipkow's 1884 German patent, showing for the first time a means of systematically scanning an image into its elemental points through the use of a perforated disc, was the seminal idea that eventually blossomed into television. Earlier experimenters had various ideas for converting optical images into electrical signals, but Nipkow never constructed a working model. Nevertheless, Nipkow's mechanical scanning concept became the platform for television experimentation for the next 50 years.

A failure at 35 turns to TV

John Logie Baird was born in Scotland in 1888. His studies at the University of Glasgow were terminated in 1915 when he tried to enlist for World War I, but failed the medical tests, probably because of the respiratory illness which plagued him throughout his life. He worked for a while as an engineer for the Clyde Valley electric utility.

During idle periods, he attempted to create artificial diamonds from carbon rods. After blowing all the main fuses at the plant, he was severely reprimanded, but never did find out whether the carbon had actually turned to diamond. He then started a venture producing "damp-free" undersocks, with borax sprinkled on the soles, for a profit of £2,000.

Seeking to alleviate his respiratory problems, he tried to build an importing business in Trinidad. Not only did the import business fail, but the tropical paradise turned into a living hell because of dysentery and malaria. With what little funds were left from the undersock venture, he tried to manufacture jam, but insects forced him to abandon the idea.

Back in London, Baird achieved his greatest success with "Speedy Cleaner," which he described as a revolutionary soap. Again beset with ill health, he tried to manufacture a glass razor blade that would never need sharpening, but required hospitalization for the severe cuts he inflicted on himself. Then, it was "pneumatic shoes" with balloons inside, but the balloons burst, causing Baird to fall over.

At last, a dismal failure at the age of 35, he turned his attention to television using Nipkow's discs, an idea which had intrigued him since his youth. With almost no funds left from his ill adventures, he ran an ad in *The Times* which attracted the financial support of Wilfred Day, a motion picture entrepreneur. Baird's claim as the "inventor" of television, widely recognized in the U.K., rests on the demonstration in London's Selfridge Department store in April 1925, apparently the first television ever to be publicly witnessed.

The transmitting and receiving discs were rotated on the same shaft. The images, transmitted over a short distance, were no more than silhouettes, scanned at eight lines per frame, "recognizable, if rather blurred." A few weeks later, Charles Francis Jenkins, an American, demonstrated 48-line images transmitted over a distance of five miles in Washington, D.C., using mechanically rotated prismatic rings.

In June 1925, Bell Laboratories developed a new technique using a "flying spot"scanner. Six months later, Baird filed for a patent on a similar scheme. The first "real" pictures, with halftone detail, were demonstrated publicly using the flying spot scanner.

In August of 1926, Baird obtained from the BBC the first license ever issued to transmit television signals. Upon learning of Baird's demonstration to the Royal Society, the *New York Times* on January 23, 1926 wrote, somewhat prematurely: "The international race for the perfection of television . . . has been won by Great Britain." Bell Labs upstaged him in April 1927 by transmitting on telephone wires a 50-line, 18 frame-per-second picture of Herbert Hoover delivering a speech in Washington, received in New York, 200 miles away. To placate distressed shareholders, Baird responded by transmitting "recognizable" images 438 miles from London to Glasgow, at 30 lines, 12.5 frames-per-second.

The BBC inaugurated experimental 30-line service on August 22, 1932. The *Daily Express* was excited about the technology, but all it had to say about the program was: "And then there was Betty Astelle, a baby-faced blonde who could be seen making movements."

In January 1935, Lord Selsdon, appointed by the British government to investigate upgrading the 30-line BBC service, called television "the latest miracle of scientific achievement," and announced that "two television systems of High Definition Television should be tried at the London Station." High definition was defined as not less than 240 lines per picture, with a minimum of 24 pictures per second.

No reward

While Baird had been by far the leading proponent of television in Great Britain, he steadfastly refused to abandon the mechanical scanning system. Meanwhile, Electric and Musical Instruments Ltd. (EMI) had been quietly developing an all-electronic system. By November 2, 1936, when the contest for "high definition television" began, Baird had brought his mechanical system up to 240 lines, using intermediate film which took 54 seconds for processing between live action and transmission.

Meanwhile, EMI had secretly pushed its electronic system to 405 lines, with 25 interlaced frames per second. In a desperate attempt to match EMI, Baird reached across to the U.S. for help from Philo T. Farnsworth and his Image Dissector camera tube. But it was too late, and Baird's dream came crashing to earth.

The BBC maintained the 405-line monochrome (vertically polarized) system for 50 years, operated in tandem with the PAL color system adopted in the mid-1960s. CED

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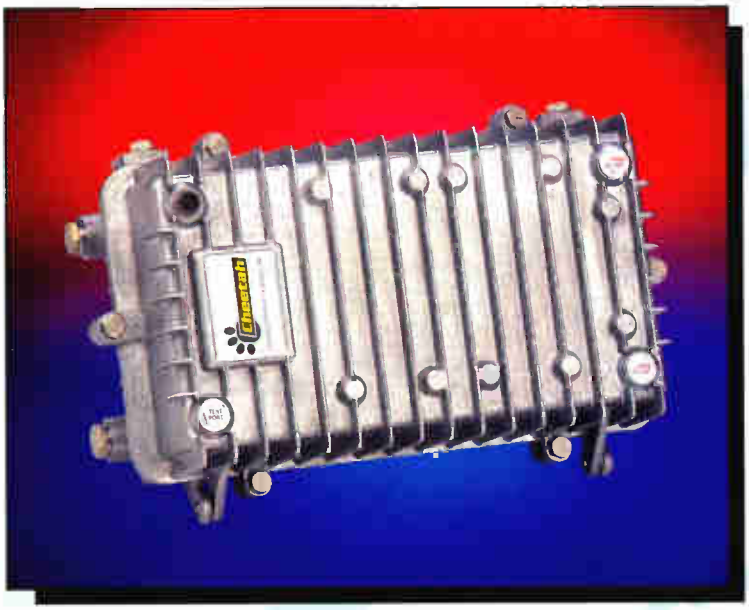

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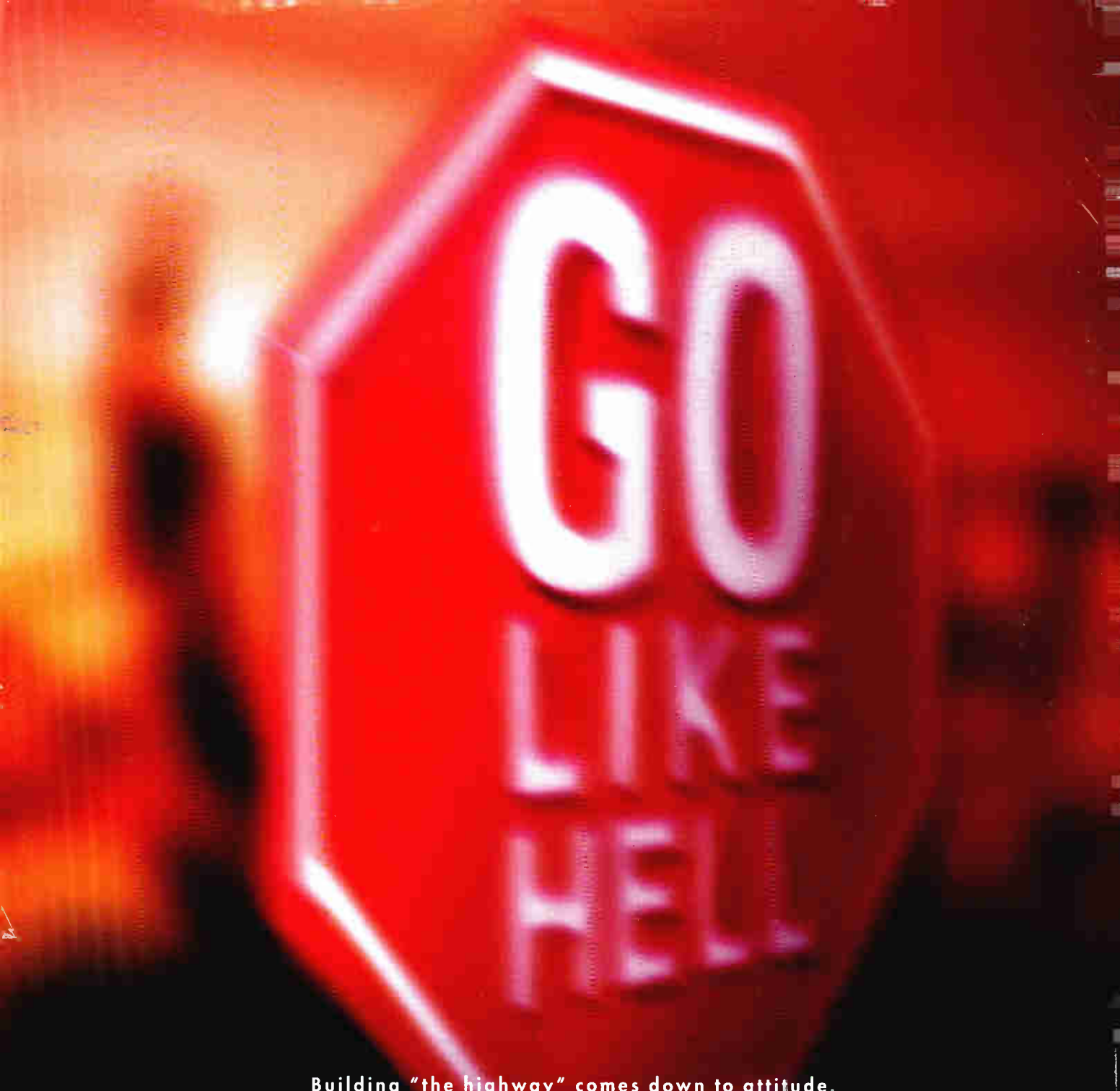

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