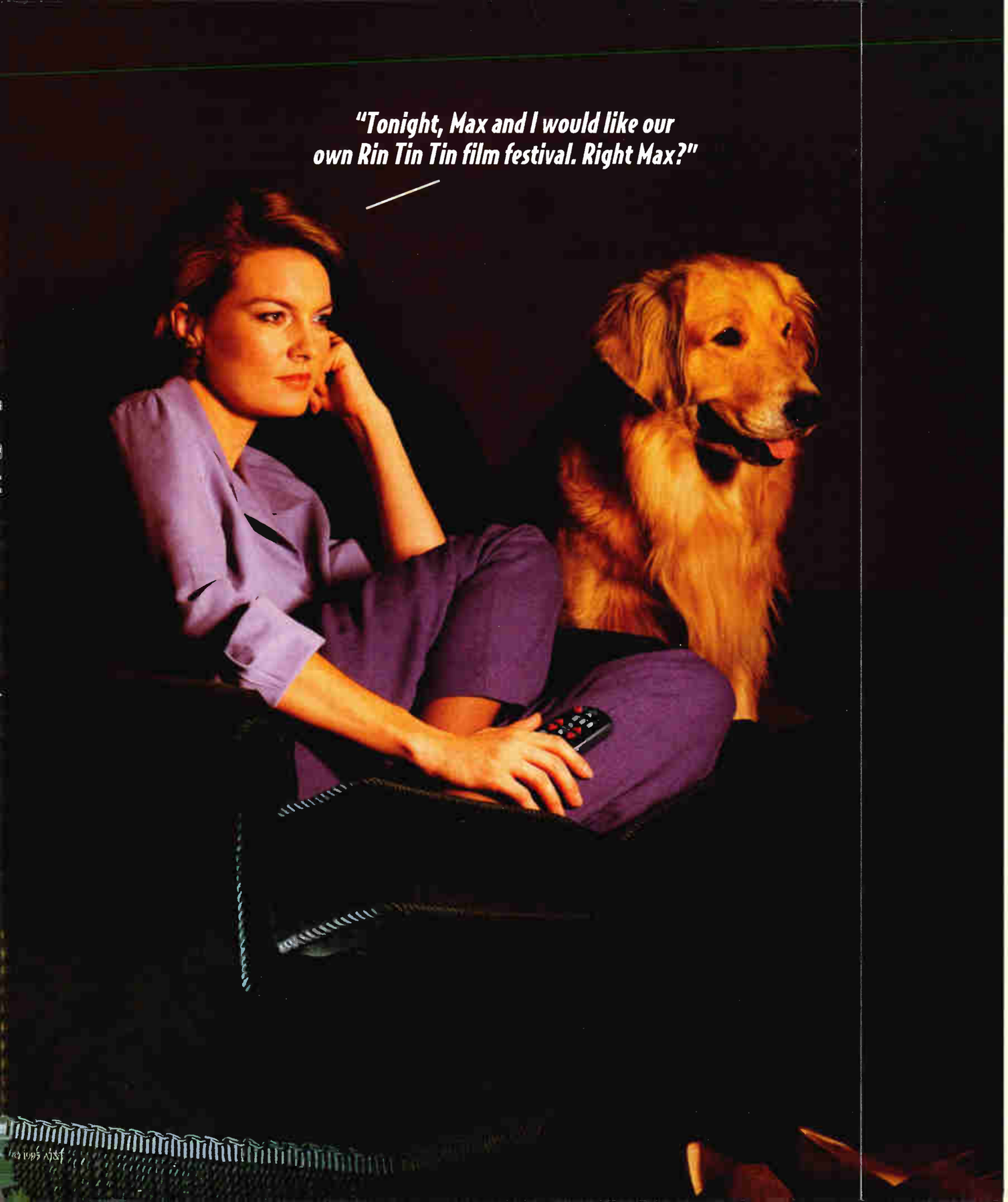
CED
THE PREMIER MAGAZINE OF BROADBAND COMMUNICATIONS

Telephony: cable leaves a message

Inside:
Telco Video Wall Chart



Is it time yet to invest in interactive? Here's a thought.

The latest research tells us that 55% of Americans are willing to spend at least as much every month on interactive services as they are on cable TV.[1]

That's an additional $5 billion a year. With who knows how much more for other broadband services.

Of course there are issues to be resolved. What program delivery standard? Which set-top box? But once you're ready, you'll need a partner who can move fast, to help you capture competitive advantage. Which is where AT&T Network Systems comes in.

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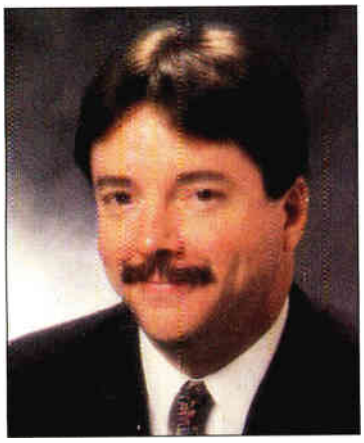
AT&T

Network Systems

[1] FIND/SVP telephone survey



Training issues in the next millennium

Take a quick scan of the headlines in any of the trade newspapers and the trends become clear: the industry is consolidating (quickly, I might add) and facing an unprecedented level of competition from telephone companies, satellite systems and microwave systems, to name just a few. It is indeed an exciting time for the cable TV industry.

But as the industry moves forward and large systems begin integrating telephony, interactivity, data and perhaps other services over their broadband plants, new challenges await the technical staff.

Training in this new era will become more important than ever before. Employees may have to be dragged kicking and screaming into the new world that has gone way beyond "cable TV." New methods will be needed and a much larger investment will be absolutely critical.

One company that has already learned that lesson is Siemens Stromberg-Carlson, which just graduated its first class of apprentices after a 30-month intensive training and education course.

Based on the German dual system, Siemens developed a program that places interested high school students in a program that combines hands-on factory training with classes recognized by the University of Central Florida to award an associates degree in science and electrical engineering technology. The result: technicians who are more loyal and work well as a team, according to Gary Garman, manager of training at Siemens.

The 15 students who comprised last month's graduating class was the first group of U.S. apprentices credentialed by Siemens, the giant German electronics company that recently made a commitment to developing broadband networks along with Sun and Scientific-Atlanta. But these students are no neophytes. When tested, the U.S. students actually outperformed their counterparts from other parts of the world, according to Garman. Siemens trains about 13,500 apprentices every year around the world.

This unique approach to training, which combines the resources and skills of the private and public sectors, represents the wave of the future, according to Siemens officials. "I think this is the workforce of the future," notes Garman. "If companies want to compete globally, this is what it's going to take."

The investment by Siemens is huge–about $15,000 per student per year. But balanced against the quality of the person who emerges from the program, the investment more than pays for itself, the company believes.

Perhaps it's time for cable companies to make a similar move. Find high school students who are interested in electronics. Offer them jobs and help send them to school, rewarding them for good grades and graduation. Then augment with SCTE certification and NCTI continuing education classes. In other words, develop loyal employees who will stay with you for most of their lives. It's an investment that pays off via a better employee who knows his craft and can be counted on for decades of service.

Siemens should be commended for bringing this program to the U.S. Other manufacturers, as well as the MSOs, should be taking notes.

Roger J. Brown

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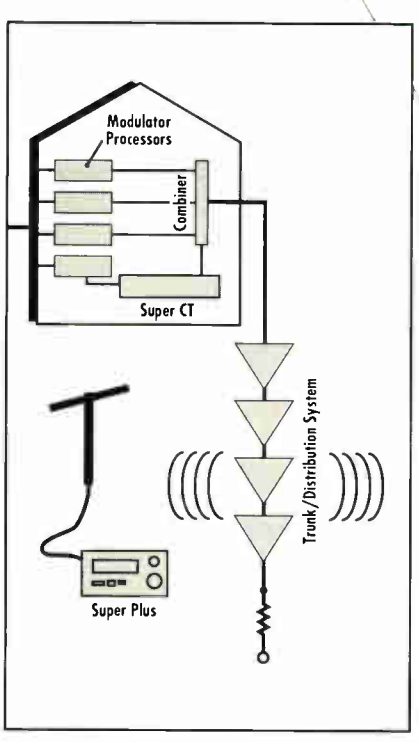

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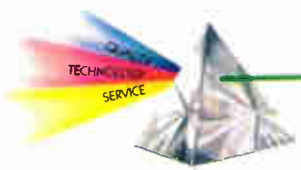

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By Dana Cervenka, CED

Several manufacturers are developing hardware that will allow cable operators to deliver telephone service over their broadband networks. This article examines the pace of development.

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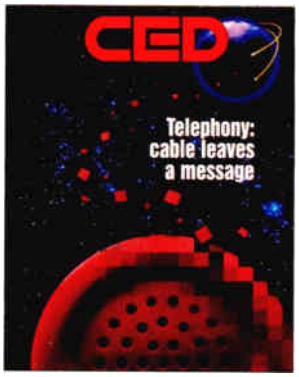
Features



About the Cover

The message is: Here come the cable operators!

Departments

 CED (USPS 330-510) (ISSN 1044-2871) is published monthly except twice in May by Chilton Publications, A Capital Cities/ABC Publishing Group, 825 7th Ave., New York, NY 10019. Volume 21, Number 3. U.S. domestic subscriptions are $48. Outside USA, subscriptions are $69 for surface delivery or $96 for air speed delivery, prepaid in U.S. funds drawn on a U.S. branch bank. Second-class postage paid at New York, NY 10019 and additional mailing offices. CED is published on behalf of the cable television and broadband communications industries. POSTMASTER: Please send address changes to CED, Circulation, P.O. Box 7699, Riverton, NJ 08077-7699. MEMBERS OF THE BPA. Printed in U.S.A.

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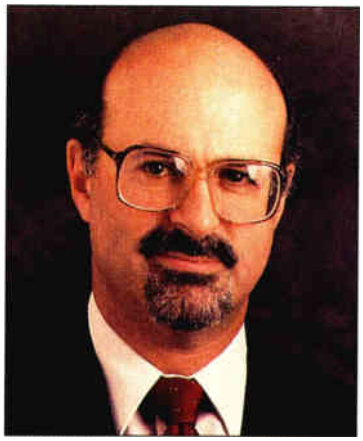
Hanging ten on the Internet



By Jeffrey Krauss, online at jkrauss@cpcug.org and President of Telecommunications and Technology Policy

The Internet is hot! And 1995 will be its year. The Internet contains a rich mixture of both consumer and business content. This column, while it describes some of the resources of the Internet that I use in my consulting business, is not a tutorial. If you don't understand, you'd do well to educate yourself.

Gophers

The FCC's Internet *gopher* (a menu-based program for searching and downloading files) is at *fcc.gov*. I "gopher" there frequently. Each day, I review the latest bids in the broadband PCS auction. I also look at the Daily Digest of FCC decisions and news releases.

Laws will be online this year. Last year, you could download the full text of a few Congressional bills from *gopher.house.gov* or *gopher.senate.gov*. This year, the Library of Congress plans to put all bills online, at *loc.marvel.gov*.

You should also be able to find the full text of telecom legislation on gophers operated by several of the Bell Operating Companies. I frequently visit *ba.com* (Bell Atlantic), and *bell.com* (the Alliance for Competitive Communications, formerly called the MFJ Task Force). I'm not aware of any comparable cable industry gopher sources, although CableLabs does have a Web site. C-SPAN has a gopher (*c-span.org*) that contains its programming schedule.

If you care about the Clinton Administration's plans for the National Information Infrastructure, you should gopher to *iitf.doc.gov*.

Patents are available, at least patents issued during 1994, from *town.hall.org*. I did a search on the keywords "quadrature" and "amplitude" and "modulation" and came up with a list of 39 patents. I searched using the gopher, then downloaded the text of the interesting ones using the Internet *ftp* (file transfer protocol).

Supreme Court decisions are available by gophering to *gopher.inform.umd.edu* and then working down through six levels of menus to *SupremeCt*.

Foreign and international sources are also available on the Internet. For example, Canadian government telecom decisions are available from the gopher at *debra.dgbt.doc.ca*. The International Telecommunications Union has a gopher at *info.itu.ch*.

There are around 6,000 different newsgroups, which are, in effect, electronic bulletin boards that each focus on a specified subject. Of primary interest for cable TV is *rec.video.cable-tv*, which is usually loaded with messages on pirating specific cable scrambling systems. Similarly, *alt.satellite.tv.europe* contains piracy information for the BSkyB system. Newsgroups covering U.S. satellite video include *rec.video.satellite.tvro* and *rec.video.satellite.misc*. There are several newsgroups with a broader coverage of telecommunications, including *comp.dcom.telecom* and *comp.dcom.telecom.tech*.

Of course, e-mail is the largest activity on the Internet, and Internet e-mail is a convenient, if not very private, way for individuals to communicate. Internet privacy is an illusory goal, particularly when most Internet access vendors make no claims about the privacy of their service, and many corporate e-mail systems have never given the subject a second thought. If you really care about e-mail privacy, you use an encryption program such as *PGP* (Pretty Good Privacy).

A mailing list (or listserve) is a cross between a newsgroup (which is an archive that anyone can access) and individually addressed e-mail messages. Each message from a member is copied to all the members of the mailing list. Mailing lists may be moderated (by someone who acts as an editor or censor), or unmoderated (all messages are copied to all on the list). Unmoderated mailing lists are true democracy, where you don't need any factual basis to hold and express strong opinions. One of these unmoderated mailing lists, with a telecom regulatory focus, is *telecomreg@relay.adp.wisc.edu*; *comlaw-l@lawlib.wuacc.edu* is a moderated mailing list.

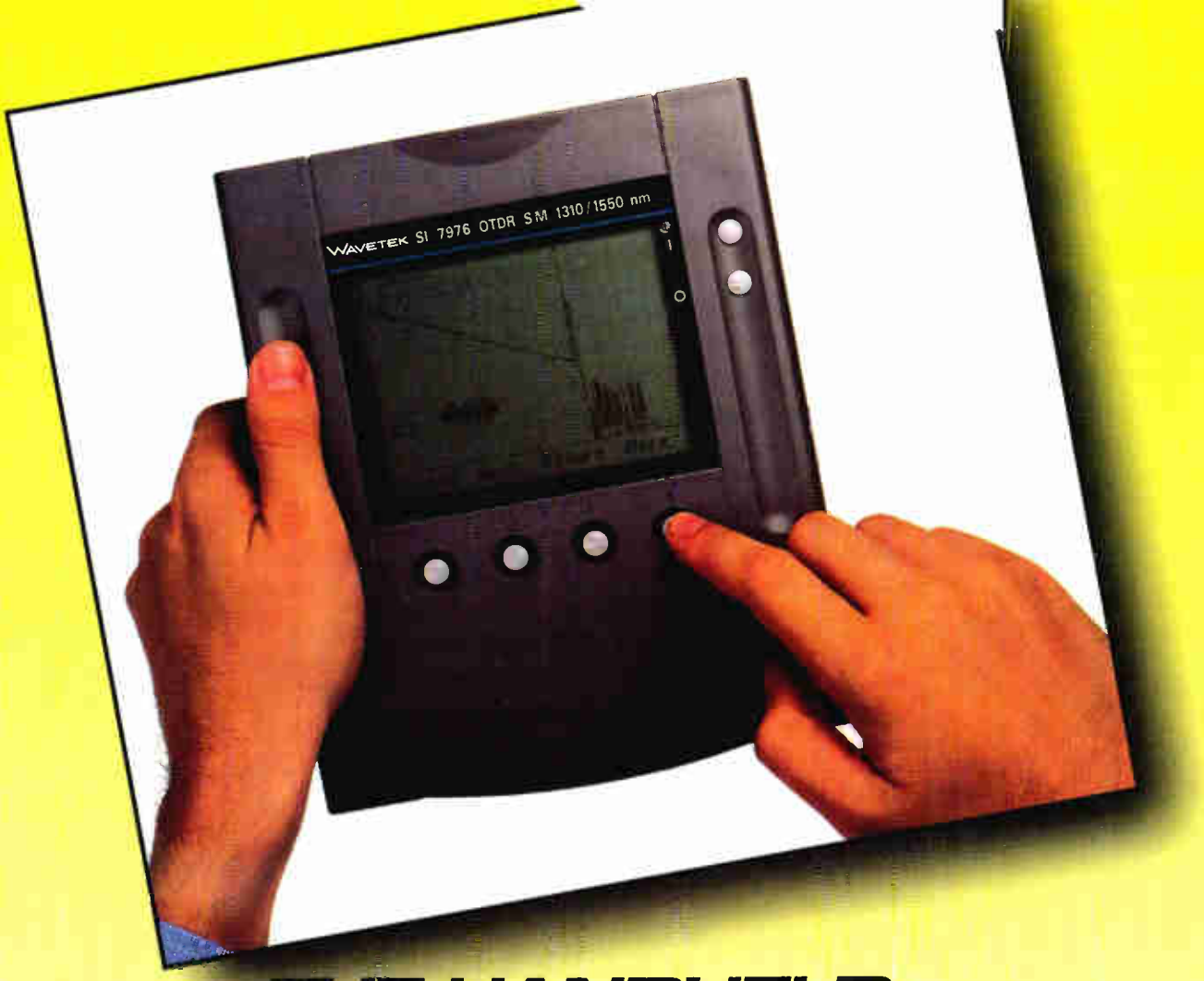
The web

I find the World Wide Web to be a pain. Everyone and his brother have created home pages, full of graphics, that take a long time to download. Even at 14.4 kbps, it will take a minute or two to download many of the pages. But this is the wave of the future, the killer application. Using graphical Web browser programs like *Netscape* or *Slipknot* or *Netcruiser*, access is easy, if tedious. Here's where cable systems will have an impact. What I really want is 500 kbps access to the Web, and telephone lines just won't support that.

There are some interesting telecom-oriented Web sites. CableLabs has a Web page at *http://www.cablelabs.com*. Bellcore has one at *http://bellcore.com*. Pacific Bell's is at *http://www.pacbell.com*. You can search the Code of Federal Regulations (including the FCC Rules) at *http://www.pls.com:8001/his/cfr.html*. And don't miss the White House at *http://www.whitehouse.gov*.

Check out the Home Recording Rights Coalition at *http://www.digex.net/hrrc/hrrc.html*. The HRRC is a front group for the VCR and audio tape recorder manufacturers of the Electronic Industries Association. If you look through its Web pages, you'll find instructions on how to disable the copy protection circuits of at least one model of digital audio recorder.

So stay away from those mindless newsgroups like *alt.tv.beavis-n-butthead* and *alt.fan.howard-stern*. C'mon in, surf's up! CED



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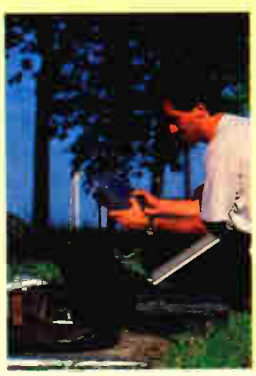

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EIA drops bombshell on NCTA, decides to scrap decoder standard

Maybe it was too good to be true. After forging ahead through countless complicated meetings over 18 months to define a new decoder interface standard that would meet the opposing needs of the cable and consumer electronics industries, talks between the two entities have bogged down over infrared command set functionality. The cable industry wants an IR pass through that would allow new services to be introduced, while the consumer equipment manufacturers want a defined set of IR commands.

Now, an apparently exasperated Electronic Industries Association Consumer Electronics Group (EIA/CEG) has decided to walk away from whatever progress has been made in favor of a different idea. In a sharply worded filing to the FCC, the EIA said it has withdrawn its support for a decoder interface, as well as the current draft decoder standard, which the two sides agreed to in principal months ago. Instead, the EIA said it is in the process of finalizing a draft descrambling-only decoder interface standard that it plans to file with the FCC when it is completed.

Through its Feb. 3 document, the EIA said that "a new approach is needed to restart the stalled decoder interface discussions," and suggested that the FCC adopt a new interface that is "designed to do nothing more than accommodate the descrambling of cable signals."

As expected, the cable industry has reacted negatively to the EIA's filing, noting that a "crippled decoder interface" would actually do more harm than good, according to Walt Ciciora, who leads the industry's negotiations for a decoder interface standard.

The new proposal is "absolutely ridiculous," continues Ciciora. He characterized the EIA action as short-sided and protectionist. He believes the manufacturers are worried cable or other service providers would offer new services that may not be supported by the remote controls that accompany TVs and VCRs. "This is a choice that should be left up to the consumer," Ciciora says (see "Ciciora's Corner," page 26). The two sides were scheduled to meet again on Feb. 15.

Cable/utility groups see many synergies

The notion of using a cable operator's broadband networks to transport communication services for gas and electric utility companies isn't new, but the concept is gathering steam at a pace that promises to make it one of the most talked about issues this year with the nation's largest multiple system operators.

In late January, Comcast, Cox, Continental and Tele-Communications announced that they have once again joined forces, this time to form CableUCS, an organization designed to "foster, build and manage strategic relationships between cable operators and electric, gas and water utilities," according to a press statement. The four MSOs are already allied through their joint ownership of Teleport, the largest provider of alternate access services.

PSE&G intends to begin a pilot program utilizing the AT&T system later this year that will be expanded to 10,000 homes and businesses in 1996

By joining forces, the companies hope to capitalize on the burgeoning automated meter reading (AMR) industry, to which many utilities are looking to automate customer usage and control of energy usage.

By controlling energy usage, utilities could realize benefits totaling upwards of $700 million annually, according to Andersen Consulting, a large management consulting company which recently released a report on the subject. That report noted that utilities will increasingly become more customer oriented as competition increases, and having a broadband communications link–as opposed to radio or telephone–offers the most flexibility.

CableUCS also intends to work with hardware vendors to create "true end-to-end solutions" that will allow a cable operator to deploy two-way technology to support AMR, immediate outage detection, real-time energy usage and pricing information, electronic billing and payment, and other services.

On the same day the consortium was announced, both AT&T and Scientific-Atlanta announced new communications initiatives and products aimed at the utility industry. Shortly after, IBM and Public Service Co. of Colorado announced an alliance to develop advanced energy management applications.

AT&T said it has formed a multi-company team of industry experts to develop a fully integrated, two-way communications system called the "AT&T integrated broadband utility solution." The team consists of Public Service Electric and Gas (PSE&G), American Meter Co., Andersen Consulting, General Electric, Honeywell and Intellon.

In the short-term, the new system will allow utilities to remotely read meters, detect power outages, conduct real-time load management and warn of meter tampering. Long-term, the system will support customer-controlled load management, "what-if" billing calculations and other revenue-generating services.

PSE&G intends to begin a pilot program utilizing the AT&T system later this year that will be expanded to 10,000 homes and businesses in 1996. By the turn of the century, the nation's fourth-largest utility plans to offer the system to 500,000 customers.

Meanwhile, S-A unveiled its "SuperStat" device that allows customers to lower the amount of energy they consume with air conditioners via a programmable thermostat equipped with a direct load control receiver that receives VHF-FM signals sent from a central site.

In systems that offer multiple rate structures, status lights built into the unit provide a visual indicator of the rate tier currently being metered. Red indicates the highest rate; yellow equals the middle rate; no light indicates the lowest rate is being charged. A green light means an optional manual override of a load control command has been activated by the customer.

Consumers can program the thermostat for each day of the week and different times of the day. A one-touch feature provides information about the day's or week's energy consumption of the air conditioning unit.

Adding fuel to the fire were IBM and PSC of Colorado, who have joined in a $500 million strategic alliance to develop and implement new communications technology that will also help IBM reduce its energy consumption. Although the use of cable TV technology was not specifically mentioned, it is an alternative IBM intends to investigate, according to a company spokesman.

Pacific Gas and Electric has been trialing technology with Microsoft and TCI in Walnut

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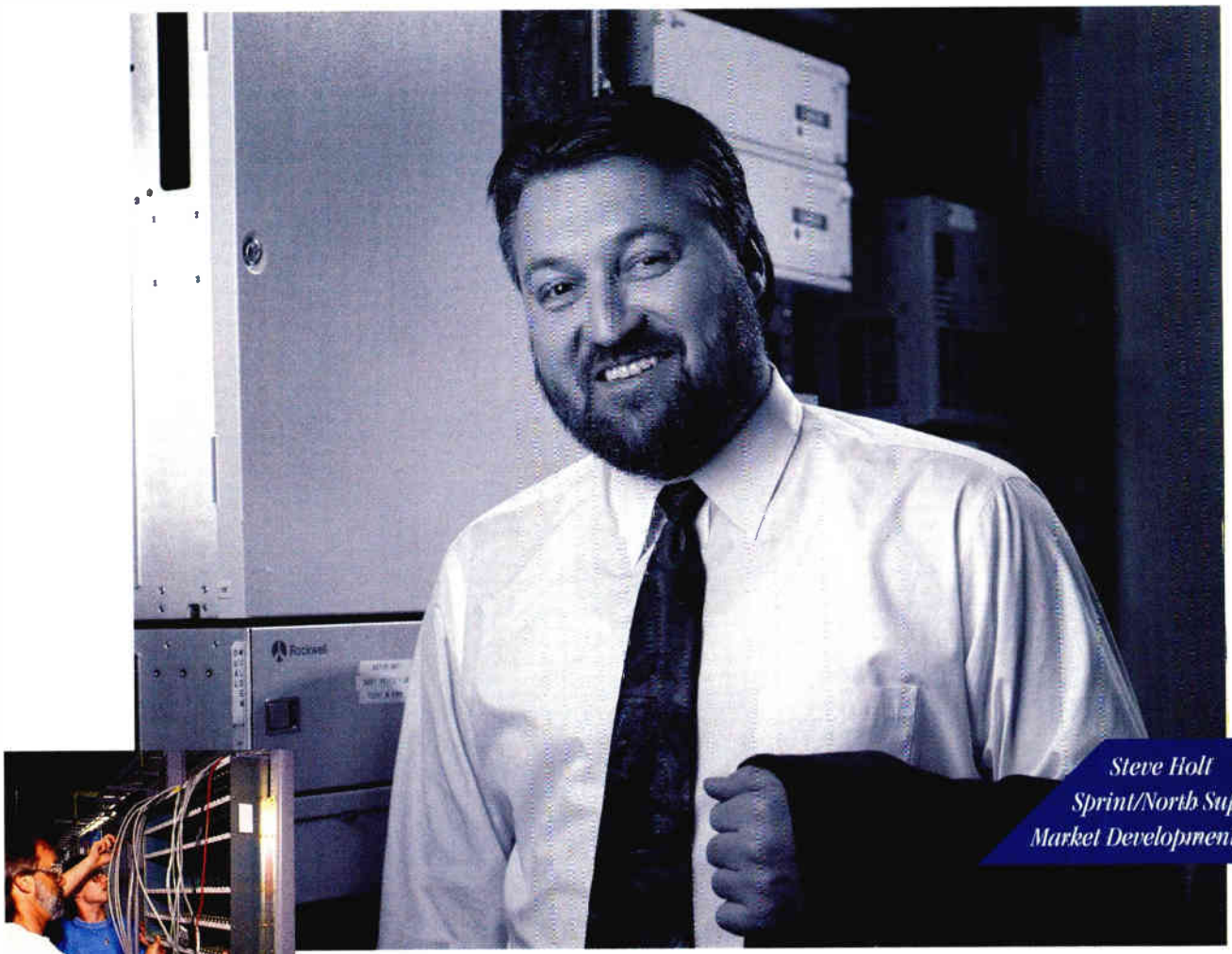

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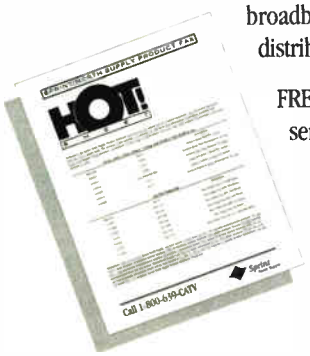

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Creek, Calif. The trial will determine the value of energy information services–including automatic meter reading, real-time energy cost, home automation, appliance monitoring and other applications–to consumers.

All of this comes as great news to cable industry veteran Clifford Schrock, president of CableBus Systems of Portland, Ore. CableBus offers technology that allows two-way voice, data and video to be sent over coax without the need for switching. The company has already successfully tested its equipment in several locations.

CableLabs hosts convergence confab

Cable Television Laboratories (CableLabs) hosted a hugely successful meeting of the Cable/Information Technology Convergence Forum during the ComNet '95 trade show in late January.

The forum was created by CableLabs to facilitate communication between information technology vendors, CableLabs, and its member companies. Strategic relationships between cable and computer companies are expected to expedite the development of networking products and architectures for wide area computing. About 50 companies were represented during the meeting at ComNet.

Firms that have already joined the Forum include Digital Equipment Corp.; Bay Networks, a manufacturer of computer networking hardware; and Fore Systems, which focuses on local area networking equipment based on Asynchronous Transfer Mode (ATM) technology.

Jim Albrycht of Digital said the cable operators are "headed in the right direction" by upgrading their networks with fiber optics and reducing the number of RF amplifiers. This new architecture will accommodate high-speed computing rather easily, he said. DEC has a system that essentially puts Ethernet-speed computing systems over cable TV networks.

Albrycht said a key focus of the Forum will be developing standards and ensuring interoperability among all players. In addition, he expects RFPs to be generated by CableLabs through input provided by the Forum.

Sony wants into set-top box biz

Confirming what many have speculated about for several months, Sony Corp. finally publicly acknowledged its intention to enter the cable set-top box market by teaming with Microsoft to build a unit that will debut next year. The arrangement also calls for the development of continuous media servers for on-demand audio and video services.

Specifically, the two companies will evaluate the technology in Microsoft's Redmond, Wash. lab and then seek input from system operators and systems integrators, according to a spokesman. Further, Sony will participate in Microsoft's Insight Program, a collaborative program for network operators, equipment manufacturers and systems integrators that offers training, technical information and participation in design and testing.

Microsoft already has alliances in place with General Instrument, Hewlett Packard and NEC to develop set-tops compatible with Microsoft software

The two companies have been working together under a memorandum of understanding since last summer. They plan to explore the creation of new markets in electronics for consumer and professional applications by developing next-generation devices and services, possibly including cable-ready TVs, gameplayers and personal digital assistants (PDAs).

Microsoft already has alliances in place with General Instrument, Hewlett Packard and NEC to develop set-tops that are compatible with Microsoft software. A Microsoft spokesman said that the deal with Sony in no way undercuts those previous relationships.

Jottings

AT&T and **GTE** have canceled a planned test of video on demand in Manassas, Va., noting that recent advances in the set-top and server technology needed to support the service make a trial moot (wonder why they don't need a marketing trial to prove people will buy the service?) . . . **Hewlett-Packard's** Kayak digital set-top will contain circuitry to support Zing Systems' interactive TV in-band data protocol that is sent via the VBI. Zing encodes messages and info into TV programs to which viewers respond via a remote control . . . **Interaxx Television Network** has completed a technical test of its interactive set-top box that features an integrated CD-ROM player, according to company executives. The test took place in Coral Springs, Fla. RFQs have been sent to set-top box manufacturers who are interested in manufacturing the unit, and national roll-out is planned for later this year. The digital unit uses 486 PC technology and offers a built-in modem, printer and CD-ROM player . . . **Tektronix** made a commitment to becoming a full video systems supplier by hiring Lucie Fjeldstad as its video systems division president. She was formerly with IBM, where she spearheaded their high-speed networking efforts. Fjeldstad will preside over the Grass Valley Group, the Digital Video Storage Systems unit and the Video Transport Products unit . . . Larry Wangberg, left unemployed by Cox's acquisition of Times Mirror, joined **StarSight Telecast** as president and CEO. He has a long history of working with interactive systems. . . A surge in demand for fiber optic cable has **Corning Inc.** investing $150 million to expand production capacity at its Wilmington, N.C. plant. Over the next two years, capacity will grow by 50 percent . . . Students in suburban Denver are gaining access to the Internet and the American Memory Project, an interactive Library of Congress collection, through LANcity's data-over-cable technology . . . **CNN Airport Network** has tapped Scientific-Atlanta to provide a digital compression delivery system for the service to replace the analog system it now uses . . . **Expressvu**, the Canadian DBS service, has chosen TV/COM to design and supply equipment that conforms to the Digital Video Broadcast MPEG-2 standard for delivery of its satellite signal. The service is set to launch Sept. 1 . . . **Digital Equipment Corp.** has announced its second-generation of Alpha AXP-based media servers for interactive TV. The new server touts improved connectivity features that offer a lower cost per data stream . . . Speaking of DEC's Alpha server, **Adlink** has signed a $9 million deal to deploy 53 of the units for digital ad insertion in the L.A. area . . . The **Sprint/cable TV** venture has added a minority- and a woman-owned company to the consortium. National Telecom of New York City and New Communications Services of L.A. will market PCS under the Sprint brand name . . . CED

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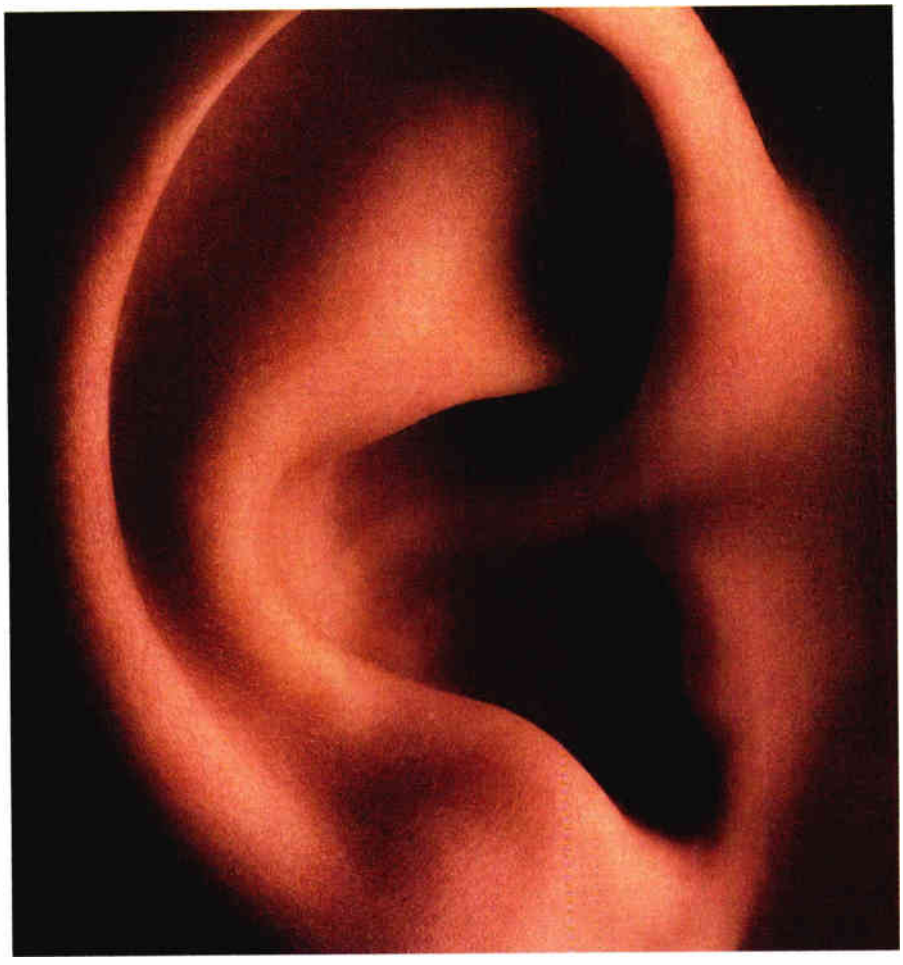

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Denenberg and the new math

By Dana Cervenka

It's outrageous. Southern New England Telephone (SNET), *a telephone company*, is ripping out 30 percent of its copper to build a hybrid fiber/coax, full service broadband network that will deliver video, data and telephony to 500,000 households in Connecticut–all within the next three years. And ultimately, all of the company's residential and business customers will be connected to the HFC network.

Who is spearheading SNET's charge into this uncharted broadband territory? She is a feisty, diminutive dynamo with a doctorate in mathematics, a flair for computers, and an obsessive vision. Dr. Charlotte Denenberg, vice president network technology and chief technology officer for SNET, is shaking things up in New England.

"Our goal is to provide our customers unparalleled communications, information and entertainment services anywhere, anytime," says Denenberg. "And you cannot do that on a copper platform." Her vision is of a Public Switched Telephone Network that is fully competitive–and competitive with all possible haste. "We want to be first to market, highest quality, lowest cost."

Not only has she convinced SNET to discard its traditional architecture, but also, its traditional practice of embracing a singular solution with other telcos. "For a good deal of my childhood, I always inherited very serviceable, but slightly too-big hand-me-downs from my cousin Betty," explains Denenberg, drawing an analogy with her youth. "This is the first time that we at SNET are not going to be wearing hand-me-downs."

Ships, soap and wimpy equations

Creating converts for this revolutionary network design and the new mentality is somewhat akin to teaching the "new math." Only the very bravest would even attempt to instruct in such a radically different way of thinking. As it so happens, this is not Denenberg's first foray into the technological fringe. In the year after she obtained her bachelor's degree in psychology and mathematics (she graduated Phi Beta Kappa at Northwestern), and before obtaining her master's in math, she worked for the Illinois Institute of Technology Research Institute (IITRI) on algorithms for numerical control. At that time, as she explains, the "wimpy equations" available were not capable of instructing a machine on how to cut dies for surfaces that cannot be described in closed form mathematics. We have Denenberg to thank for creating algorithms which tell machines how to cut the dies for Dove soap, ship hulls and airplane wings, among other necessities.

After earning her Ph.D., Denenberg journeyed to Bell Labs, where she conjured up computer language for the programmers who worked on switching systems, which in those days, were actually highly specialized computers. Then the itch for a new challenge hit, taking her to ITT, where she created, from scratch, an entirely new set of language and language support tools for a brand new switching system. In her capacity as director of technology evaluation and support, she was also involved in launching the company's PC clone, called XTRA. That experience cemented her ideas about the crucial need for open interfaces and the value of standards. "There's an entire industry of people out there who have good ideas," explains Denenberg, "but they need access to the hardware."

This belief in open environments is driving her to create a network platform that is both open and accessible, and which, with any luck, will expand SNET's customer base into new markets. "I am a firm believer that customers can be competitors, and competitors can be customers," she declares, "and an open marketplace is one which is the most beneficial to all the customers, and therefore, to all the players."

Redefining the game

Denenberg's ambitious broadband deployment schedule has earned her *Telephony's* 1994 Fiber-in-the-Loop Award for Network Design and Implementation. Outside of SNET, she is working to better her community through technology, as she embarks on work with a consortium of universities to establish a bridge to bring college courses to students at other institutions. Of course, Denenberg is being called on to contribute her network expertise.

She's also a member of the Association for Computing Machinery (ACM), the Association for Telecommunications Industry Solutions (ATIS), the Eastern Communications Forum, a board member of Junior Achievement of South-East Connecticut Inc., and is a former director of SNET Cellular.

She credits her supportive family for giving her the ability to handle everything on her professional plate. She and husband Jeffrey have two children–and they are all fanatical tennis players. Tennis is a great stress reliever for Denenberg, who has been known to exorcise her frustrations by "naming tennis balls" and giving them a good whack.

Design and trial

For the immediate future, 1995 will be the year of design and trial for SNET's broadband nets, as the company reinvents its backroom systems to better serve customers in the full service arena.

How committed is Denenberg to realizing her vision? "When I die, I want them to remember me for the full service network," she explains, "not just the hybrid fiber/coax network." CED

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Prepare to enter the fray

By Wendell Bailey, VP of Science and Technology, NCTA

I recently voiced a fervent wish that the difficult negotiations with the consumer electronics industry would by now be concluded. Still to be decided, however, is the definition of a decoder interface which will complete the concept of a cable-ready television or VCR.

The one thing that has not been agreed to is a command set for communications "from the couch," so to speak, to the set-back module. The cable industry wished to have a full, complete and flexible command set that would not only deal with services that we have to offer today, but which would also contemplate the new services and commands that cable, telephone, DBS or wireless companies might need in the years ahead.

The consumer electronics side offered a limited set of commands. To be fair, it is a set that can be redefined and can do most anything with menus, even if it has no way to be upgraded.

To protect the service providers' future offerings, the cable industry asked for a simple concept: Tell us how the command set can be changed or augmented when providers are either offering new services, or want to deploy set-back devices that require unusual, unique or complicated commands.

One way, says the other side, would be to have the set-back module incorporate a pigtail with an IR receiver that is perched on top of the television set. While it's true that this solves the problem, it's inelegant and probably unacceptable to most consumers. Another way would be the so-called infrared pass through. In this case, the remote control pointed at the infrared receiver of a television set would emit commands that the television set understood, such as volume up, volume down, mute, etc. The TV set's infrared detector would detect those commands, and out one of its ports, send appropriate digital signals to operate the set's volume control circuitry.

The question comes when we point a remote control at that same TV set's infrared receiver that was not manufactured for, or meant to control that television. What does the infrared information entering that receiver do? If it doesn't control the television, we ask that the consumer electronics industry arrange for the commands to be passed through the infrared detector module and out the port as digital signals.

When the consumer electronics industry wondered what good it was to pass unused commands out the back if nothing understands them, we corrected them. Someone may have connected a device on the back that does understand those commands, and will act on them appropriately. In this way, we hope to demonstrate to the consumer electronics industry that we are trying to preserve the rights of any service provider to package, deliver and organize their services in a way that is the best for the consumer.

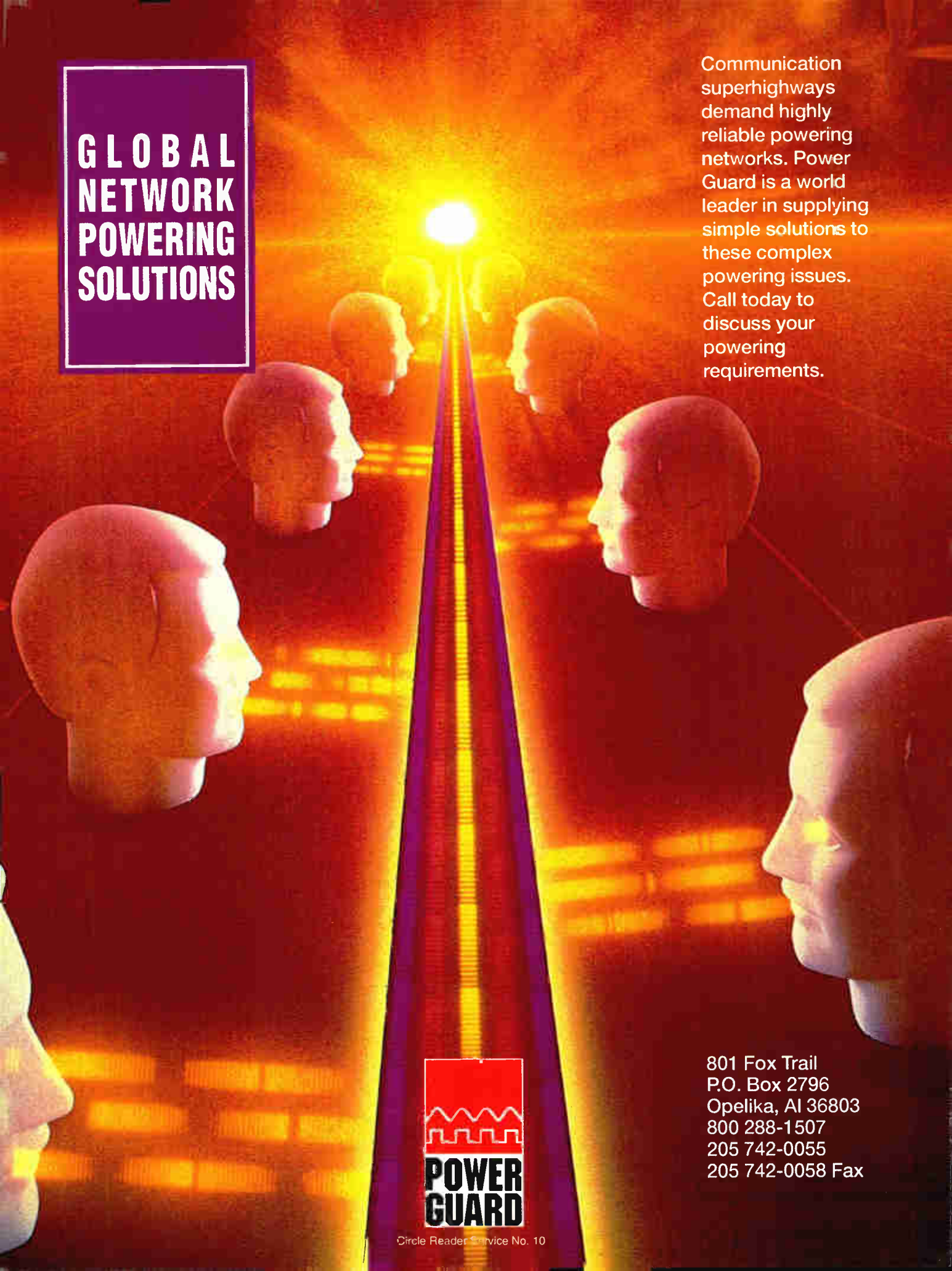
A unilateral withdrawal

Recently, the consumer electronics industry went to the FCC and stated that this debate over the command set has led to a loggerheads, and that the only answer is for the negotiations and the deal as agreed to date be withdrawn. This is a unilateral withdrawal of agreement to a deal that has taken a great deal of time and energy by two industries to arrive at. In its argument, the consumer electronics industry says that the correct solution to this problem is for the decoder interface to be designed to support only modules that descramble or decode and have no other feature or function. If subscribers wish to procure modules that have some other features or functions, such as on-screen guides or game ports, they would buy a separate box and plug it into the set as set-top boxes are plugged in today.

In other words, this would be an unbundling of the traditional piece of equipment that cable operators have used to satisfy customer needs and correct deficiencies in television sets. While it's amazing that a major organization would blatantly repudiate a deal that had been negotiated, the most amazing thing to me is that in the course of these negotiations, there was a time when several significant members of the cable industry argued that the consumer electronics people should unbundle their television sets. It became clear that this was an absolutely frightening scenario for the manufacturers of TV sets. The cable negotiators backed off of this demand in return for understanding on points important to us. To now have the consumer electronics industry make a demand that we unbundle our equipment from its features and functions is discouraging beyond words.

The consumer electronics industry proposed this to the FCC in what is known in Washington as an Ex Parte comment, in the form of a statement, and that while they purported to represent all consumer electronics companies in this position, there are at least a couple of consumer electronics companies who do not support the position espoused in this statement. As you can imagine, those were the manufacturers who know not only the consumer electronics business, but also the cable business intimately. And since we are expecting the FCC to release an NPRM to deal with the issues of cable-ready television sets, decoder interfaces, and other issues that were left undecided in the first report and order on compatibility, we expect to have a full and frank discussion of all of these issues in that form.

If you and your company have not been involved in this debate, you should know that the cable industry stands to lose a significant amount of flexibility if the manufacturers of TVs and VCRs are allowed to misrepresent how the cable industry and its equipment manufacturers conduct their businesses. I urge you all to be prepared to enter the debate when the FCC finally moves it onto the front burner. CED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The great disappearing drop cable issue

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

Last month, I reported on a rumor that our vendor community was breeding "brand-loyal" rodents whose sole purpose in life was to gobble up every bit of their company's drop cable. This, of course, was reported to be one of the primary reasons the cable TV industry deploys so much drop cable.

As of today, however, I must admit that I have been unable to substantiate that rumor–however true it might be. However, in an effort to better understand drop cable usage patterns, why we use so much, and how we might better control its deployment, Tom Elliot of TCI and I commissioned a study to examine the issue. We tapped our colleagues at Media Management Services Inc. to help, and the outcome was a well-researched and documented study. The study was conducted through a series of face-to-face interviews with corporate and system personnel, phone interviews, system visits and detailed records review.

Almost everyone in the technical community who was interviewed agreed that the industry deploys much more drop cable than anyone would expect. In fact, according to the study, we could be deploying, on average, as much as 32 feet of drop cable per subscriber per year!

If we then assume that an average drop is about 225 feet in length (125 outside and 100 inside), simple mathematics reflects that, on average, operators are replacing every subscriber's drop every seven years (225/32). To make matters worse, if we believe that most of the drop cable we are deploying is being used to replace outside drop, then we could get the impression we are replacing every outside drop every 3.9 years (125/32)! If you talk with just about any old-timer in the industry, however, they will tell you that a properly installed drop should certainly last for 12 to 15 years. So what's going on? Why the discrepancy?

There are a number of possible contributing factors as to why a drop might not reach its perceived 12- to 15-year useful life. Some might include things like: MSO- or FCC-directed performance standards which might cause the gradual replacement/conversion of RG-59 with RG-6, for example; MSO-directed changes in connector standards; FCC radiation standards–if it leaks, don't fix it, just replace it; improper weather protection of disconnected drop ends; and moisture seepage into the coax due to the use of poor connectors, or poor installation of the connectors. One of the most interesting findings of the study, however, was that while it appears at first glance that our subscribers' drops are being replaced every seven years, if you study the findings further, it really isn't true.

Probably the single biggest factor that contributes to this perception is the amount of in-home wiring we do today, as compared to several years ago. After all, drop cable consists of all cable between the tap and the back of every TV set. One manufacturer was quoted as saying that 10 years ago, *indoor* drop cable was only about 10 percent of his drop cable shipments. Today, however, indoor drop cable comprises between 60 and 70 percent of the drop cable shipments.

Data from our cable systems confirms that these numbers might not be far off the mark. This is a phenomenal increase in in-home wiring and can be primarily attributed to our focus on improved customer service. The philosophy is simple: Let's rearrange or extend the in-home drop to wherever our newbuild or re-connected customer needs it, and let's adopt a whole-house strategy and connect as many AOs as possible.

In the face of competition, this approach is a sound one, but it sure takes a lot of drop cable to do it. For example, the average length of the outside portion of a drop is between 100 and 150 feet. The indoor portion, however, varies all over the map. While an older installation might have only 10 to 20 feet of indoor drop, a newer installation that satisfies the subscriber's needs for location and additional outlets can consume 200 to 300 feet of drop cable inside the house. And the industry is doing a huge number of these installations and reconnects. It's the right thing to do from a customer service perspective, but it's a lot of drop.

The real story

It could be argued then that inside drop wiring is not being used to replace the active subscriber drop inventory. Instead, it's being used to expand the inside portion of the drop plant for more convenient drop locations and additional outlets. During reconnects, the outside wiring is quite likely to be re-used when activating a new customer; however, it is very likely that new wiring will be added indoors.

With these factors taken into consideration, and if we conservatively estimate that only about 35 percent of the drop we use today is for outside wiring, some of that being for newbuild and pre-wire activity, we would find that it will take about 13 years for us to completely replace all of the active outside drop inventory (assuming an average outside drop length of 125 feet). This closely matches the estimates that have been given for the useful life of a well-maintained drop–in the range of 12-15 years.

While it's true that drop cable usage patterns have shifted from "outside" to "inside" over the years, and have caused the perception that we are replacing every subscriber's drop every few years, the reality is that this is not the case. Note, however, that I would not want to leave you with the impression that all is perfect in the land of drop. The study also indicated that we could reduce waste in the deployment of drop cable–perhaps to the tune of about a 20 percent usage reduction per year. CED

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Note: The following comments were presented during the SCTE Conference on Emerging Technologies in January.

Keep your eye on the bear

By Ted Hartson
Post-Newsweek Cable

Most of you are cable veterans who have worked your way through the steps of management. You are to be commended for your accomplishment.

Before this turns into a love fest, however, let's remember the conclusion of an old story that goes, "Some days you get the bear, and some days the bear gets you."

A generation ago, I worked for a guy named Monty Rifkin. He once exhorted, "I don't want you to work harder; I want you to think harder." The rules have changed–it's time to think harder. But about what? The winds of change are blowing, traditional values disappear, finely honed thought processes no longer work, and everything is less sure. These are the inevitable byproducts of evolution, but if you keep your cool, growth will happen.

It is sometimes said that you're only as good as your last performance. Yesterday's answers and their messengers may be good for awhile, but in a short time, old answers and their proponents, while speaking as clearly as before, will be heard by fewer.

The world of telecommunications promises to be a part of our collective future. Some time ago, I saw a quote, "Only the smart shall thrive, and surely the dumb will perish."

This industry evolved by being just what the customer wanted, on the cusp of technology, in hock to its ears, with personnel short on skill but long on determination. We built earth stations when they were 25 feet across and needed 25 yards of concrete to keep them from blowing away, and when 180-degree LNAs cost $4,000. We invented AML. We made AM fiber work when the other guys said it wasn't possible. We are inventing a lot more neat stuff because it is what we, as an industry, need to go forward.

Telcos beginning to look like cable

Before you think this business is passé, please note that it isn't the cable guys who are trying to emulate the telephone companies. We are not changing to copper pair. Rather, telephone companies are looking like us. Cable television has more bandwidth by accident than telephone companies have on purpose. Our hybrid fiber/coax network will be the preferred embodiment for telecommunications well into the next century.

We have brought the choice of visual entertainment into the home, first here in the U.S., and now to an increasing degree, abroad.

Careful though. Sometimes you get the bear, and sometimes, the bear gets you.

If you believe that what you know now, where you've been, and yesterday's answers will work in the future, please repeat after me: "Would you like that with fries, sir?"

What's going to be happening next is like lightning. Stuff will happen that will leave you out of touch, out of inspiration and, if you're not careful, out of work.

Only the smart shall thrive, and surely the dumb will perish.

The vaccine for the disease called "the future" is education. And the surest way to understand something is to teach it. Organize and conduct meaningful training for your staff. Make it worthwhile; don't waste anybody's time. Sincere training directed at elevating awareness, not showing how much you know, is the most pure form of human effort. Take time to teach and see what you learn. SCTE courses, self-directed programs such as those of the NCTI, or enrollment in junior colleges are all meaningful ways of raising understanding.

We are heading into new territory–new to us, but familiar to others. We need to add telecommunications skills to our toolbox. To compete in interactivity, telephony and the digital marketplace, we need to expand our skills. Attendance at and attention to presentations such as those found at this conference are essential for survival.

But before heading out for tomorrow's technology, let's make sure we are on a firm foundation with today's business. I worry about the prospects for erosion of cable penetration by DBS. I am fearful the entry of alternative video providers will leave us a smaller pie. But most of all, I am afraid of the people in this industry and in this room who sell crappy pictures. There are a lot of bad pictures out there, and we are responsible for them. Too many systems barely pass FCC proofs. Too many systems operate by letting the customer define quality by how much the phone rings. When you're talking about quality that costs, let's say $1 million to add glass and shorten cascades, it ultimately becomes an economic issue. On the other hand, when you're talking about quality that is left on the pole, or in the hole, because of sloppy maintenance or inept operating parameters, then that quality was bought and paid for–and it's our job to see that it gets to our customers.

In the final analysis, we make our own destiny. We–you and I–determine how much quality we'll give our subscribers. Cut a corner, or close your eyes, and someone else will step right up. It's really simple. The rules for engagement are:

✔ Consumers want to be entertained. He or she wants choice through non-invasive complimentary technology.

✔ The low-cost provider will always win.

It is the caliber of presentations such as this conference that lifts us all. Don't disappoint yourself, your customer, or each other. Remember, only the smart shall thrive, and surely the dumb will perish. And keep your eye on the bear. CED

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From the couch to the module

By Walter S. Ciciora Ph.D.

The Electronic Industries Association filed comments with the FCC on Feb. 3 which contained a large number of technical errors and gross misrepresentations regarding the Decoder Interface standard being hammered out by the EIA and NCTA. It called for the FCC to go backwards and consider a Decoder Interface which was limited to only descrambling. It also called for this "crippled" Decoder Interface to be required on all set-top boxes. It even launched a request that the FCC standardize set-top boxes!

A decade ago, the Decoder Interface was a means of adding an external plug-in descrambler to a consumer electronics product so that the tuner could be used and descrambling made transparent. The old "MultiPort," unfortunately, didn't translate into a roll out. Instead, the EIA/NCTA Joint Engineering Committee developed the ANSI/EIA 563 Decoder Interface standard.

When the 1992 Cable Act required the FCC to improve the compatibility between consumer electronics equipment and cable systems, the Decoder Interface was determined to be the most practical way to accomplish these goals. Most on both sides felt that the ANSI/EIA 563 had to be upgraded..

An IF output from the consumer electronics hardware was able to accommodate digital signals and a couple of unique analog formats. But most importantly, new services and the prospect of interactivity and multimedia required the consumer to be able to interact with the plug-in Decoder Interface modules.

Nearly all of the committee effort of the last 18 months has focused on expanding the ability of the Decoder Interface so that value is added for the consumer. 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."

The "command set" problem, symmetrical fears

From the very beginning of the work on the command set, the service provider side has been concerned about ensuring that the consumer who purchases a cable ready product has the same access to services as the consumer who has an older–or new, inexpensive, non-cable ready–TV.

Indeed, the cable ready product should not be second class. It's important that the consumer have the same "look and feel" and be able to use the same procedures for accessing services through the cable ready product as with a set-top box. Otherwise, the consumer is unnecessarily burdened and confused. The consumer will, in nearly all cases, first have a set-top and only later acquire a cable ready TV or VCR. The purchaser of a new cable ready product should not be disadvantaged relative to the user of a set-top box on an old TV.

There are symmetrical fears. The service provider is concerned that consumers may not have access to all services with a cable ready product. Another concern is that the access may be limited or made inconvenient, strange or cumbersome. The consumer electronics manufacturers are concerned that some services may require a separate remote control which may limit access to TV or VCR features. The correct answer to both of these concerns is to let the consumer decide!

When the consumer is purchasing a new TV or VCR, the set-top box is not present. Instead, the products are fed with an off-air antenna or a bank of laser disks. The consumer is steered to features and functions which he finds attractive.

The product goes home and is connected to the service provider. If scrambled services are involved, the service provider installs a Decoder Interface module, or the subscriber self-installs it. If the consumer electronics manufacturer provided satisfactory access to the services the subscriber desires, everyone is happy.

If, on the other hand, there are services which are not accommodated by the cable ready TV and the remote control which came with it, the consumer may rent, purchase or be given a different remote control, giving him two remotes. If the new remote gives full access to all of the TV or VCR features which the consumer values, the remote that came with the TV is placed on the shelf, and there is another happy ending.

If there are features in either the TV or VCR, or that are offered by the service provider which are not easily accessible through a single remote control, the consumer must make a choice. The first choice is between the features in the consumer electronics product which are not readily accessible in the one remote control, or the programming from the service provider which is not available with the other remote control.

There are still other alternatives. If either the consumer electronics remote control or the service provider's remote control has a learning feature, it can absorb the commands from the other device. If neither has the ability to "learn," a third-party remote control can be acquired for the cost of one or two pizzas.

Only open, uncensored "couch-to-module" communications allows the consumer to have full access to programming offered by service providers and to features included in "features boxes" sold at retail. If the TV's or VCR's microprocessor becomes a gatekeeper and decides which signals are allowed to pass from consumer to module, the Decoder Interface is crippled and inherently limited. It can't accommodate exciting new interactive and multimedia services. CED

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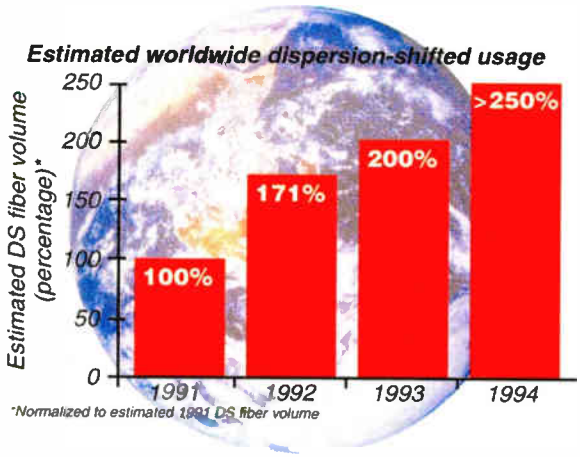

Another issue is laser chirp, a phenomenon that causes the laser to shift in wavelength when modulated. Laser chirp is most prevalent in directly modulated lasers. Interaction between laser chirp and dispersion in the 1550 nm operating window will lead to unacceptably high CSO levels after only a few kilometers. Cable TV AM transmission is sensitive to high levels of CSO, which appears on a television monitor as rolling diagonal lines.

One approach to managing CSO is an externally modulated laser, which produces a single, continuous wavelength modulated by an external source. The use of an external cavity laser eliminates the wavelength oscillations, thereby eradicating laser chirp and enabling system designers to deploy 1550 nm solutions over standard, singlemode fiber.

Regardless of transmission technique, dispersion-shifted fiber, designed to minimize dispersion while capitalizing on the lower attenuation rates at 1550 nm, allows for greater transmission capacity over longer distances than would be possible with standard, singlemode fiber.

Some leading MSOs are investigating dense WDM technology

The 1550 nm window revisited

Transmission at 1550 nm seemed, at best, a niche application in the early 1990s, when the cable TV industry first became interested in the operating window. Five years ago, the performance of 1550 nm AM lasers didn't compare favorably to that of their 1310 nm laser counterparts. Additionally, optical amplifiers weren't as advanced then as they are today. And dispersion-shifted fiber was generally viewed as a highly specialized solution for long distance applications.

In 1995, however, advances in component technology, the introduction of a new, high-capacity fiber, and the advent of "dense-wave division multiplexing" (dense-WDM) promise to make 1550 nm transmission a highly viable operating protocol.

As cable operators continue to leverage their investment in their networks through a more detailed examination of 1550 nm technology, an enhanced dispersion-shifted fiber optimized for a variety of applications requiring multiple, high-bit rate communications over long system lengths has been introduced. It may be optimal in newbuild situations where operators anticipate the need to move large amounts of information over longer distances.

For example, some long-haul and regional telephony carriers are operating at 2.4 gigabits per second (Gbps). Industry observers estimate that 10 Gbps systems will begin to appear in the not too distant future. Those cable operators who wish to support the hand-off of regional voice traffic to the public switched telephone network (PSTN), or to a long distance carrier will require a network infrastructure that can accommodate high bit-rate traffic.

For cable TV applications, consider this basic scenario: assume a master headend with a media server for an entire regional network. To handle video-on-demand (VOD) for just five percent of a regional network which serves 50,000 subscribers, 2,500 simultaneous video streams of data will be needed. Each video stream requires 4 megabits per second (Mbps) MPEG-2 format (Motion Pictures Expert Group compressed video technology).

Multiply 4 Mbps by 2,500 video streams, and you have 10 Gbps–the necessary capacity for tomorrow's cable TV applications.

This example assumes that a media server is located farther back in the system, as opposed to an edge switching design, where lower performance media servers are located at various points in the regional network.

1550 applications, including dense WDM

Nearer term, 1550 nm technology is likely to be driven by the following evolving applications and technologies:

✔ Longer transmission requirements, such as headend consolidation and subscriber "clustering," with the resulting need for regional interconnects;

✔ the inevitable progression from analog to digital communications, especially in regional rings, where cable operators will look to transmit more information over longer distances; and,

✔ recent advances in enabling technologies, such as EDFAs and WDM.

Some leading MSOs, notably Cablevision Systems Corp., Time Warner Cable, NewChannels Corp. and Rogers Cablesystems, are investigating dense WDM technology, where several narrow wavelengths in the 1550 nm operating window are carried on a single fiber. As mentioned earlier, this technology allows cable TV operators to coordinate economical system interconnection over long distances.

For example, it could accommodate four different wavelengths at 1550 nm; one wavelength could deliver telephony services, another digital video, the third video-on-demand channels, and the fourth wavelength would be reserved for the return path.

Dense WDM technology has been applied successfully by at least one telephone interexchange carrier in recent months (for more information, see "1550 nm gear back on radar screen," by Leslie Ellis, February 1995 issue of *CED*, page 44).

As the next generation of cable TV network architectures emerges, it seems possible that 1550 nm transmission represents an important operating window of opportunity, as cable evolves from providing television to full service telecommunications. CED

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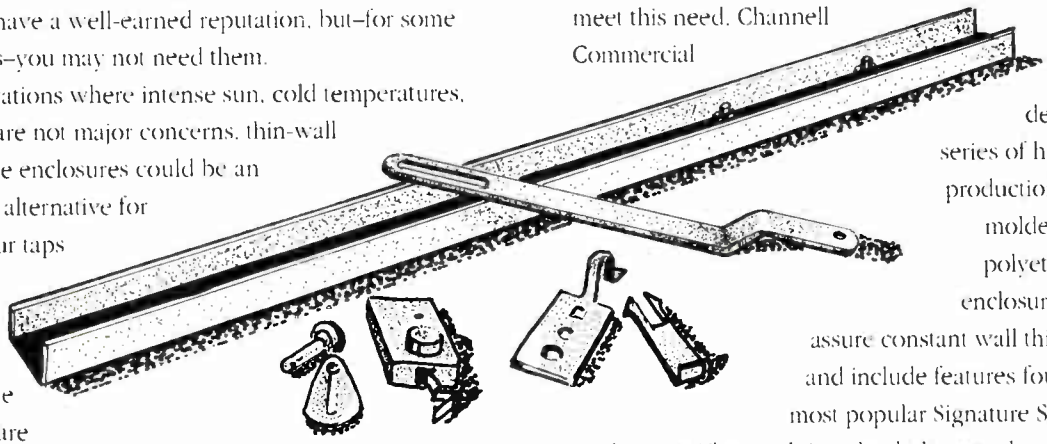

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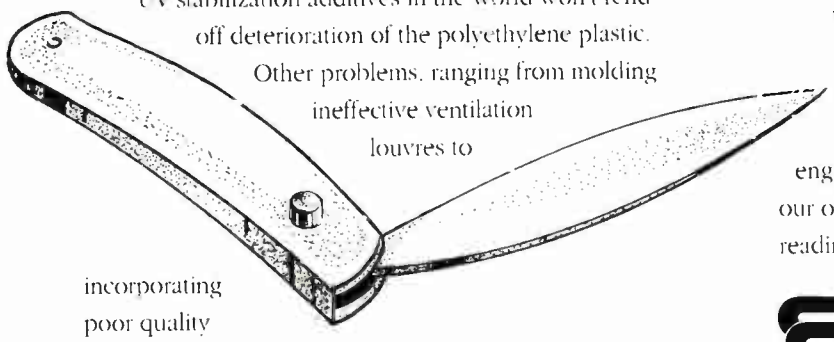

incorporating poor quality locking features, are associated with these techniques. And, as many system operators have found out, a simple pocketknife in the hands of the local street bully can be a polyethylene enclosure's worst nightmare.

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Time to re-examine 1550?

A viable network option

By Don C. Vassel, Senior Market Engineer–Cable TV, Corning Inc.

What will the communications network of the future look like? While today's fiber-to-the-feeder and hybrid fiber/coax network designs take shape, it's safe to say that cable TV systems will continue their transition from delivering video entertainment programming to providing integrated broadband telecommunications services.

Tomorrow's cable TV network may be asked to enable a broad array of applications, including video-on-demand, telephony, high-speed data transport, and telecommuting, to name just a few. In fact, it's likely that cable TV applications requiring high bit-rate connections over long distances will become prevalent in the coming years.

As a result, one of the most significant challenges facing cable TV operators is to provision their networks now to accommodate these future services.

In the near future, many cable TV applications will require high bit-rate connections over long distances. Photo courtesy of Corning Inc.

Increasingly, cable TV engineers are choosing to re-examine transmission in the 1550 nanometer (nm) operating window as a "future-proofing" measure for their networks.

Why 1550 nm?

The primary appeal of 1550 nm transmission lies in its ability to access standard, singlemode fiber's lower intrinsic attenuation rate (the reduction in signal strength over the length of the fiber), thereby extending the economy and reliability of fiber-based systems by eliminating downstream active components. In addition, advances in erbium-doped fiber amplifiers (EDFAs), which operate in the 1550 nm window, now can be utilized to boost the transmission of the signal without adding any significant distortion to the system.

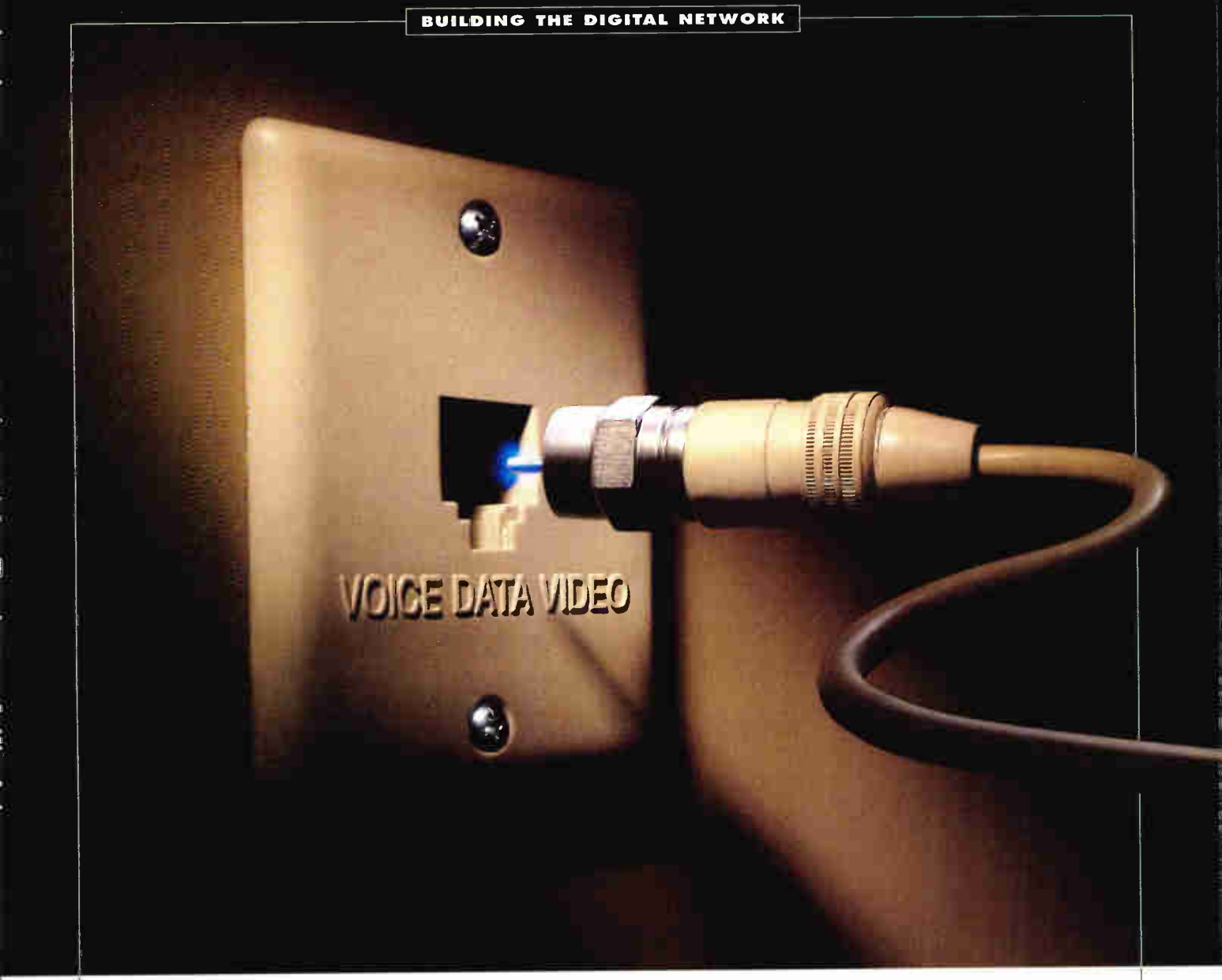
Yet certain issues must be addressed when considering 1550 nm technology. Cable TV operators who plan to build their plant with standard, singlemode fiber operating at 1550 nm will find that the signal quality of an AM system may degrade to an unacceptable level after only a few kilometers when using conventional, directly modulated DFB lasers. Why? The problem is dispersion, a key optical performance parameter for singlemode fiber.

Simply put, while 1550 nm operation on standard, singlemode fiber offers the benefit of lower attenuation, it brings with it the trade-off of greater dispersion. The effects of dispersion are commonly accounted for in long-distance digital transmission, as well as in analog applications to determine the maximum data rate or information-carrying capacity of a singlemode fiber link.

Understanding dispersion

Dispersion refers to the spreading of each pulse of laser light as it travels along a fiber. In digital communications, as the light pulse travels along the fiber, it spreads because of the different wavelengths that make up the pulse traveling at different speeds. Eventually, the pulses can overlap one another and become unrecognizable, thus limiting the received data rate.

In analog transmission, the effect is slightly different. Dispersion causes a slightly distorted analog waveform to become significantly distorted more rapidly. This is a result of different wavelengths of light traveling at different speeds within the waveform. In AM systems, this distortion shows up as second order harmonics (or "beats") and is commonly referred to as composite second order (CSO) distortion.



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Cablephone not ringing yet

Manufacturers still testing, defining products

By Dana Cervenka

Engineers are anxious to test the technology in their systems now, to ensure that their upgrades won't be wasted

The task: design a system for a service that has not yet been given the regulatory green light, for customers who are still pondering engineering and operational decisions, at a cost that is competitive with a structure that has been in place seemingly forever. Given these challenges, it shouldn't be too surprising that communications manufacturers are running behind operators' expectations in their development of products for telephony over the cable plant.

But while manufacturers are planning and designing, cable engineers are chomping at the bit to get started in telephony, as they warily eye the telcos, which are very interested in cable's existing video customer base.

"I think that the technology development is lagging from where it needs to be," says Joe Van Loan, senior vice president engineering, Cablevision Industries. "We've had applications for more than a year that we would like to work on, and we haven't even been able to get prototype hardware."

While acknowledging that the status of cable telephony is dependent on what Congress does in the next several months, David Fellows, senior vice president, engineering and technology for Continental Cablevision, adds, "I would like [the equipment] sooner, but at the moment, it looks like everything is hanging together for trials this year, and heavy deployment next year."

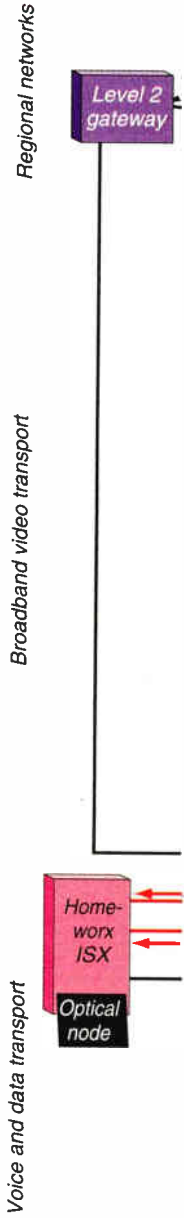
More than anything else, cable engineers are anxious to test the technology in their systems now, to ensure that their current efforts to upgrade won't be wasted, and to determine if they need to make additional architectural changes.

With these concerns in mind, this article provides a brief update on each manufacturer's product line and deployment schedule, as well as an overview of trials.

ADC Telecommunications

The modular Homeworx access platform represents ADC Telecommunications' efforts to calm the fears of MSOs wrestling with how to get into telephony at an incremental rate. With ADC's platform, the system components necessary to offer telephony and data services include the Homeworx Host Digital Terminal (HDT), Integrated Services Unit (ISU) and transceivers for both the headend and optical node. To get started in telephony, an MSO could purchase the basic building block–a shelf capable of handling 672 DS-0s, which, using an assumption of one-and-a-half lines allocated per home, would equate to about 448 lines (note: while the telcos allocate one-and-a-half circuits for every home passed, MSOs will calculate their allotment based on a penetration rate that is less than 100 percent).

How much will systems like these cost? Who really knows? Because of the difficulty of specifying the many variables involved in any one cable telephony system, it's next to impossible to estimate the cost of the equipment on a per-line basis. And in fact, many manufacturers shy away from the question altogether. "We have literally binders and binders full of cost modeling that we've done for customers," says Greg Wortman, senior manager, corporate communications, with ADC.

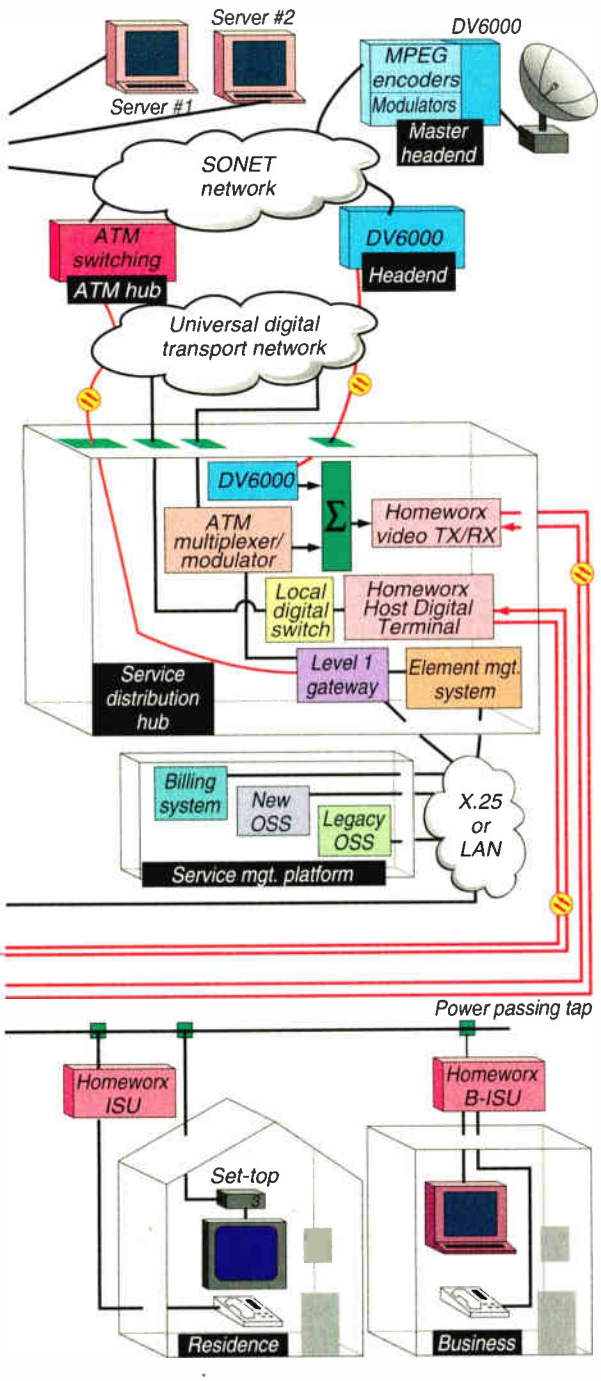


Field trials should provide some additional data on cost and a host of other factors. Although ADC officials are not able to comment on current trials, Time Warner Communications is testing the Homeworx telephony platform in its Rochester, N.Y. trial in order to learn more about how video and telephony will coexist over the hybrid fiber/coax plant in the real world.

Full-scale roll-out of the product line is slated for the fall of 1995.

Architecture. On the surface, at least, most of the cablephone systems are achitecturally very similar. In ADC's case, the HDT hooks into the Public Switched Telephone Network (PSTN) via a T-1 into a local digi-

Figure 1: The ADC end-to-end integrated network solution



tal switch. In most cases, the switch would be co-located with the HDT in the headend. Eventually, the signal will make the trip over the plant to the ISU, located at the customer's home, which receives its intended signal, and separates the telephony portion from the video. The telephony signal travels over the twisted pair into the home, while the video passes into the home over the coax.

Features. The Homeworx system is transparent to the CLASS features provided by the switch. A telco industry acronym for Customized Local Access Signaling Service, these CLASS features include services such as caller ID, call waiting, forwarding, etc. And the system will also provide a range of services, from POTS (plain old telephone service) to ISDN, coin, T-1/E-1 and other options.

Because there is no clear consensus among operators about powering, Wortman notes that, "We are open to designing it in the manner that the customer wants."

Another major issue that cable operators will be forced to deal with as they enter the telephony realm is that of the Operational Support System (OSS), which governs network monitoring, control and business functions. In concert with the OSS, ops will also need an effective network management system. While ADC is offering several levels of network management systems, it, like many of the manufacturers, will leave it to operators to secure higher level operational support.

AT&T Network Systems

AT&T's offering for broadband multimedia and narrowband telephony services is dubbed the HFC-2000 Broadband Access System, a family of products that includes a Host Digital Terminal (HDT), as well as distribution hub optics, fiber nodes, network interface units, amplifiers and power-passing taps. AT&T is already building the system–not for MSOs, but for a couple of local exchange carriers: Pacific Bell and Southern New England Telephone (SNET). On the cable side, the company has not yet announced any contracts for the HFC-2000; however, they are working through the CableLabs' telephony RFP and are talking to major MSOs, according to Rick Cavanaugh, MSO offer manager, HFC-2000 Broadband Access System. Cavanaugh predicts that the platform will be available for general deployment in the first quarter of 1996.

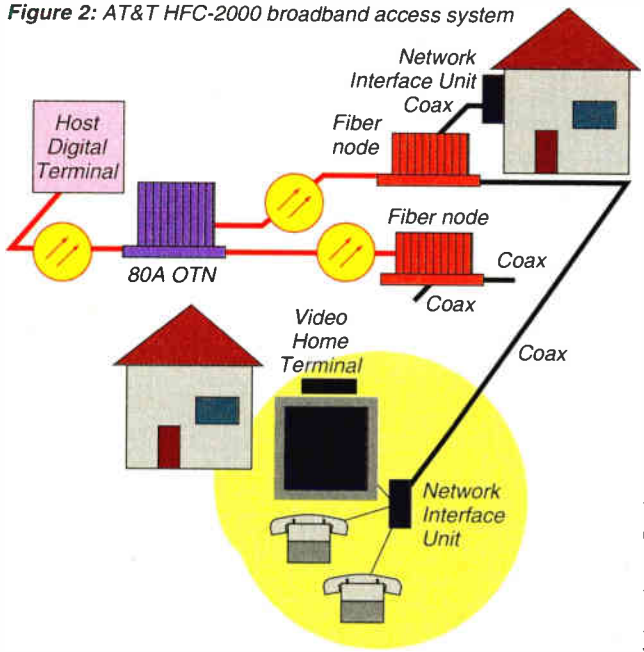
Architecture. The HFC-2000 telephony platform begins with the HDT, which would typically sit in the distribution hub, one level down from the headend. ("Host Digital Terminal" is the Bellcore terminology for the switch interface box, and is used by many of the vendors.) The HDT is linked to the PSTN via links running to a Class 5 switch (an MSO could lease, own, or partner to gain access to the switch). The interface employed is Bellcore's TR-303, a standard, open specification. From the HDT, a telephony signal would travel down an operator's network to a fiber node, and from there, to a box on the side of the subscriber's house called the NIU (or Network Interface Unit).

Features. The residential unit, the SLU NIU2P, is targeted to provide two phone lines and a CATV drop to the residence. The unit is actually part of a family of network interface units; other models will support AT&T's SLC channel unit.

As far as the system as a whole is concerned, AT&T went with the network powering option, says Cavanaugh, simply because that's what its customers wanted. Powering and its effect on system cost was a challenge, as engineers had to figure out a way to cost-effectively power the NIUs and support eight hours of battery backup. Because MSOs will initially start with low subscriber penetration, it's critical for their business

AT&T is already building the system for a couple of local exchange carriers

Figure 2: AT&T HFC-2000 broadband access system



case that power consumption be as low as possible. To that end, AT&T has been working to reduce the power consumption of the NIUs.

The company is planning to offer its own OSS platform, called ASOS (Advanced Services Operations System).

General Instrument

About a year ago, General Instrument teamed with DSC Communications, a Digital Loop Carrier vendor, to produce its Mediaspan system for telephony over the HFC cable plant. In fact, GI feels that DSC is a good partner, simply because of the company's experience in telephony and the local loop market, says Jeff Lanctot, director of Broadband Telephone Systems for GI.

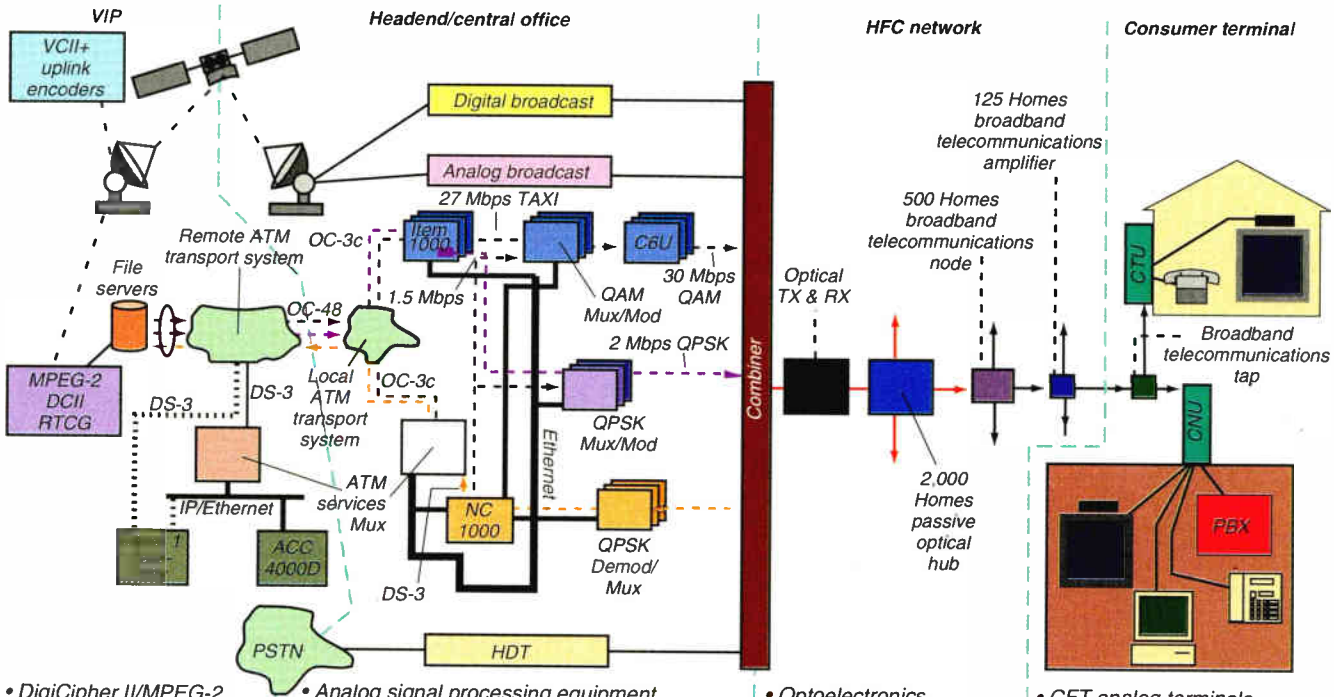
While reluctant to reveal GI's schedule for full product roll-out, Lanctot reports that some initial field trials of the technology will take place this summer.

He adds that in terms of the equipment only, GI's system would cost somewhere in the range of $200-400 per line. "It's very volume-dependent, of course," explains Lanctot. "And we have to be comparing apples to apples to get any kind of placement of the relativity of those numbers."

Architecture. GI's HDT functions as a switch interface box, and is both TR-8 and TR-303 ready. Once the telephony signals reach the HDT (again, via an interconnection with a Class 5 switch), the terminal multiplexes them together and combines the telephony signals with the downstream video signal, sending them over the same optical fiber. The signals travel over the fiber network to broadband nodes, where the optical/electrical conversion takes place. From there, as usual, the signals travel over the coax to the customer's home. GI's side-of-the-house box, the Coaxial Termination Unit (CTU), splits the telephony signal off from the video signal and delivers the call over the existing copper.

Features. The Mediaspan system will provide stan-

Figure 3: General Instrument's broadcast video, interactive video and telephony systems



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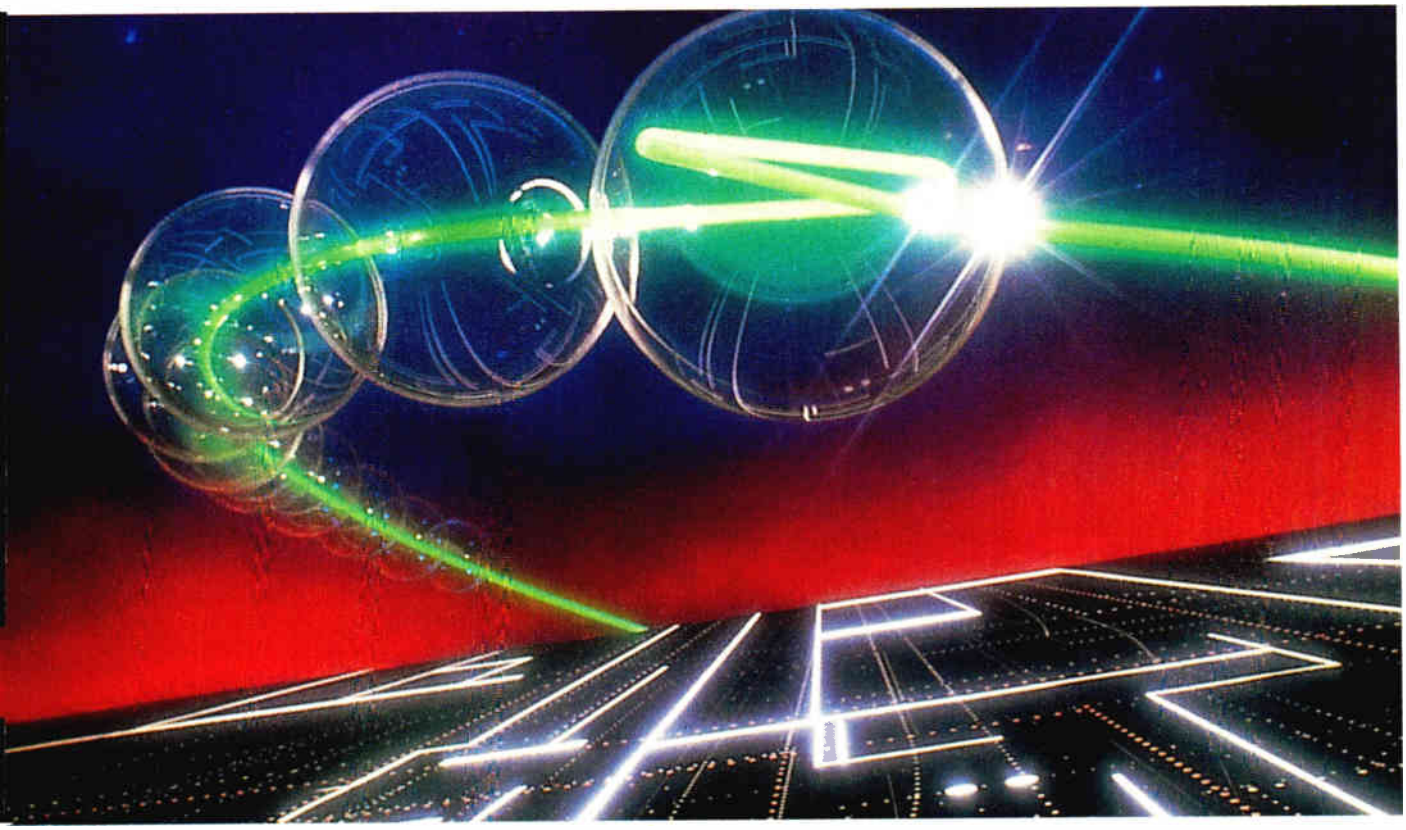

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dard POTS, including all of the CLASS features, as well as digital services such as ISDN, and will also support foreign exchange lines. GI plans to offer several powering options, including network and local.

In developing the platform, the company has thrown its engineering efforts into conquering three challenges in the development of the CTU. The first is keeping the power of the box in the range of three watts per unit. The second is keeping the cost of the unit in check by integrating it as much as possible down to the chip level, for mass production.

And the third challenge is handling the limited amount of bandwidth and the ingress in the upstream.

Motorola

Motorola entered the cablephone fray through the backdoor, as the manufacturer was originally looking at ways to backhaul wireless communications services over cable. And the design of its CableComm system for wired telephony and PCS reflects that strategy, as the manufacturer has borrowed trunking and frequency re-use techniques from its wireless vault to overcome challenges in offering telephony over the cable plant. Originally announced in 1994, the CableComm system targets operators' HFC systems for services including telephony, data, PCS and videophone.

At present, the company is in the formulative stages of a trial with TCI and Teleport Communications Group in Arlington Heights, Ill., where a demo room is being utilized to run voice, video and high-speed data over TCI's system. This summer, Motorola will start installing Cable Access Units (CAUs) at the homes of 25 employees, drawn in some mix from the three participating companies.

Full-scale commercial roll-out is planned for the first quarter of 1996, according to James Phillips, vice president and general manager of Multimedia Worldwide Distribution and Marketing for Motorola. Phillips estimates that equipment cost per line would run from $350 up to $550, depending on configuration.

Architecture. Motorola's headend unit, called a Cable Control Unit (CCU) interfaces, to the telephone network via a TR-8 or TR-303 interface, and also hooks into the Operations and Maintenance Center (OMC). The customer premise box is called the Cable Access Unit (CAU), which siphons off the telephony signal in the downstream.

In terms of capacity, the system's use of trunking technology and time division multiplexing in the upstream and downstream will allow MSOs to send between 500 and 1,000 calls in one, 6-MHz channel, says Phillips.

Features. The Motorola system is transparent to all the basic CLASS features offered by the switch, as well as basic rate ISDN. The residential units will come in one-, two- and eight-line versions. In addition, CableComm is designed to conduct loopback diagnostics.

Powered by the network, the system includes CAUs that consume less than one-half watt of power each, says Phillips, as they were built on the powering techniques used for pagers and cellular phones.

Northern Telecom

As the manufacturer of millions of telephony line cards per year, Northern Telecom is hoping to drive down the cost of cablephone by building on some of its existing products. Northern's "Cornerstone" family of broadband products is segmented into services for voice,

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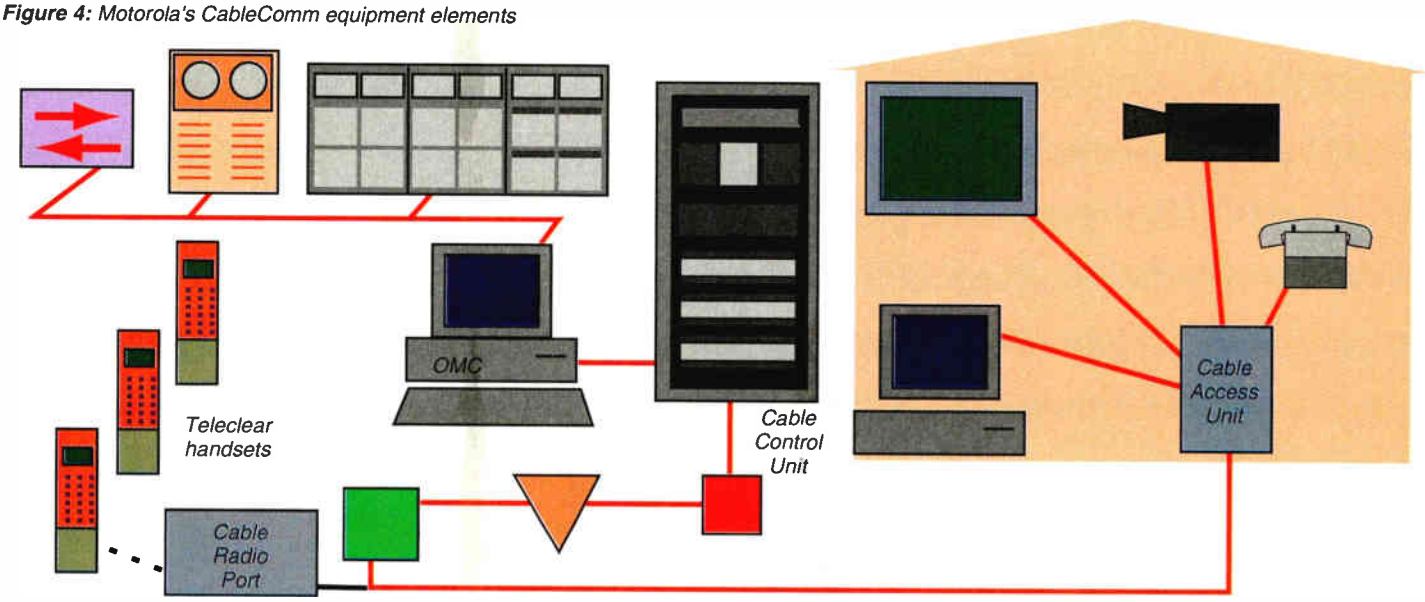
PCS, data and multimedia. The segments, though they share common elements, are running at different developmental rates. There will be several field trials of Cornerstone Voice this April, according to Cortland Wolfe, senior manager, Broadband Networks. Roll-out and volume production of Cornerstone Voice will take place sometime in early '96, according to John Mattson, director of product marketing, Broadband Networks.

Architecture. The Cornerstone Voice line includes a Voice Gate–a line card and a modem in a wallbox package mounted at the side of the house–and a Voice Module, which is mounted in a cable operator's headend or in a fiber hub. The Voice Module serves as the interface to the PSTN and provides the modulation to make the telephony signal compatible with the cable network. Once the signal arrives at the Voice Gate, the digital component is stripped off the analog signal, then it is handed over to one of the line cards in the wallbox, which processes the signal for the subscriber's phone.

Features. For residential service, two lines are standard, with all the CLASS features. There are also two flavors of wallbox–basic and premium. Because the Cornerstone line is built on the company's next generation Digital Loop Carrier platform, the OSS already in place with that system can be delivered to MSOs, notes Wolfe, while the company is working with various partners to deliver "a complete network management solution for the cable operator."

There are currently three powering options with Cornerstone: two types of network powering, and one type of subscriber powering.

Figure 4: Motorola's CableComm equipment elements



As the manufacturer of millions of line cards, Northern Telecom is hoping to build on its existing product lines

Scientific-Atlanta

CoAxiom (formerly CoAccess), Scientific-Atlanta's family of telephone service products, is designed to deliver both video and telephony services. The CoAxiom system has been used in a technical trial in Alexandria, Va., in a partnership with Jones Intercable and MCI. While that trial tested original prototype units, there are plans to conduct another trial with MCI, using equipment "that is very close to final production configuration," notes Ron Foster, vice president of telecommunications systems for S-A. The additional trial, to take place in Chicago, is slated for the middle of this year. With the data gained from the trials, the product line should be turned over to the factory to produce S-A's first volume shipments in fourth quarter '95, marking commercial availability.

Most of the manufacturers seem to be clustering together in their estimates of equipment costs, and S-A's products fall in line. A ballpark estimate of per-line equipment cost is $350-400, initially, but Foster believes that over the next several years, the cost will be driven down to about half that, as a result of volume and continued vertical integration.

Architecture. The electrical architecture closely resembles that of a set-top application. The main components of the system are the box in the headend, called the Headend Interface Unit, or HIU; and the side of the house box, called the Customer Interface Unit, or CIU. Another version of the CIU serves multiple tenant applications.

Though principally designed to be network-powered, there is a provision for subscriber powering in S-A's system.

Features. The residential interface will offer two telephone lines; and two additional, optional lines for data, fax, energy management and other data applications. A built-in interface allows customers to plug-in S-A's line of energy management products for controlling power usage and monitoring outages. Because the system is transparent, CLASS features move through automatically. The platform can also support ISDN.

While the company will not offer an OSS, it will be providing an element manager incorporating an industry standard interface.

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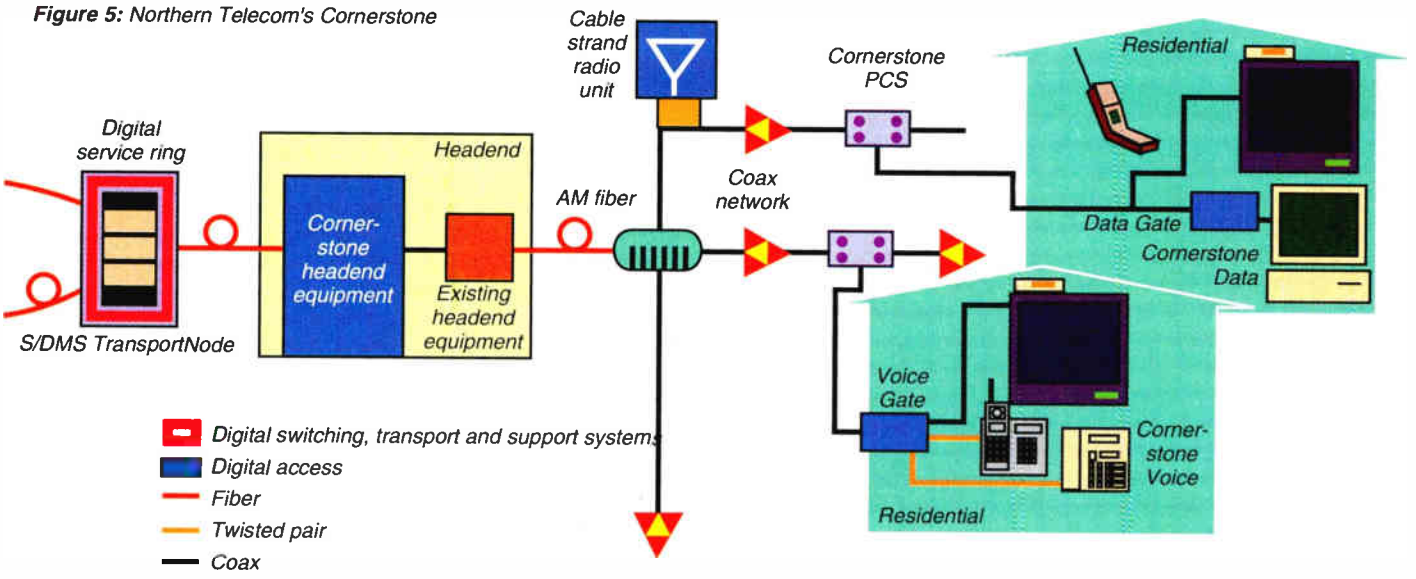

Figure 5: Northern Telecom's Cornerstone

Tellabs

NewChannels Corp. is currently conducting a field trial of Tellabs Operations Inc.'s Cablespan cable telephony product portfolio in the Syracuse, N.Y. area. In addition to that test, there is another major trial being conducted by an undisclosed MSO in the U.S., and by the beginning of this month, two more trials were scheduled to fire up, according to Wayne Partington, group product manager, network access systems, for Tellabs Operations Inc.

If all goes as planned, roll-out of the version used in MDU applications will take place this June; trial and roll-out of the residential version will take longer, notes Partington, due to the complexity of the upstream path and the multiple access protocol (TDMA) needed to manage point-to-multipoint distribution.

For MDU applications, the targeted per line equipment cost is $300 per subscriber or less, while the cost will probably run between $300-350 per sub for residential applications. As with the estimates of other manufacturers, this will be highly variable depending on specifics.

Architecture. The Cablespan system is set up with an HDT in the headend, the equivalent of a central office terminal in a digital loop carrier system. At maximum capacity, the HDT can support 672 subscribers in a "completely non-blocking configuration," according to corporate literature.

The box at the subscriber end is either a Remote Service Unit (RSU), for single family residences or small busi-

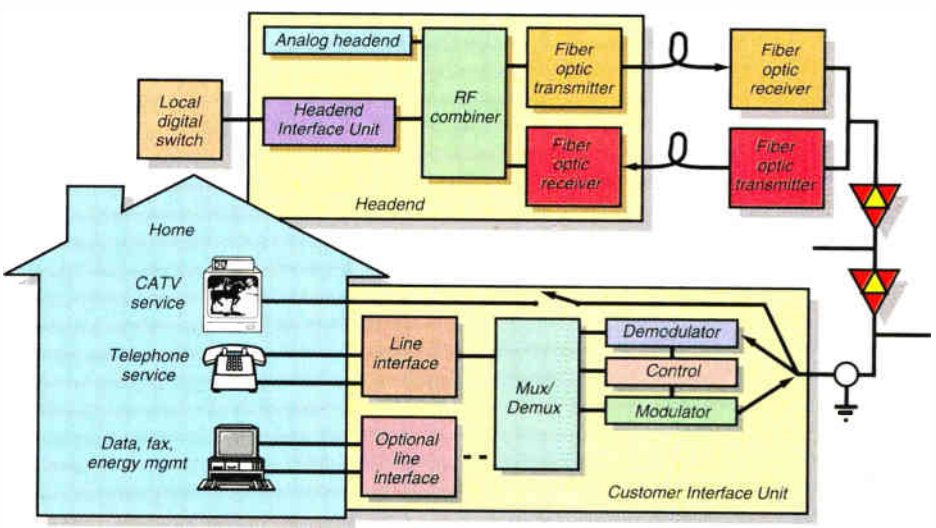

Figure 6: Scientific-Atlanta's CoAxiom–a dual services delivery system for CATV networks

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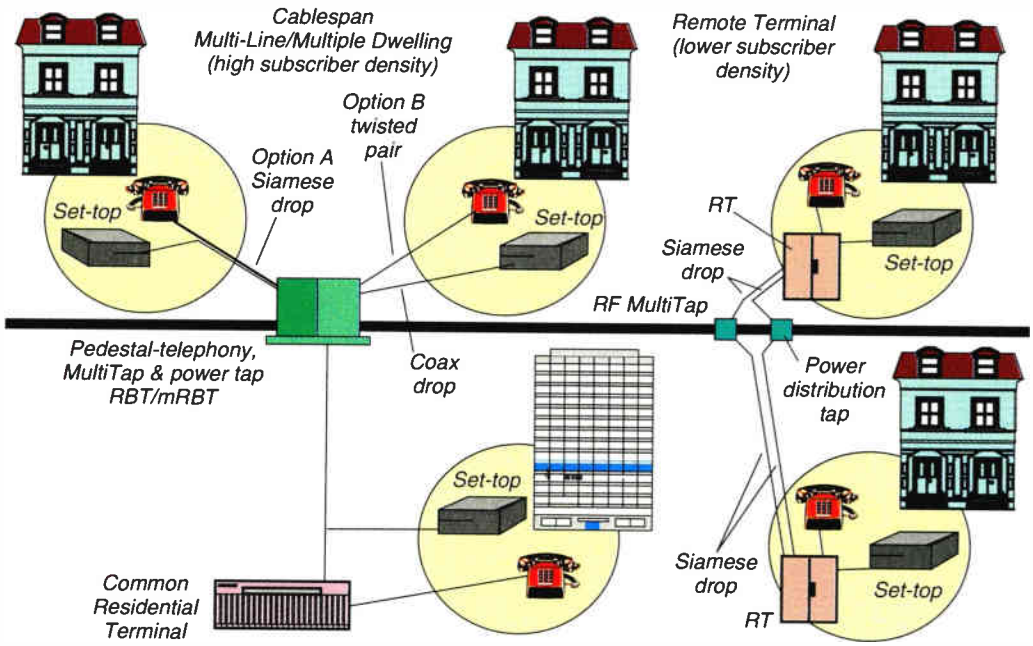
Figure 7: CATV/telephony delivery alternatives in the Tellabs' system



nesses, or a Remote Subscriber Terminal (RST) for multiple dwelling unit/business applications. In the RSU upstream, TDMA is used on a 1.6-1.7 MHz carrier to handle 30 DS-0s. The RST uses TDM in both the upstream and the downstream paths.

Features. A variety of services, including POTS, analog/digital data, payphone service, ISDN and T-1/E-1 are supported by the system.

While there were a number of obstacles to overcome, "What we were most worried about was giving MSOs a platform that was migratable beyond POTS service," explains Partington, "meaning, giving them a platform that would truly work in a residential, as well as a business environment."

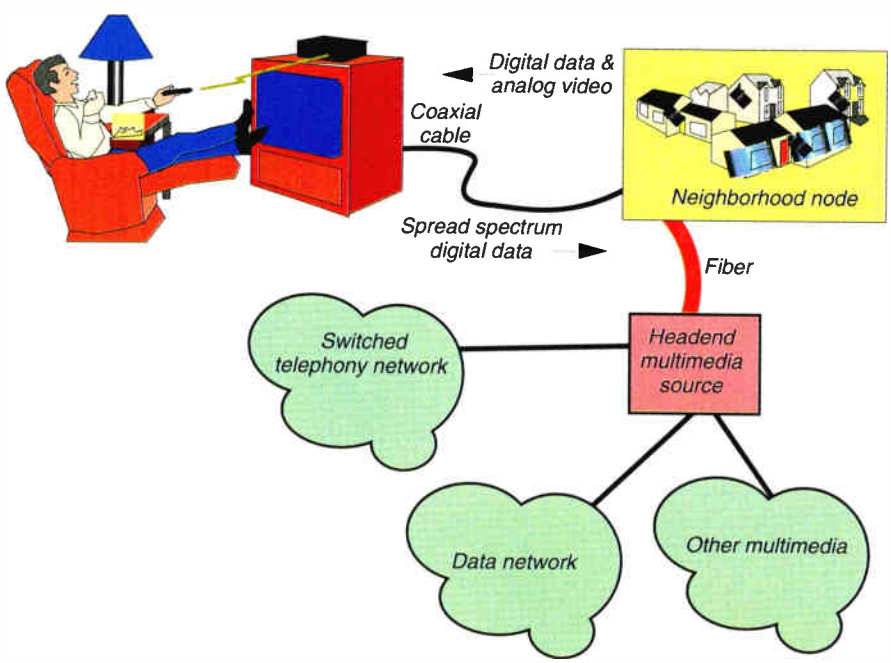
Unisys

The Digital Cable Services System (DCSS), produced by Unisys, is crafted around secure communications technology originally used by the military to overcome noisy environments. To establish the reliable return path required for cable telephony and other interactive services, the company provides a direct sequence spread spectrum modem at both ends of the HFC network; the modem uses a special ASIC that has only recently been cleared for use in the commercial world. Use of spread spectrum in the return can overcome the ingress, path distortion and other types of noise inherent in this path, according to company officials.

The company tested DCSS at CableLabs in the spring of '94, and demonstrated the system as part of the CableNET exhibit at the Western Show last winter. Although it has yet to be field tested by MSOs, DCSS will be put through its paces in trials conducted later this year, probably in the September/October timeframe, according to Wayne McPherson, vice president Commercial New Business Development at Unisys. While the company is capable of shipping trial versions in the thousands-of-units range, it's targeting first quarter '96 for commercial rollout of the product line.

Although still in the process of conducting internal pricing analysis, Unisys intends to be competitive with the $300-350 per-subscriber equipment cost that cable companies say they would be willing to pay, says McPherson.

Figure 8: Unisys spread spectrum over coax



Architecture. The DCSS includes an HDT and a Neighborhood Interface Unit (NIU). For the return path, the two communicate over the network via a spread spectrum modem link. For the forward path, differentially encoded QPSK is used. The NIU is available in different combinations of single family residence and multi-dwelling unit/business versions.

Features: The DCSS can provide POTS, video telephony, data and telemetry, as well as transparent access to features from the telco. And the company will also provide, at minimum, the shell of an OSS structure, or a generic software package that would collect usage data while managing the network.

Given the complexity of the system, the "toughest nut to crack" has been bringing the cost of the DCSS down, while providing the capabilities that operators will require, says McPherson, who adds, "we are convinced that we are there, now." CED

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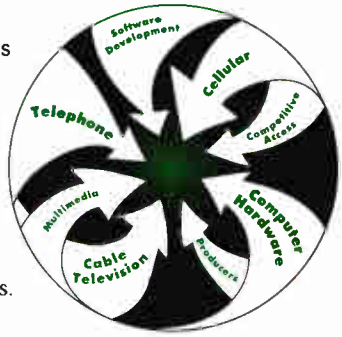

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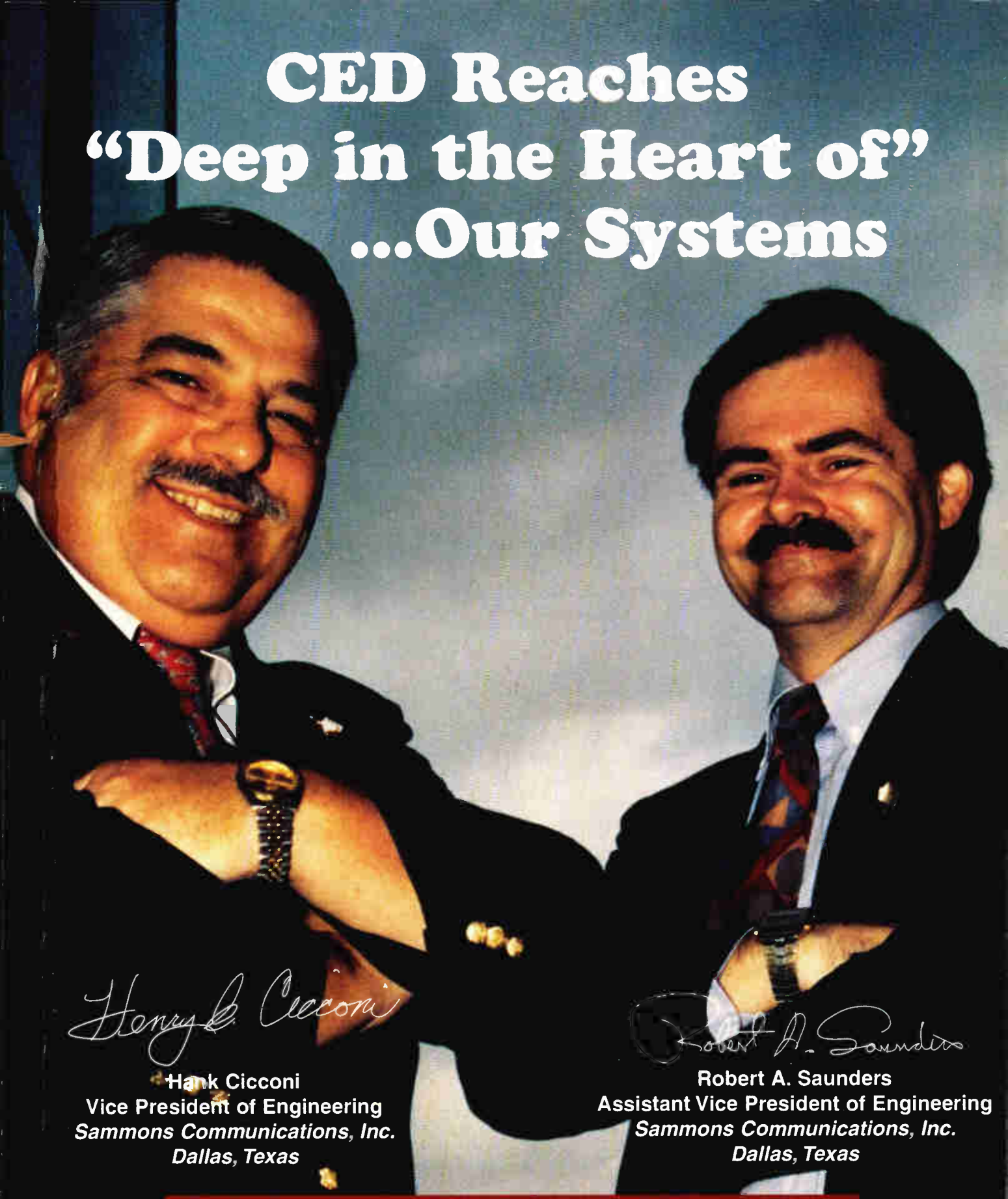

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Telephone system engineering

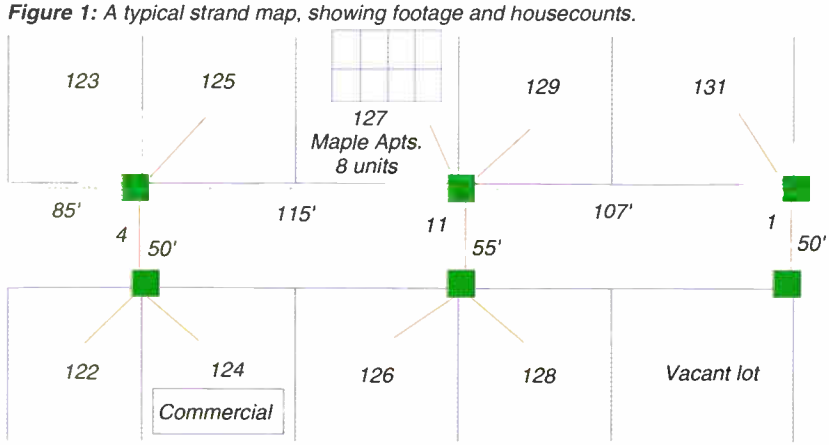
Understanding the art of network planning

By Steve Day, President, Comm DOC Services

It wasn't more than 10 years ago that broadband network engineering focused exclusively on delivery of AM-VSB 6 MHz video channels. In these networks of the past, simple engineering practices held true: Design an RF wideband system with 0 to 3 dBmV of amplitude at the back of each customer television set. In this case, the fundamental information required to build such a network was cable footage and house count.

A typical strand map from the past looked something like Figure 1, a simple stick diagram with footages and house counts. The conduit structure and service laterals are documented. The appropriate house counts are denoted at each structure point and the footages are denoted between each structure point. Simply put, a network could get built with these two statistics meticulously recorded for each structure span (i.e. pole span) and each structure point (i.e. pole, pedestal).

Figure 1: *A typical strand map, showing footage and housecounts.*



Access line management

Today, when looking at this same challenge, the networks are being designed to carry an incredible amount of additional information. This network information can be divided into three distinct partitions:

✔ Broadcast service represents information that is being broadcast to each and every customer. This information can be video channels, data signaling information and other information available at each and every customer location.

✔ Access lines or circuit services represent the services that create a two-way circuit to one customer. They can represent a data circuit, a phone circuit or a video conference. For the purpose of this article we will discuss access lines as a DS-0 56 Kbps circuit (offering POTS).

✔ Packet services represent the services that are sent to one customer and are bursty in nature. This information can be the delivery of video-on-demand movies to a specific customer location. It can be a data transfer containing massive data files or video imaging. It is information delivered upon request (from sender or receiver).

When looking at the prospect of offering all three services over the same network, the traditional RF engineering does not come close to getting the job done. In fact, today's current method of sizing a fiber cell by homes passed is outmoded.

These additional services require different and unique information not typically required in the CATV field engineering model. For the telephone engineers reading this article, they will understand access line planning and access line fill boxes. Figure 2 represents an example of these. In this example, the CATV/telephone engineer completes the field engineering and attempts to determine the number of access lines (telephone lines) to be served from any given point in the system. In Figure 2, at the given location, there are eight telephone lines. However, being fed through this location (the field side of the location) there are 16 access lines.

The engineer also attempts to forecast the future demand for access lines. In the Figure 2 example, the engineer would forecast a growth of four lines (in 10 years) at the given location and a pass through of 27 lines. Traditionally, this is how residential services were planned. It is important that this process be re-instituted in the mapping model. This field information can easily be input, analyzed and modeled in today's CAD engineering systems. It all begins with a more expanded version of today's strand mapping process.

In Figure 3, the access line fill boxes are placed at every "strategic" location. Strategic locations can be every structure point or every major street intersection. The field engineer makes a determination on how many access lines will be fed from the primary structure point (i.e. pole, pedestal). Two ways this information can be derived is by counting water meters (at a minimum) and telephone station protector connections (at a maximum). This can be furthered by also forecasting a growth factor. Many field conditions could be used to determine the growth. Some are as follows:

Today's current method of sizing a fiber cell by homes passed is outmoded.

1. The residential neighborhood appears to be experiencing a transformation as dwelling units are being converted to professional offices, leading to the conclusion that access lines should be increased in the future.

2. The local residential demographic represents high usage households and the engineer factors a growth of several access lines for these demographics.

3. A commercial unit reflects little growth, but a high user business is slated to move into the commercial unit in the future.

4. Anticipated buy rate of access lines, circuit switched services or POTS lines for a

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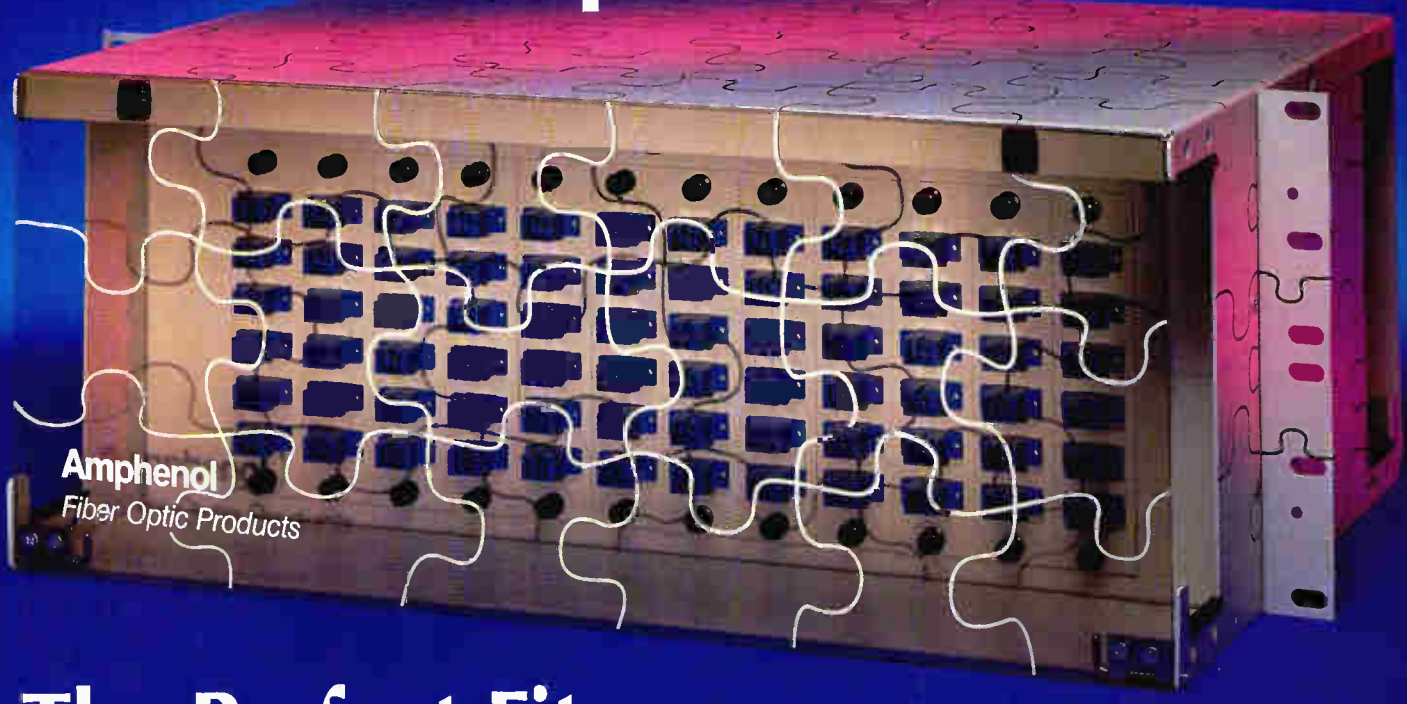

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given area. This could be represented as two access lines per home or a "50 percent of homes" customer buy rate.

These represent some valid observations that a field engineer can collect. This will drive the access line forecast and appropriate planning for fiber cell sizing and fiber cable management. In Figure 3, a current access line count of 17 access lines represents the fill box toward the office. The end-of-line represents an access line of only 1. The street will represent a circuit growth from 17 to 31. This field engineering data is important in a traditional telephone network and is equally important in today's HFC or coaxial telephony networks. This collected data represents much more that the typical information collected in Figure 1 and allows the network planners to conduct valuable circuit provisioning (down to the structure point) and telephone traffic modeling.

This information is vital to properly planning an HFC network. To the CATV field engineer, this represents the beginning "art form" of true network planning. To the telephone engineer, it brings the importance of network planning (that has been abandoned) back into the picture. To all engineers, this information becomes the vital starting point for telephony network planning.

Figure 2

Access line fill box		
	Incremental	*Total*
Present	8	16
One year	9	22
Three years	10	22
Five years	11	26
Ten years	12	27

Traffic study

From a uniquely defined home passed, to the service drop, to the coaxial leg, to the fiber optic node, to the optical laser, to the telephony hand-off; there is an increasing amount of common equipment. In other words, the amount of common equipment required is determined by an assumption that *not* all users of the network need services at the same time. For example, if an HFC fiber optic cell can modulate 224 DS-0s, then it could service 200 access lines at the same time. It could serve 100 homes requiring two access lines each.

Lastly, assuming only 25 percent of the customers use the system at the same time, in a peak demand period, the node's common telephone equipment can handle a cell size of 400 homes. This should become the fundamental planning tool for sizing fiber optic cells.

By refining this process of traffic analysis, the assignment of common equipment can be determined. This can save millions of dollars and create high utilization of network equipment. Effective cell size planning, fiber cable sizing, interoffice trunk circuits, interstage switching links, call processors and digital receivers can be effectively utilized. This all begins with taking random call traffic, access line information, house count information and creating a probabilistic framework that allows for traffic analysis and common equipment assignment.

Traffic analysis begins with traffic flow analysis. Traffic flow analysis starts with being able to predict the call arrivals and holding times of these calls. Coupling this information with the number of access lines provides a modeling program that will serve as the vital information for network provisioning. Figure 4 is an illustration of how a group of customers can be analyzed.

In this model, 20 individual sources can be plotted with respect to call arrival and hold time. Although the individual randomness exists, a probabilistic framework reflects a peak call volume of 17 sources. Consequently, the network peak utilization is 85 percent. The average utilization is approximately 11 sources. If these statistics were projected across a fiber cell with 600 access lines, the maximum circuits (trunks) required would be 510 circuits.

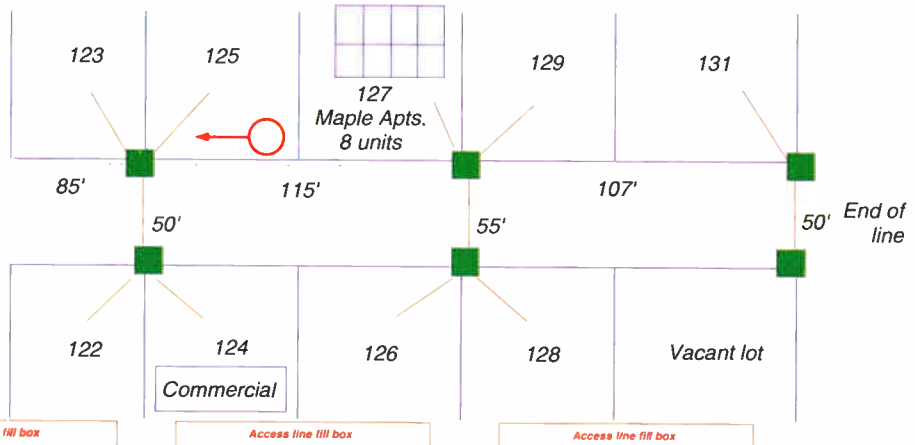
This data allows network planners to conduct circuit provisioning and telephone traffic modeling.

The second key statistic is the average time of each call made (call hold time). This is particularly important in any circuit switching where the hold time of a call (from the point of end-to-end connection to disconnect) determines the amount of network equipment occupied by the call. This is the time that the common equipment is being used.

The sum of the random hold times, during a given interval, represents the traffic volume. Figure 5 represents two different calling areas with different traffic volume. This traffic volume can be coupled with average circuit use time. By dividing traffic volume by the interval of the time which it is measured, the traffic flow can be determined. This is typically expressed in Erlangs, or hundred call seconds per hour (CCS). CCS denotes century call seconds. One Erlang equals 36 CCS.

On the other hand, if all 750 calls had an average hold time of 60 minutes (maxium loading), then this would represent 750 Erlangs and 750 trunk circuits. Provisioning can vary by this wide margin and

Figure 3: Combining a strand map with access line fill boxes



Access line fill box		
	Incremental	Total
Present	5	17
One year	9	26
Three years	10	24
Five years	14	30
Ten years	15	31

Access line fill box		
	Incremental	Total
Present	11	12
One year	11	12
Three years	12	14
Five years	14	16
Ten years	14	16

Access line fill box		
	Incremental	Total
Present	1	1
One year	1	1
Three years	2	2
Five years	3	2
Ten years	2	2

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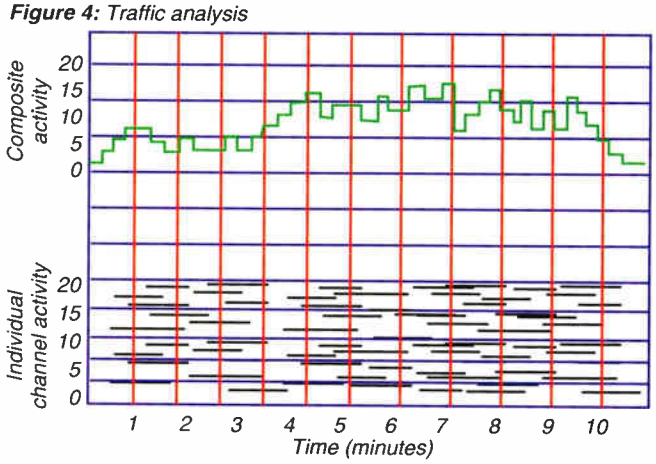
only effective traffic flow analysis can take the randomness of telephone traffic and predict how many circuits are needed. This essential science (correlated with common equipment provisioning) can save millions of dollars in unnecessary equipment costs.

The maximum capacity of any common equipment circuit is 1 Erlang. This indicates that the circuit is *always* busy. The maximum Erlang capacity of a common circuit network is simply the number of circuits. Typically, the traffic analysis of a public network take place by analyzing the period of time with the highest traffic intensity.

Figure 4: *Traffic analysis*



In figure 5, Cell #1 has the highest traffic intensity at 9 a.m. Cell #2 has the highest at 10 a.m. To get the traffic intensity during this period, the average number of calls would simply be multiplied by the average hold time, expressed in Erlangs.

As an example, let us assume that (at the peak period) the average number of calls in a 500-home cell is 750 calls per hour. Furthermore, the average hold time is 180 seconds. This would represent 135,000 seconds in an hour of traffic intensity. This would represent 37.5 Erlangs and perhaps 37.5 circuit trunks.

Conclusion

Network operators should consider a new approach to designing CATV/HFC systems. For the first time, the placement of circuit services on this type of network are being considered. Consequently, these circuit loads need to be determined from the outset–the strand mapping process. Access line counts and forecasts are vital.

Secondly, the sizing of fiber nodes cannot be based on homes passed, alone. To say a specific number of homes/cells will serve all geographic or demographic serving areas is simply not a realistic design goal. A careful documentation of homes (broken out by residential, commercial, PEGs, apartments and vacants), access lines, special services and higher capacity circuit services is important. This documentation will allow for adequate network planning and answer such questions as: Where to serve with HFC? Where to serve with FTTC? Where to serve with FLC (fiber loop carrier)? Although this may seem like a lot of additional information, the evolution of mapping and CAD systems should allow for mechanized modeling to bring meaning to the additional information.

Once the network is built, this information can be compared to traffic analysis for constant monitoring of circuit network deployment and common equipment provisioning. By plotting the access lines and their respective peak/average call arrivals, call hold times and traffic intensity, fiber cell adjustments and circuit network provisioning can be handled efficiently. Again, there are computer modeling programs that can provide this analysis.

Network operators should consider a new approach to designing CATV/HFC systems.

The engineering planning will result in:

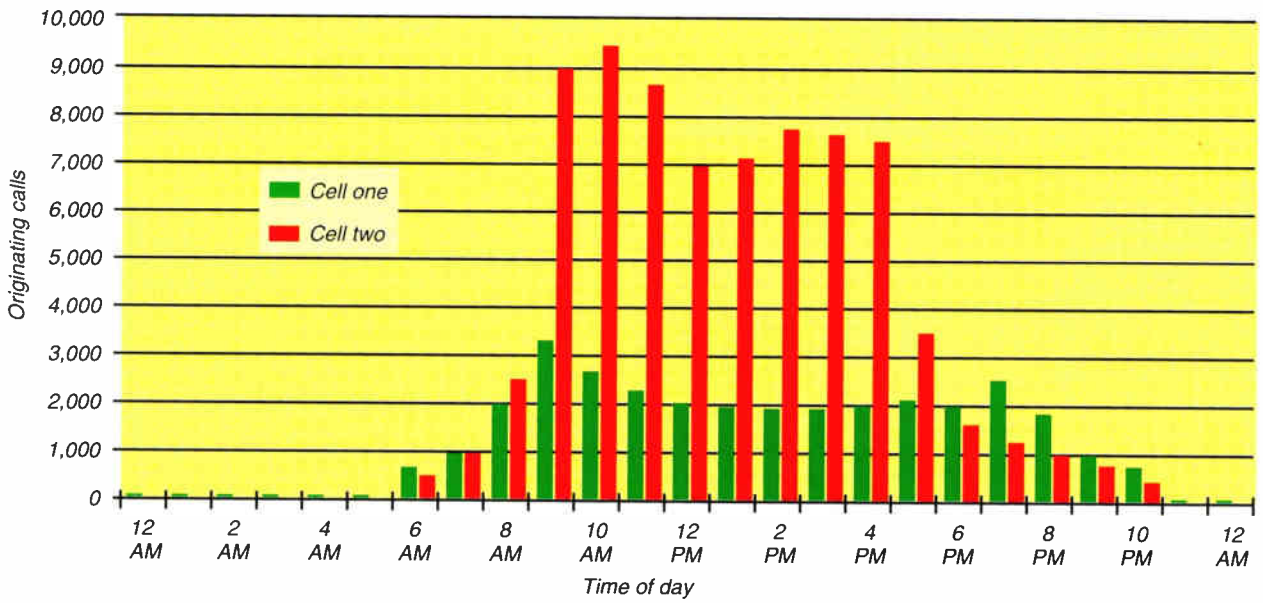
✔ Determination of the appropriate broadband network architecture and circuit provisioning based on access line demand for each serving area.

✔ HFC fiber cell size determined by the access line demand and traffic volume analysis associated with each proposed cell.

✔ Traffic volume analysis that will identify the time when a fiber cell needs to be reduced. CED

Comm DOC Services is an engineering, training and marketing services company based in State College, Pa.

Figure 5: *Traffic volume analysis*



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Residential shared tenant services

The door to full-fledged cable telephony

By C. Derrick Huang, Manager, New Business Development, Northern Telecom; and Dick Swan, AVP, Networks Marketing, Northern Telecom

With an infrastructure capable of providing two-way telecommunications and more, cable companies want to determine the best vehicle that will allow them to enter the residential telephone market. To be sure, the ideal entry vehicle must meet certain criteria. It must incur little trouble with the regulators. It should rely on existing and proven technologies, thus causing few or no technical delays. It should share the upgraded cable system with cable TV services, thus eliminating the costs of a separate outside plant. It should be accountable as a standalone revenue center without subsidy from other services–but, when necessary, it could be used as a defensive mechanism to fend off video competitors. Last, but certainly not least, it should require low marketing costs.

With that in mind, one particular application emerges as an ideal entry vehicle: residential shared tenant service (R-STS). R-STS is being increasingly cited by cable companies as a stepping stone into the residential telephone market. Just as competitive access providers have exploited opportunities such as private line transmission and Centrex service to get into the business market, cable companies can implement R-STS to gain a foothold in the residential telephone market.

A brief history of R-STS

Residential shared tenant service is an alternative local telephone service provided to occupants of a multi-tenant apartment building or complex of buildings, also known as a "multiple dwelling unit," or MDU. The service features shared switching components operated by the building owner, the users as a group, or a third party other than the local telephone company. Historically, a typical R-STS provider would serve several regional MDU locations, each with a private branch exchange (PBX) connecting to the public switched network on site. Essentially, the services offered would be a resale of local telephone service at a lower cost, with or without added benefits such as bundled calling features.

Just after divestiture, R-STS was viewed as holding great promise for competition and growth. But strict state regulation and the intrinsic limitations of the traditional R-STS system architecture have kept its growth to a minimum. As a result, R-STS has had limited success, and most R-STS providers remain small, non-diversified and local.

For the cable companies, however, the conditions are quite different. With an infrastructure optimized for the more cost-efficient centralized R-STS systems—and with the help of a slow but sure trend toward deregulation—cable companies are set to become successful in the R-STS business.

Why is R-STS attractive to cable?

R-STS meets all the criteria of an ideal entry vehicle for the cable companies to get into telephony. At last check, most states had authorized R-STS, and none of those states that had not authorized it explicitly prohibit such a service.[1] Minor restrictions on the R-STS business still exist,[2] but they are easier to overcome than the barriers to offering full-fledged residential local exchange service. Instead of being delayed in front of the state commissions or in court before providing full residential telephone services, cable companies can offer R-STS today with little regulatory distraction.

The equipment for providing R-STS is also readily available today. The service can be implemented with mature technology and does not depend on hybrid fiber coax (HFC) telephony products. In fact, the fiber right-of-way is already optimized for a centralized, switch-remote system ideal for MDUs in an R-STS environment, with the option to easily extend to include HFC access products for single dwelling units when such technology matures. From a risk management point of view, R-STS—requiring only existing technologies and proven products—presents a terrific opportunity for cable companies to get their feet wet in telephony.

Furthermore, the marketing barrier to local exchange competition is relatively low, in the case of R-STS. The cable company does not have to take extraordinary measures to convince tenants to switch to its service; the MDU owner, with the proper arrangement (discussed below) can be an effective sales

agent. The lack of local number portability—the ability for users to keep the same telephone numbers after changing service providers—is no longer a barrier, because almost all incoming tenants receive a new telephone number anyway. And in addition to treating R-STS as a standalone service generating its own revenues and profits, cable companies can easily bundle telephone and video service in such a way as to fend off competitors on either side.

A partnership arrangement

The MDU property owner will play an integral role in the success of R-STS. Cable companies can easily operate both the video service and R-STS without extra efforts or costs to the property owner. And in return for a share of the revenues—say five percent—the owner becomes a partner of the R-STS and thus has the incentive to pitch the service. All that is required of the property owner is asking the rental agent to explain and offer the service when a tenant signs the lease.

In a typical apartment complex with the normal rental-unit turnover rate, the R-STS can find success even if only new tenants are targeted. Research has shown that, with the right price and service offering, in excess of 70 percent of new tenants can be expected to accept the R-STS instead of the service offered by the local exchange carrier (LEC). With an average rental-unit turnover rate of seven percent (roughly equivalent to an average rental period of 12 to 18 months), penetration can quickly exceed 50 percent. The growth can be even more rapid in the case of new buildings.

R-STS meets all the criteria of an ideal entry vehicle for the cable companies to get into telephony.

Differentiation

The key to the success of residential shared tenant service is providing users with the right incentive to choose R-STS over the LEC's service. The ideas for differentiation—all based on better pricing, better service or a combination of both—are endless. The following is only a partial list of potential candidates.

First, providing the same quality of service as the LECs do, cable companies do not have to undercut the LECs' prices to compete. Local telephone companies cannot match the bundled offerings of combined voice and video services; nor can they offer users a combined telephone and cable TV bill. Incentives such as "free premium channel for six months if you use my phone service," or "certificate for one movie on pay-per-view every time you spend $50 on your telephone bill" can be effective selling propositions.

Second, a bundled service plan can be an attractive offer. Today, most LECs charge between $2 and $5 each month for individual features such as call waiting, call forwarding, three-way calling, speed dialing, and so on. There is no reason for cable companies to follow the same pricing scheme, especially in light of the fact that delivering these features results in little incremental cost to the service

provider. A bundled service that includes dial-tone and a set of calling features—at a price not much higher than the LEC's basic rate—would be extremely attractive to residents.

Third, cable companies may also offer a competitive toll rate to entice new customers. Traditionally, R-STS providers offered lower long-distance rates by contracting a specific carrier to provide interstate service. But today's long-distance market is highly competitive, with TV commercials for competing services constantly bombarding consumers. In this environment, the R-STS provider must allow users to switch long-distance carriers freely via a presubscribed "1+" capability. Cable companies may arrange to resell bulk long-distance service—essentially becoming interexchange carriers themselves—to provide tenants with a lower rate.

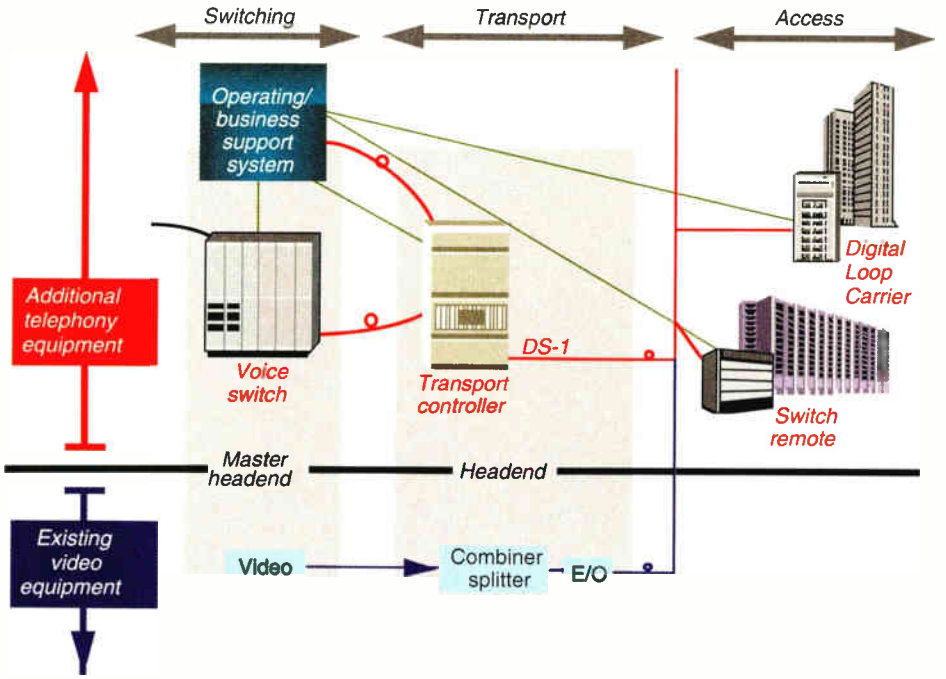
More substantial savings would come from intraLATA toll.[3] Still dominated by the LECs, intraLATA toll services are offered at a significantly higher rate than interLATA services provided by interexchange carriers.[4] Cable companies can extend equal access long-distance service to include intraLATA toll to give R-STS users tremendous savings, compared to LECs' rates.

Finally, in places where most MDU tenants are young professionals, data services can be a significant lure to attract customers. More likely to be early adopters of new information technologies, young professionals may be particularly interested in services such as work-at-home, high-speed data lines, Ethernet connection, Internet access, and so on.

Centralized network architecture

Like any other telecommunications network, a capable R-STS system would include three major components: switching, transport and access. A single centralized switch in the headend or "super-headend" can provide services to many R-STS sites, or MDUs. In most cases, the fiber-backbone portion of an HFC architecture is ideal for transport: a fiber drop into each campus more than meets the bandwidth requirement for R-STS. Each campus would be equipped with a switch remote or a digital loop carrier (DLC) to serve as the local switching vehicle. The in-building, twisted-pair wiring can distribute services to every home.

Centralized architecture for R-STS



This centralized architecture is different from traditional R-STS systems, in which an individual PBX at each location—with no centralized switching vehicle—is used to provide service. To cable companies, the centralized approach is far superior, and offers the following advantages:

✔ A centralized architecture takes full advantage of the cable company's right-of-way and backbone distribution network. And it's fully compatible with HFC technology when it's ready. Only the access vehicle—DLC/remote vs. cable modem box—is different. The rest of the system—switching, network connections, operational support system—is common.

✔ It facilitates centrally-managed operations, which translates into cost savings to cable companies.

✔ A centralized switch allows a single trunk group for external LEC access. In comparison, individual PBXs all require their own trunk connections to the LEC's network, thus disrupting the economies of scale.

✔ A centralized switch allows equal access in long distance service, which a PBX cannot accommodate. Also, the switch gives users service transparency when they convert their service from the LEC to the R-STS—the conversion does not require a different interface, should a user want to activate an equivalent feature. In contrast, a PBX requires proprietary equipment and a different user interface to provide services similar to those provided by the LECs.

Final words

In brief, R-STS *is* an ideal means for the cable company to enter the residential telephone market. With a properly designed centralized architecture, R-STS is also compatible with the future, when HFC and other technologies become mature. And, if offering full-fledged local telephone service sounds too risky to the cable company, R-STS can at least provide a good test-bed opportunity. After all, it would be extremely difficult to justify a business case for full residential telephony, if R-STS at MDUs cannot be profitable. CED

References

1. National Association of Regulatory Utility Commissioners, *NARUC Report on the Status of Competition in Intrastate Telecommunications*, 1993; in particular Table 9, pp. 178–197.

2. Some states prohibit, for example, the resale of local service at a profit. In such cases, margins can only come from value-added services, extra features, or long-distance charges. Other possible regulatory requirements (varied greatly from state to state) include measured rate for local service where available, "partitioned" switch (i.e., an individual switching vehicle connecting to the public network at each location), certification and tariffing.

3. "LATA" stands for "Local Access and Transport Area," a local calling area served by local exchange carriers.

4. Toll service within a LATA is traditionally served by LECs only. And although the majority of states have authorized IntraLATA toll competition, equal access provision is usually not mandated. The LECs remain default carriers of such calls when users dial "1+," resulting in continued high toll rates.

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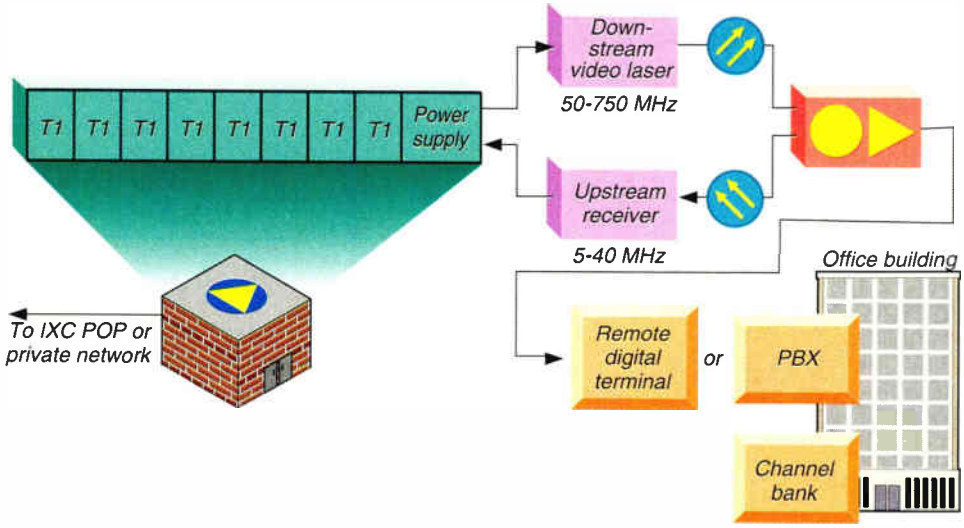

By Richard Lyford, Digital Technologies Project Director, Antec Corp.

For years, many have touted the advent of interactive services delivered over the broadband network. While advances in digital technology are making some of these interactive applications a reality, large scale implementation of these services remains at least a year or more away. Widescale deployment may take even longer.

Of interest to many in the industry are services that can be incrementally added to the broadband network in order to drive up revenues. As new revenues are generated, cable operators can position themselves to fully deploy interactive, full service network systems.

Telecommunications services to the small- or medium-sized business market meet this goal, because such services can be delivered via the broadband network currently in place. By adding low-cost modem devices at each end-user location, point-to-point telecommunications services can be deployed. Long-distance access, data connectivity, distance learning, private networking or other types of telecommunications services are all possible with low-cost modems. Each of these new services can contribute to short-term, potentially lucrative new revenue streams that broadband operators need to continue their migration to full service capabilities.

Point-to-point T-1 services

The T-1 (or DS-1) signal is one of the basic building blocks of the telecommunications network. T-1s consist of 24 individual voice or data channels. T-1 service is usually the lowest speed service offered for business access and requires an interface with channel bank-type equipment to demultiplex the voice or data signals into individual channels.

Developments in point-to-point T-1 modems–designed specifically for the broadband network–enable the same signal currently delivered via the telco's fiber/copper network to be delivered via the hybrid fiber/coax cable (HFC) network.

T-1 modems are not intended for systems seeking to compete directly with traditional access providers, but to enable the cable operator to extend typical access or private network services to small- to medium-sized businesses not well served by large access networks.

Two types of access opportunities exist where the T-1 modem could be used: alternate access and shared customer premise. The main difference between the two is that the alternate access provider (the network with facilities that connect the business or resident to an interexchange carrier's point-of-presence) approaches the interexchange carrier (IXC) as an alternative provider and gains the IXC's approval to provide such access services. In this case, each IXC assumes responsibility for network performance to the end customer and provides funds to the access provider to deliver signals to the IXC's network. This is the predominate approach used by the major existing access providers (MFS, Teleport, Wometco's ATI, etc.).

In the shared customer premise scenario, access providers typically approach the end user, rather than the IXC, and are paid directly by their business customers. This provider remains responsible for the quality and reliability in the access portion of their network.

In either case, low-cost T-1 modems provide the connectivity between the IXC and customer; the broadband plant simply becomes the conduit.

In the local arena, voice and data connectivity over the HFC network consists of private networks, distance learning and data connections (LANs or MANs). Rather than paying the telephone company to transmit this type of non-switched data point-to-point, the cable network can often offer these services for lower costs. Metropolitan area branch banks, for example, could use this service to transfer data to and from the main bank's computer center. A high school district could use the T-1 service to link classroom computers.

Working with T-1 modems

For example, a metropolitan college has a central location and two remote sites. The cable operator can provide the college with telephone services and data connectivity, in addition to traditional video service.

For the college to send a data file from one location to another, outgoing data signals from the central site would be fed into a channel bank and converted into the digital T-1 format (any unused capacity is bit-stuffed by the channel bank). From there, the digital signals are fed into the T-1 modem, which converts these signals to RF and transmits them upstream to the headend.

At the headend, another modem converts the signals from RF to digital and feeds them into the modular T-1 headend digital terminal. Output signals from the headend then enter the downstream T-1 modem, which converts the signals back to RF and feeds the downstream signals to the receiving location. At that site, the T-1 modem converts the RF back to digital, feeds signals into the channel bank/PBX sys-

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tem which demultiplexes the T-1 into 24 single channels, and delivers those signals to the phone or computer at the receiving location.

Why is this better than existing telco service? Cable operators can use the existing network, helping to keep costs low for their customers. This incremental service also paves the way to greater interactivity potential in the future. True multimedia distance learning would combine voice, video and data capabilities and allow students to simultaneously work, talk and learn together.

For the cable operator, broadband T-1 modems use existing coaxial capacity. Each downstream T-1 signal occupies just 1 MHz of bandwidth anywhere in the 50 MHz to 750 MHz range. Upstream T-1 signals occupy 1 MHz of bandwidth and could be placed anywhere from 5 MHz to 40 MHz. This means that six T-1 signals could then be transmitted in the space of one 6-MHz channel.

The small amount of spectrum required for the T-1 modem means that virtually any size cable system should have bandwidth available for at least one to four T-1s per node. As demand builds, bandwidth allocated to T-1 services could grow.

In high demand areas, trade-offs can be made between channels that enjoy only low subscriber interest and potentially lucrative T-1 services because T-1 service can be segmented on a node-by-node basis. T-1 applications in some areas could virtually eliminate the need for traditional cable channels to open up the spectrum for all-node telecom services.

With the increasingly varied usage of the HFC network comes new operational necessities. Transmission quality, network reliability and network availability all become important factors when carrying not only video, but voice and data as well.

Modularity

T-1 modems should have the ability to perform loopback testing at both ends in order to verify the performance of the network, and this is especially important at the time of equipment installation. Continuous network monitoring through "errored seconds" reporting will provide performance data and should trigger alarms, if performance degrades beyond acceptable levels. In this manner, the operator can set up and maintain the performance required when transmitting voice and data, all via software, at either end of the link.

Modularity of broadband T-1 systems is also of concern. One T-1 modem design would allow up to eight T-1 modems per shelf to save on space and facilitate monitoring of the network. This modularity means new equipment can be added incrementally as business demand builds.

By using the cable network to extend voice and data services to the small- to medium-sized businesses that are often difficult to access, two things occur. First, a new market is now available to the operator that is easy to enter, already passed by the broadband network, and is a source of new revenue. Second, the cable network's assets are now more fully utilized, with little incremental capital expended and a relatively short payback.

As broadband network operators scramble to prepare for the interactive services future, product vendors are scrambling to complete development and successfully test their products. While few doubt that these interactive services will someday be a reality, the questions remains: When is "someday"?

New interactive service systems will be more complicated than traditional video networks, presenting a gamut of technology and operating requirements that are still foreign to traditional cable television providers. Therefore, any incremental interactive service should be simple to implement and easy to deploy.

Before federal policy is changed to allow cable operators to jump into the telephony business full force, T-1 modems focused on the small- to mid-size business can begin increasing revenues derived from the HFC network and give operators a chance to learn how interactive applications can be managed.

By offering a smaller-scale interactive service, like alternate access or point-to-point data connectivity, operators can gradually come to terms with the operational needs of the interactive network and become familiar with the technology, personnel requirements and revenue potential of entering different interactive arenas.

When full service networks are fully installed and widely available, operating and managing these networks will become more complicated. Sophisticated Operational Support Systems (OSS) will be required, as will a new breed of technician.

Conclusions

T-1 services provide the means to understand these operational concerns immediately, on a simple, cost-effective level, without making the jump from a downstream-only video system to the full service network. The lessons learned from a more straightforward interactive application today will prove invaluable when other interactive applications come onto the system in the future. CED

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Competition for the local loop

Wireless technologies and PCS applications

By Raymond Schulz, Vice President–Wireless Business Development, GLA International

The Federal Communications Commission, as part of an effort to stimulate cellular and local exchange telephone service competition (and respond to commercial interests for more spectrum with which to introduce new telecommunications services) has auctioned spectrum for Personal Communications Services (PCS). These auctions began last summer with the national and regional licenses for narrowband spectrum (primarily for advanced messaging services) and on December 5, 1994 for broadband spectrum (primarily to be used for voice services). While spectrum licenses were granted at no cost to cellular operators in the 1980s, the FCC has responded to a Congressional mandate to conduct spectrum auctions to raise funds for the U.S. Treasury. More than $650 million was received in the narrowband PCS license auctions.

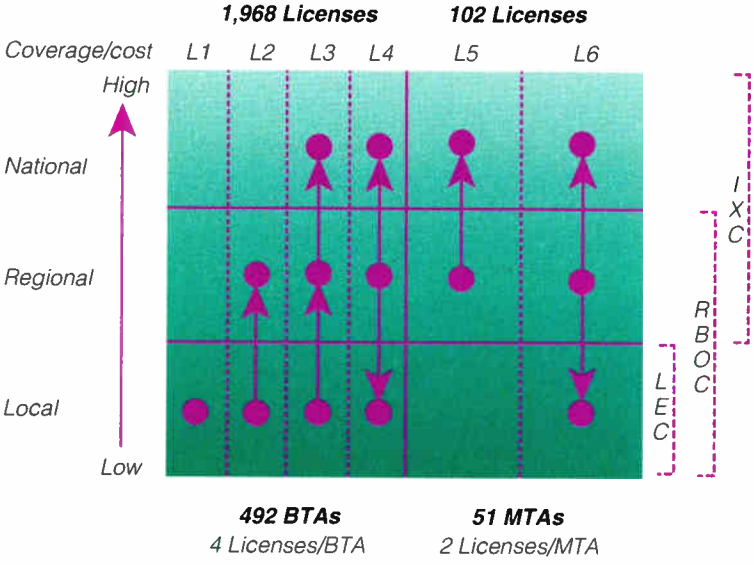
Cable MSOs participating in the broadband PCS spectrum auctions include: Comcast, TCI and Cox Cable. Several of these companies participated in early technology/service trials for proposed Personal Communications Services technologies/service offerings. And Cox Cable was granted a Pioneer's Preference award for the Los Angeles/San Diego Major Trading Area (MTA). MTA license awards were also granted to Omnipoint Corporation and American Personal Communications. As of the writing of this article, the MTA auction bids in round 41 total more than $3.5 billion for 99 licenses as the auction process moves on to Phase three.

Table 1: Final FCC PCS broadband spectrum plan–June 9, 1994

Channel block	Bandwidth (MHz)	Frequency (MHz)	Tx/Rx guard band (MHz)	Service areas (*)	Licensed or unlicensed spectrum
A (30 MHz)	30	1850-1865/1930-1945	80	MTA	L
B (30 MHz)	30	1870-1885/1950-1965	80	MTA	L
C (30 MHz)	30	1895-1910/1975-1990	80	BTA	L
D (10 MHz)	10	1865-1870/1945-1950	80	BTA	L
E (10 MHz)	10	1885-1890/1965-1970	80	BTA	L
F (10 MHz)	10	1890-1895/1970-1975	80	BTA	L
U	10	1910-1920	NA	NA	U
U	10	1920-1930	NA	NA	U

(*) MTA: Major Trading Area; BTA: Basic Trading Area; U: Unlicensed Spectrum; L: Licensed Spectrum; NA: Not Applicable

Figure 1: PCS license/coverage strategy map



PCS

When the FCC initiated its Personal Communications Service Docket 90-314 in 1990, it sought industry input as to what constituted a "personal communications service," or PCS, and how much RF spectrum would be required by these services (and where in the RF spectrum these services should reside). Responses to this docket included wireless data, wireless voice, wireless video, advanced messaging and satellite-based services as PCS services. Spectrum requests in support of proposed PCS services also varied, with most interest focused in a band near 2 GHz. A widely supported view of PCS defines the service as an affordable mass market wireless voice service that would compete with existing cellular telephone services. This mass market wireless voice PCS service definition includes the following characteristics:

- ✔ a "follow-me tetherless" service capability;
- ✔ a unique PCS service access code ("500" service);
- ✔ a user "service profile" database;
- ✔ user mobility across networks;
- ✔ service portability across networks;
- ✔ macrocell/microcell coverage;
- ✔ potential use of a "smart card" with a standard handset (as a service registration database);
- ✔ a paradigm shift from offering "mass services" to "mass customization" of services; and,
- ✔ an intelligent network infrastructure that maintains a database of the physical location of the mobile station to permit calls to follow the subscriber wherever he/she travels.

With this diversity of input received from docket respondents, the FCC elected to adopt a broad definition that described PCS as: "a

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Glossary of terms/acronyms

BTA (Basic Trading Area). *A basic economic trading area defined by Rand McNally in terms of state county boundaries.*

CDMA (Code Division Multiple Access). *A method of digital wireless telecommunications transmission allowing a large number of users to simultaneously access a single radio frequency channel by allocating unique code sequences to each user across each channel. Users share the full bandwidth of the channel (reuse factor of 1/1).*

CELP (Code Excited Linear Prediction). *A form of voice coding to improve spectrum efficiency of the voice signal.*

DQPSK. *Differential Quadrature Phase Shift Key modulation.*

ESMR (Enhanced Specialized Mobile Radio). *An improved SMR radio access scheme where digital SMR channels are used in a cellular topography to provide cellular-like telephone service.*

FDD (Frequency Division Duplex). *An allocation of spectrum where one band is used for the transmit direction, and a second band is used for the receive signal to provide a two-way channel.*

GMSK. *Gaussian Minimum Shift Keying modulation.*

IXC (Interexchange Carrier). *The classification of telephone carriers that switch and route long distance traffic between LATAs (local access and transport areas).*

LATA (Local Access and Transport Area). *Geographic telephone service areas created at the time of the AT&T divestiture within which the RBOCs provide local exchange and toll long distance (toll) telephone services. Traffic between LATAs must be carried by IXCs.*

LEC (Local Exchange Carrier). *The telephone carrier that provides basic local exchange service to subscribers in franchised market areas.*

M16QAM Modulation. *Modulation is the process of adding information to the radio carrier wave that alters its size, frequency or phase of the carrier signal to represent the information content. More advanced modulation can increase the density of the information put on the signal. Motorola's unique M16QAM technology allows each divided information pathway to transmit at a 64 kilobit-per-second rate.*

MSAs (Metropolitan Statistical Areas). *The 306 largest urban population markets as defined by the U.S. government; each has two licensed cellular-service operators.*

MTA (Major Trading Area). *A major economic trading area defined by Rand McNally, determined by state county boundaries or BTAs.*

POP. *A term for the population in the area served by a carrier. An area with a million people is said to have one million POPs - a million potential customers.*

QCELP (Qualcomm Code Excited Linear Prediction). *Qualcomm's proprietary voice coding to improve spectrum efficiency of the voice signal.*

QPSK. *Quadrature Phase Shift Key modulation.*

RBOC (Regional Bell Operating Company). *One of seven regional telephone companies that were created at the time of the AT&T divestiture.*

RELP (Residual Excited Linear Prediction). *A form of voice coding to improve spectrum efficiency of the voice signal.*

RSA (Rural Service Area). *A mobile cellular service area that covers geographic areas outside the boundaries of MSAs.*

SMR (Specialized Mobile Radio). *SMR is the traditional analog, dispatch-oriented, shared trunk radio system. Subscribers pay a system operator a fee for using their mobile and portable two-way radios on the operator's infrastructure and spectrum.*

Spectrum. *Spectrum consists of a continuous range of electromagnetic frequencies and their associated waves. Spectrum licenses granted by the FCC provide exclusive use of a band of frequencies for specific communications applications, such as cellular and satellite services.*

Spectrum efficiency. *The quantity of users or services that can be simultaneously supported by a limited radio frequency bandwidth in a defined geographic area. In analog systems, spectrum efficiency is measured in terms of bandwidth per voice channel. In digital systems, the measure is in bits/Hz.*

TDMA (Time Division Multiple Access). *A method of digital wireless communications transmission, allowing a large number of users to access (in sequence) a single radio frequency channel without interference by allocating unique time slots to each user within each channel.*

VSELP (Vector Sum Excited Linear Prediction). *A form of voice coding to improve spectrum efficiency of the voice signal.*

family of mobile or portable radio communications services which could provide services to individuals and be integrated with a variety of competing networks."

The FCC elected to allocate spectrum to PCS services and let market forces and commercial interests define the services used within the various licensed bands. In June 1994, the FCC finalized the spectrum allocations for broadband PCS. These allocations are summarized in Table 1.

These spectrum bands are referred to as the Broadband PCS bands. Major Trading Areas (MTAs) and Basic Trading Areas (BTAs) are economically defined market areas developed by Rand McNally. These coverage areas are geographically more extensive than existing licensed cellular telephone service areas and are defined by county boundaries.

Cellular licensing history

Cellular service areas were geographically defined in terms of Metropolitan Service Areas (MSAs) and Rural Service Areas (RSAs). Licenses for the top 30 MSA markets (as measured by population count or POPs) were allocated by the FCC to non-wireline (A carriers) and wireline (LECs–B carriers) service operators. The FCC's objective in issuing two licenses per market was to provide a duopoly source of service supply and encourage competitive market forces. MSA markets 31-120 were divided among non-wireline applicants through pre-lottery settlements and alliances. MSA markets 121-305 and the RSA markets were allocated by the FCC through a lottery process. Table 2 provides a summary comparison of the number of PCS MTAs/BTAs versus cellular's MSAs/RSAs and the number of associated licenses.

ESMR enters the picture

Today, competition in wireless voice services is limited to two cellular service suppliers. By 1995-1996, Enhanced Specialized Mobile Radio (ESMR) operators will emerge as a third (but digital) wireless cellular service supplier in major markets using 800 MHz spectrum licenses acquired from Specialized Mobile Radio (SMR) operators. Upon completion of the broadband spectrum license auctions, six more (two MTA + four BTA) potential licensed operators may offer cellular-like voice services–creating a highly competitive market of nine potential service suppliers in a given geographic service area. If broadband PCS entrants elect to go into head-to-head competition with "me-too" cellular-like services for the same customer segments (with the added costs of spectrum acquisition), a

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Table 2: Cellular and broadband PCS

Service	Cellular (*)		Broadband PCS (**)	
Markets	MSAs	RSAs	MTAs	BTAs
Number of Mkts.	305	428	51	492
Licensees/Mkt.	2	2	2	4
Total Licenses	610	856	102	1,968

(*) MSAs and RSAs are mutually exclusive geographic coverage
(**)MTA markets overlap BTA markets

costly market and financial battle will ensue. It is very questionable whether sufficient market price/demand elasticity exists to support nine cellular-like voice service operators in any given market. Broadband PCS infrastructure costs must achieve significant reductions relative to incumbent operators to successfully compete and seek niche market opportunities as a way to differentiate their services. This competitive environment is illustrated by the broadband PCS License/Coverage Strategy Map in Figure 1.

The local, regional and national coverage of the BTAs/MTAs are depicted in relation to the traditional telephone markets of the local exchange carriers (LECs), Regional Bell Operating Companies (RBOCs) and the interexchange carriers (IXCs). The geographic coverage of PCS licenses map to natural competitors within incumbent landline service markets. The strategy "bullets" illustrate where a PCS licensee may elect to enter the market, and the arrows illustrate how licensees may choose to evolve their market strategy.

PCS technologies

Various technologies have been proposed to support PCS services, and it is widely expected that digital access schemes will be deployed to more efficiently use the acquired spectrum and provide an increased level of communications security for subscribers. Table 3 summarizes the major digital technologies proposed for U.S. and European cellular systems and compares their voice channel capacities. It is widely expected that PCS technologies will be derivatives of the technologies developed for cellular and re-positioned for application within the 1850-1990 MHz spectrum band.

A detailed discussion of each entry within this table is beyond the scope of this article; however, more details are provided in GLA International's report, "Wireless Technologies and PCS Applications." Major decisions that must be made by each PCS licensee include which markets to enter, what services to offer and which technologies to use to deliver these services. Not all PCS licensees will elect to compete with incumbent cellular operators, and some will likely compete in local exchange markets. Long-term technology trends indicate the wireless infrastructure will evolve to support both mobile and fixed wireless service applications. This trend is already taking place with cellular operators who are deploying microcells for in-building coverage applications such as the wireless PBX stations.

MSO opportunities

The primary business objective for cable MSO participation in the broadband PCS auctions is to acquire spectrum that allows them to become full service network providers using the existing broadband CATV distribution networks to deliver telephony services, thus increasing their service revenue base. Their core business will experience increased competitive pressures from Direct Broadcast Satellite (DBS) services, wireless CATV services and the LECs.

MSOs expect the LECs to quickly enter the CATV business once regulatory barriers on cross-ownership are removed. Most PCS BTA/MTA market areas will overlap highly fragmented CATV franchises. Any MSO that acquires a PCS license must quickly form a business consortia with others that have a shared competitive communications vision to maximize PCS license opportunities and minimize capital expenditures.

MSOs already own distribution facilities that can be used to deliver PCS services, pole rights that can be used for base stations and

Table 3: U.S. and European digital cellular system parameters

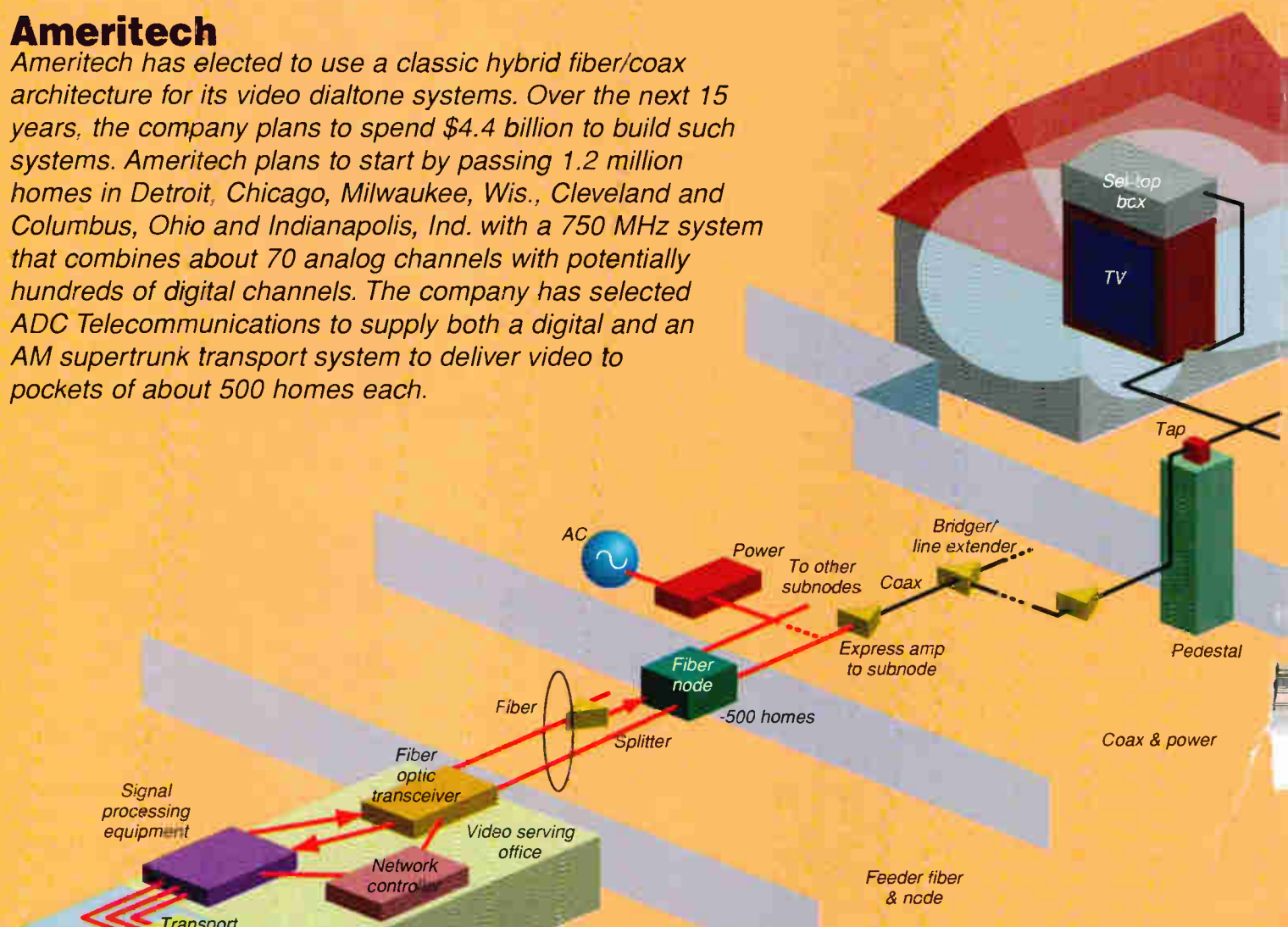
Radio system parameter	IS-54 (Digital mobile phone service)	E-TDMA (Extended Time Division Multiple Access)	IS-95 Q-CDMA (Qualcomm Code Division Multiple Access)	ESMR (Enhanced SMR) Motorola proprietary	GSM (European digital standard)
Multiple access method	TDMA	TDMA	CDMA	TDMA	TDMA
Duplexing method	FDD	FDD	FDD	FDD	FDD
Modulation	π/4 DQPSK	π/4 DQPSK	QPSK	M16QAM(*)	GMSK(**)
Voice channel coding	8 kbps VSELP	4 kbps CELP	8,4,2,1-kbps variable rate QCELP	7.2 kbps VSELP	13 kbps RELP
TX freq.: (MHz) base mobile	869-894 824-849	869-894 824-849	869-894 824-849	806-821 851-866	890-915 935-960
RF channel size	30 kHz	30 kHz	1.25 MHz	25 kHz	125 ch. @ 200 kHz
Channel rate	48 kbps	48 kbps	1.228 Mbps	64 kbps	270.8 kbps
Spectral efficiency	1.6 b/Hz	1.6 b/Hz	0.98 chips/sec	1.77 b/Hz	1.35 b/Hz
No. of voice ch./RF ch.	**3**	**10-15**	**20-30**	**5.5**	**8**
Frequency reuse	1/7	1/7	1/1	1/3 to 1/4	1/3 to 1/7
Duplex voice channel size	20 kHz (3/RF pair)	20 kHz (3/RF pair)	All share 2.50 MHz	50 kHz	400 kHz
Voice bit rate	8 kbps	4 kbps	8,4,2,1-kbps	7.4 kbps per time slot	13 kbps
Handset xmit PwerMax/avg (Mw)-portables	600/ 200	600/ 200	200/6	1W-portable 3 watts stationary	5W, 8W, 20W 0.8W
Max cell radius (***)	>32 km	>32 km	>32 km	6-8 km urban 24-32 km rural	35 km

(*) Proprietary Motorola modulation scheme
(**) Gaussian-minimum shift keying
(***) Maximum cell radius is a function of propagation characteristics and established base station power limits

CED Telc

Ameritech

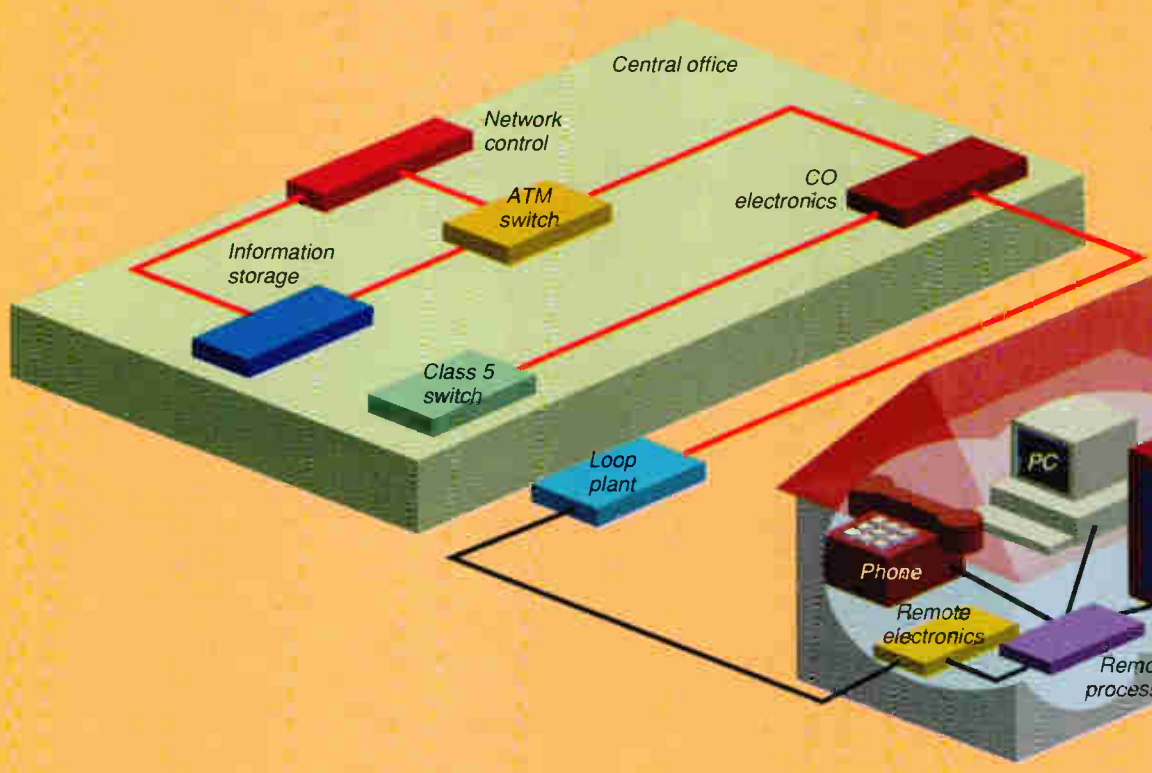
Ameritech has elected to use a classic hybrid fiber/coax architecture for its video dialtone systems. Over the next 15 years, the company plans to spend $4.4 billion to build such systems. Ameritech plans to start by passing 1.2 million homes in Detroit, Chicago, Milwaukee, Wis., Cleveland and Columbus, Ohio and Indianapolis, Ind. with a 750 MHz system that combines about 70 analog channels with potentially hundreds of digital channels. The company has selected ADC Telecommunications to supply both a digital and an AM supertrunk transport system to deliver video to pockets of about 500 homes each.



BellSouth

BellSouth, which invested mill is using equipment from Scien trial. The system uses a combi coaxial cable to deliver 750 MH customers. Several fibers (two sig ce

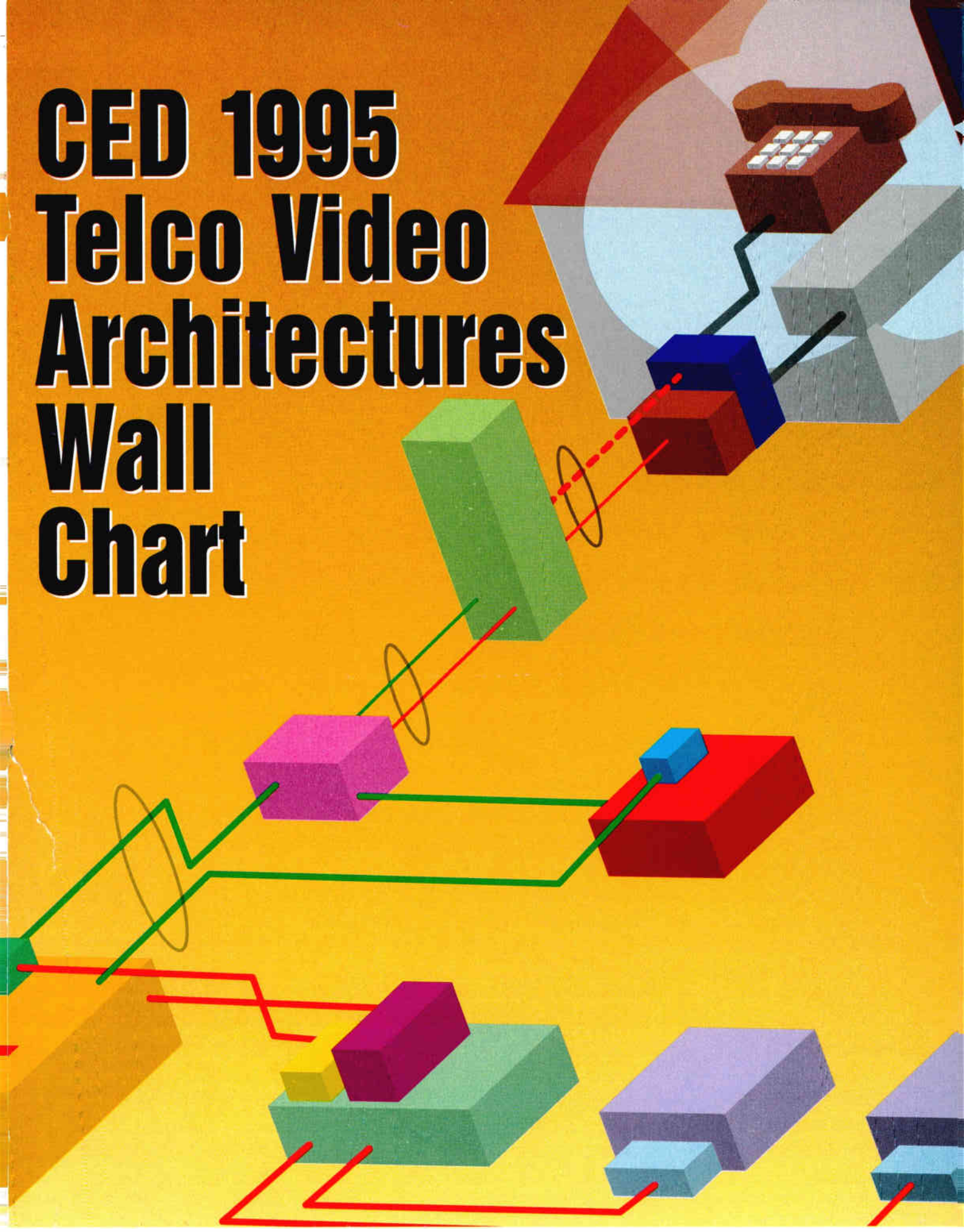
a technolc interface on th coax trial slated for s



Nynex

Nynex has been trialing v under the "Liberty Trial," w video signals to 2,5 rise apartment b interactive serv VCR functio services. E video se fiber/co office in V future tha analog ch dialtone" Raynet to components Digital Equipment and Zenith for the in-hom

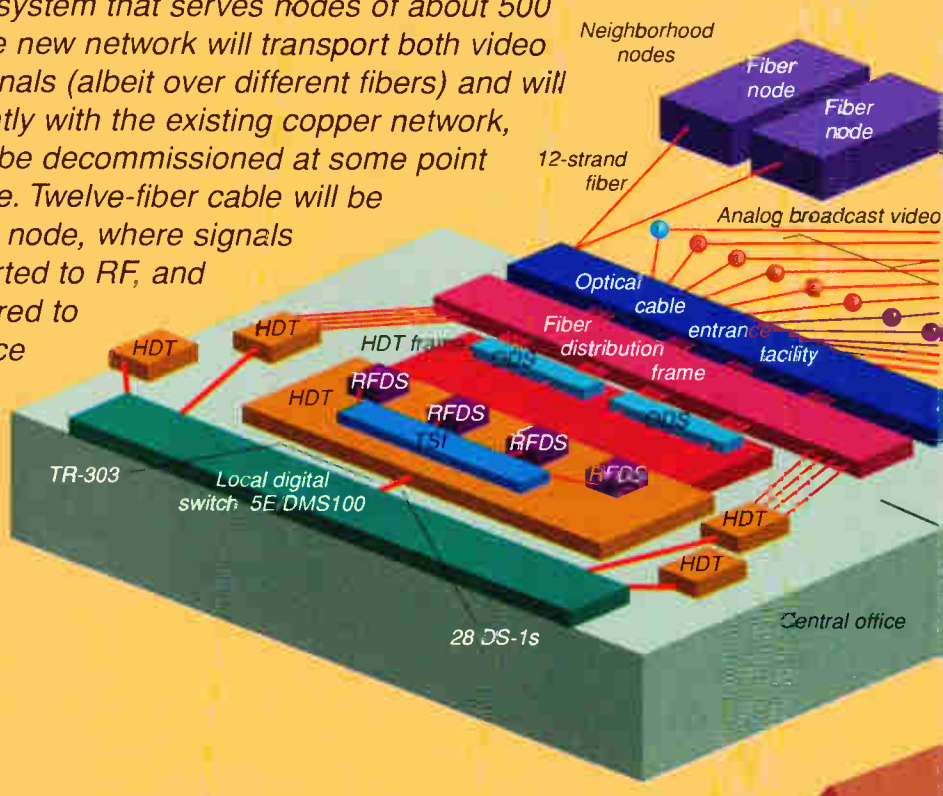
CED 1995 Telco Video Architectures Wall Chart

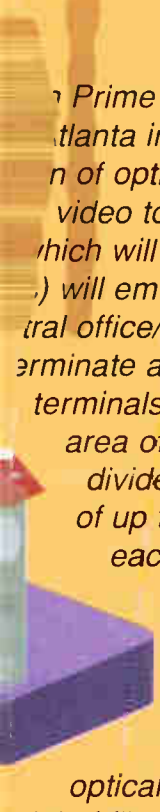


o Video Arch

Pacific Bell

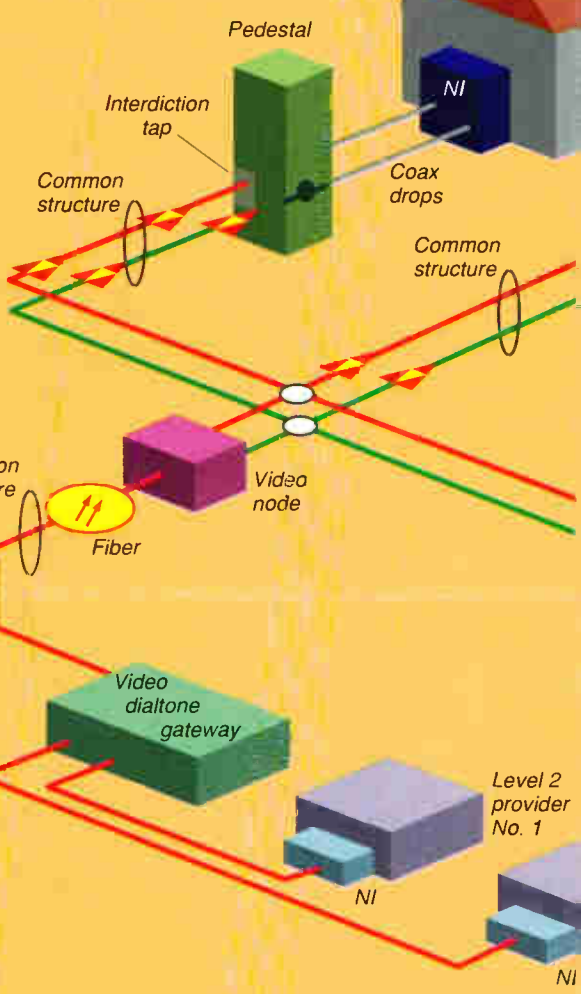
Pacific Bell has chosen to work with AT&T to deploy a 750 MHz hybrid fiber/coax system that serves nodes of about 500 homes each. The new network will transport both video and telephony signals (albeit over different fibers) and will operate concurrently with the existing copper network, which is slated to be decommissioned at some point in the future. Twelve-fiber cable will be deployed to each node, where signals are converted to RF, and ultimately delivered to network interface units mounted on the side of the home.





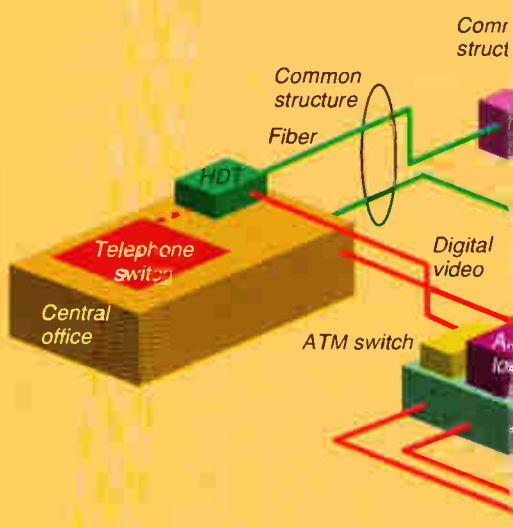
Prime Management Co., tlanta in its Atlanta video n of optical fiber and video to 12,000 hich will carry video .) will emanate from the tral office/headend and erminate at remote terminals. The serving area of each RT is divided into subnodes of up to 100 homes each. From there, video will ride on coax to the home. The coax will also transport power to optical network units for trial of fiber-to-the-curb gy and to a network e home for a telephony-over- ometime next year.

Omaha only



ideo provision in Manhattan hich provides voice and 00 residents in three high- uildings. Fifty get full vice, complete with virtual nality and on-demand video But Nynex will actually deploy rvice via a 750 MHz hybrid ax network out of a central Warwick, R.I. in the very near t will offer 80 conventional annels and up to 320 "video channels. Nynex has selected provide network Fujitsu for ATM switches, Corp. for the video servers e set-tops.

New US West architecture



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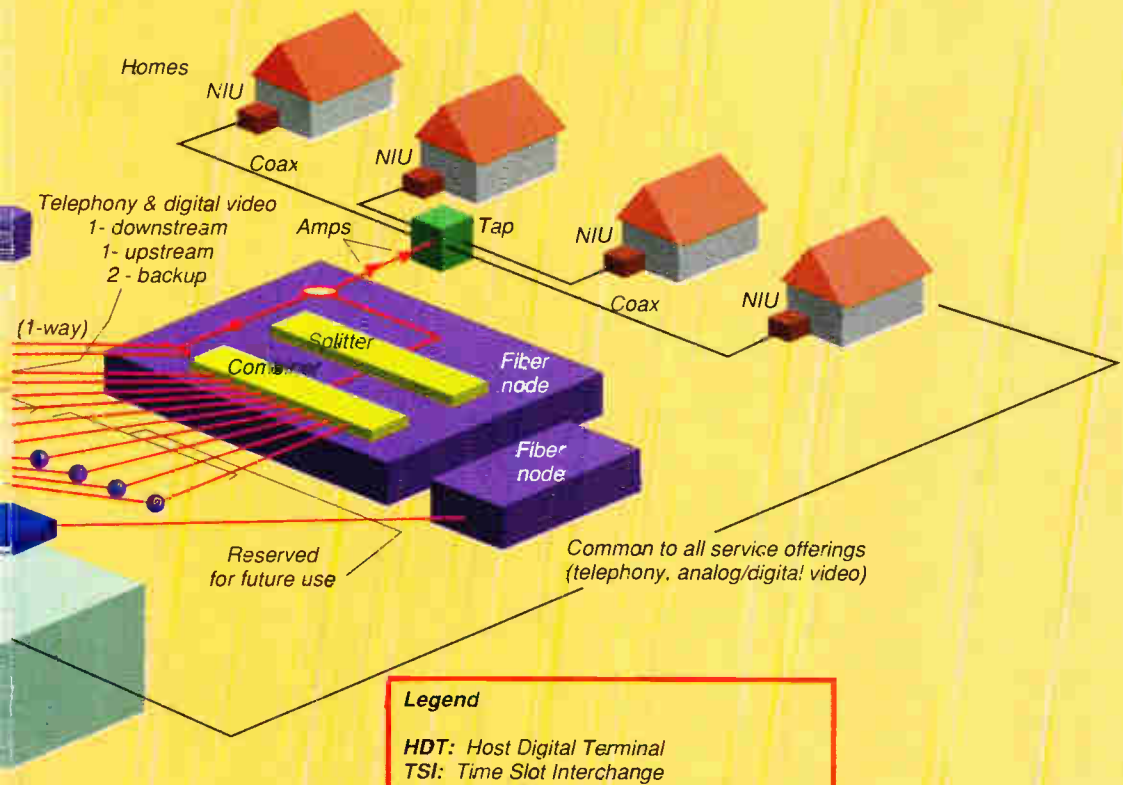
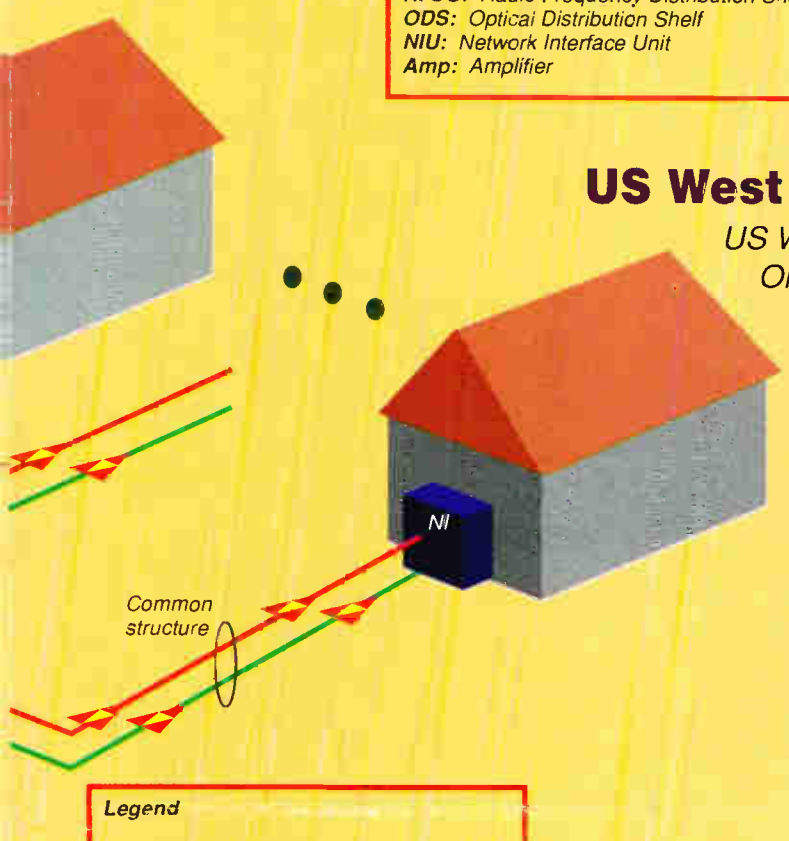


Legend

HDT: Host Digital Terminal
TSI: Time Slot Interchange
RFDS: Radio Frequency Distribution Shelf
ODS: Optical Distribution Shelf
NIU: Network Interface Unit
Amp: Amplifier

US West

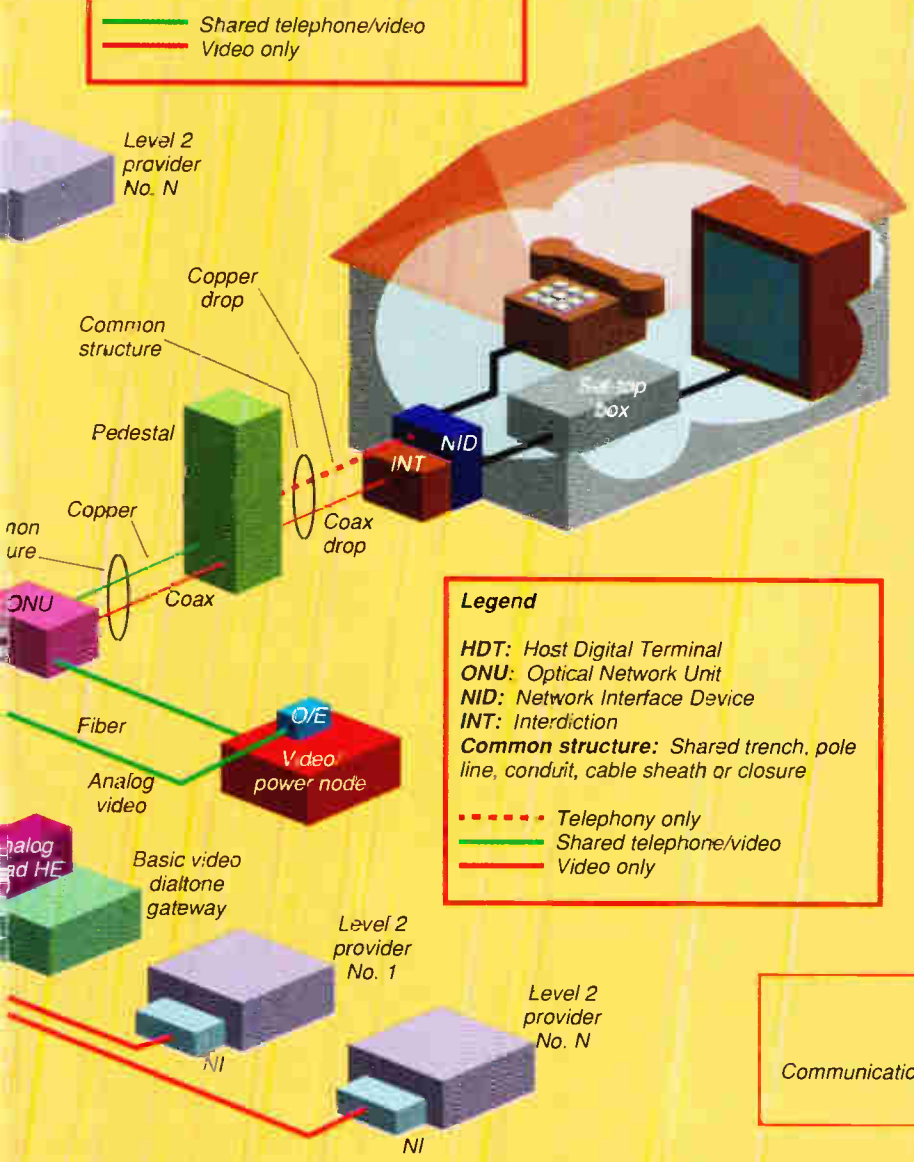
US West's first video dialtone deployment, in Omaha, Neb., delivers video and telephony signals over a common structure to a video node. From there, the two services are sent over separate coaxial cables, with the video passing through an interdiction unit housed in a pedestal. Network interface devices on the side of the home feed signals to coax and twisted pair in the home. US West's latest architecture integrates the two services even more, all the way to the curb. Interdiction units have been moved to the side of the house, adjacent to the NID. This new network is the one the RBOC intends to deploy throughout its 14-state territory, including Denver, Boise, Portland, Ore. and Minneapolis/St. Paul, Minn. for starters.



Legend

INT: Interdiction
Common structure: Shared trench, pole line, conduit, cable sheath or closure

Shared telephone/video
Video only



Legend

HDT: Host Digital Terminal
ONU: Optical Network Unit
NID: Network Interface Device
INT: Interdiction
Common structure: Shared trench, pole line, conduit, cable sheath or closure

Telephony only
Shared telephone/video
Video only

Very much the pion different meth known hybrid fiber/ to deploy in Balti Roads, Va. and nor system from Broa about 24 homes e offered to residents also testing asymm technology, wh signals and sends th pairs to an in-home the most ex

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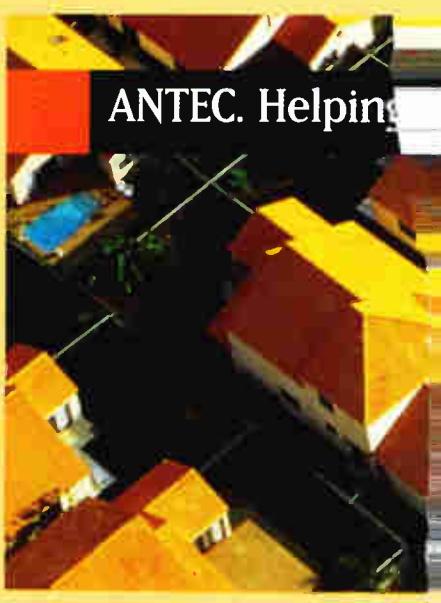
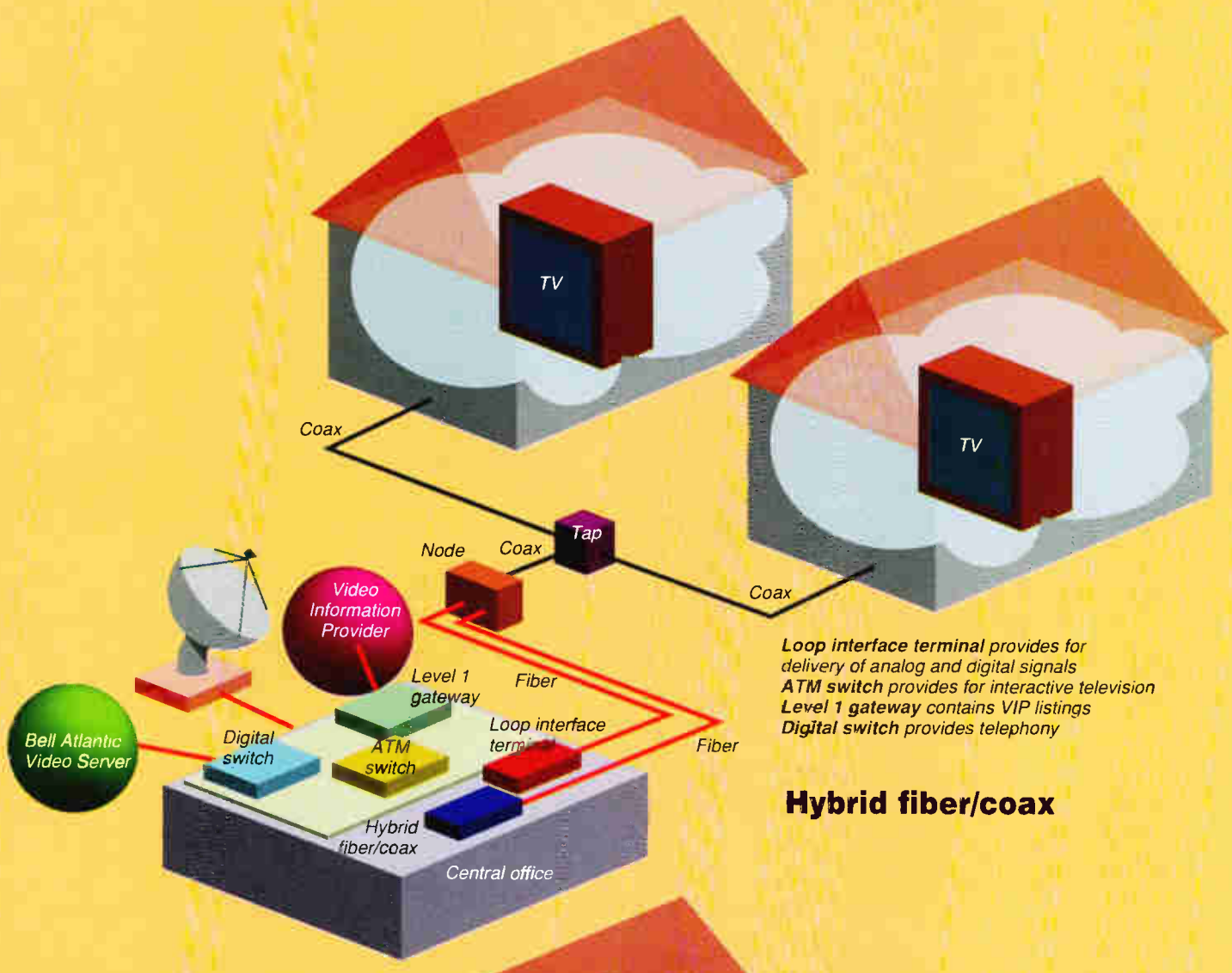
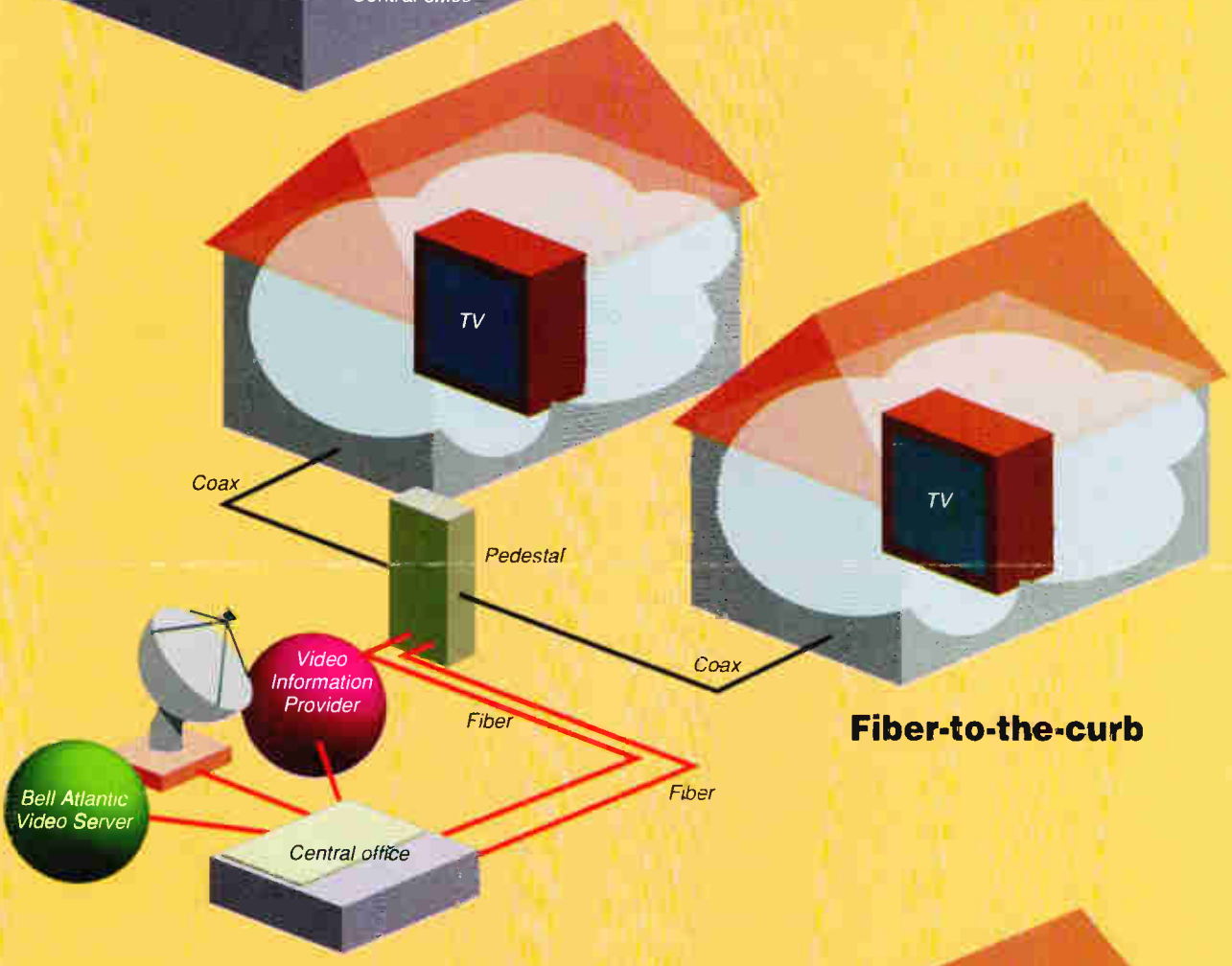


all Chart



***Loop interface terminal** provides for delivery of analog and digital signals*
***ATM switch** provides for interactive television*
***Level 1 gateway** contains VIP listings*
***Digital switch** provides telephony*

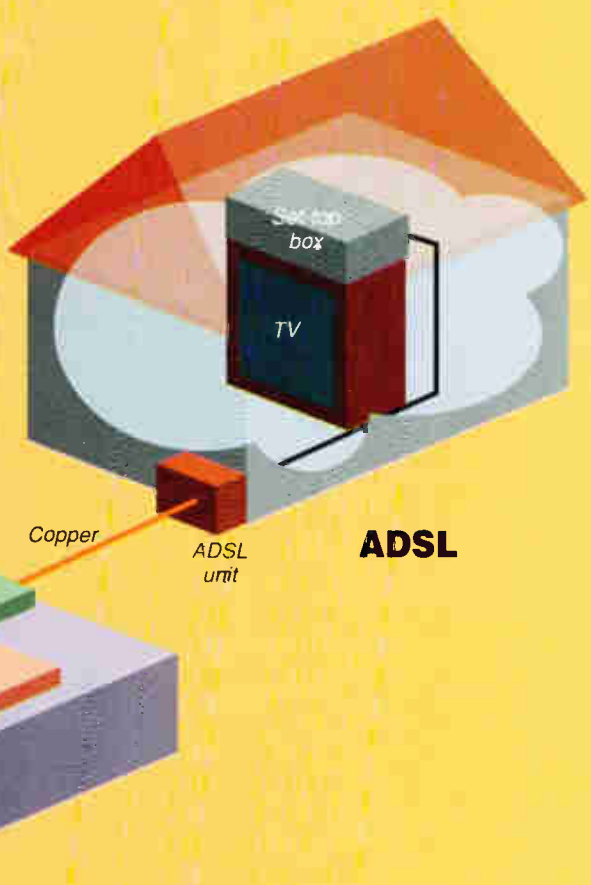
Hybrid fiber/coax



Fiber-to-the-curb

Bell Atlantic

eer among the Bell companies, Bell Atlantic is testing three ods to deliver video to its customers. In addition to the well- oax equipment from AT&T and General Instrument it plans more, Washington, D.C., Philadelphia, Pittsburgh, Hampton thern New Jersey, the company is using a fiber-to-the-curb dBand Technologies that takes fiber to pedestals that serve ach. This "switched digital" alternative will be in Dover Township, N.J. Bell Atlantic is etrical digital subscriber line (ADSL) ich compresses the video em over existing copper decoder. It is considered pensive method of video delivery.



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Wendell Woody, Executive Director, Cable Television Sales, Sprint/North Supply

"I wait for it. I always keep it and use it."

Joe Van Loan, Sr. V.P. Engineering, Cable Vision Industries

right-of-way access to building entrance facilities. The Teleport Communications Group (TCG) model developed for multi-MSO participation in competitive access services may be appropriate for PCS. MSOs could remain focused initially on the business segment (as with competitive access) and expand to the consumer segment or elect to aggressively go after the consumer market in their initial business plan.

The MSO-telephony business model is currently being created in the United Kingdom (U.K.), where cable operators can provide telephone services in their franchised markets. U.K. cable operators quickly attained 15-20 percent market shares for local telephone service in their franchised markets. Telephony/PCS revenues will help to offset competitive losses to DBS/LEC entry into CATV services. Additionally, MSOs do not have interexchange carrier business restrictions to keep them from becoming end-to-end regional service providers and deploying statewide interconnect networks. Consumer PCS may be a better fit for MSOs than business PCS, since the MSO's embedded customer base is predominantly residential. Distribution channels and telemarketing forces already exist to serve consumers. These same resources can be used to market consumer PCS services.

MSOs' lack of telecom expertise is a major weakness, and a partnering approach that includes these skill sets can fill this gap

The major disadvantages that the MSO has relative to the LEC are the limited geographic coverage of its core cable TV franchise area, and a shortage of telecommunications business skills.

Thus, strong consortia relationships will be key factors to success. MSOs' lack of telecommunications expertise is a major weakness, and a partnering approach that includes these skill sets can fill this gap.

Competitive forces unleashed by the FCC's PCS license initiative pose both opportunities and threats for MSOs. A business strategy that properly balances market objectives with technology adoption, while leveraging the MSO's existing broadband infrastructure to achieve cost advantages, should prove successful. The reward will be increased revenues supported by an efficiently deployed infrastructure (i.e., investment).

Threats are related to inadequately defined service plans/objectives that may divert critical resources from the core business and negatively impact financial performance. Competitive forces currently being unleashed in both the core CATV business and in telecommunications will prove beneficial to consumers. The competitor that offers the best package of services over the most efficient infrastructure will be the market winner. CED

ATM: Sure thing, or leap of faith?

Switch cost makes future cloudy

By Alan Stewart, contributor

Asynchronous Transfer Mode (ATM) is being hailed by many in the telecommunications arena as the solution for switching bursty computer data, voice conversations and constant bit rate (CBR) video from one source to another. But for ATM to play out economically for the cable industry, MSOs need to foster lasting relationships with large businesses and/or governments to help pay for the switching hardware.

Backbone ATM switches are among the most complex and expensive telecommunications devices yet developed. A large switch with several gigabits of capacity can easily cost more than $1 million. And because they are still in the developmental phase, many of the required standards remain to be written. Despite this, most observers believe ATM will form an integral part of a future National Information Infrastructure (NII).

Broadband ATM switches are designed to process trillions of small, fixed-length cells containing 48 octets (bytes) of end-user information, and five octets of call processing data. Although these 53-byte cells are capable of carrying bursty computer data and constant bit rate (CBR) voice and video signals, different switch interfaces are required to accommodate them. Much of the work of the ATM Forum is devoted to developing signaling and switching protocols that will provide a standard interface for all kinds of multimedia information.

Are the big switches ready?

Although this "full service" capability is required in a backbone switch, none of those currently on the market have this ability, because they are at the early development stage. Peter Bracket, research manager at BellSouth's Advanced Data Network Group, notes that many of the features that vendors have touted in their ATM products will not be available until next year, because both hardware and software changes are needed, and the way these are implemented depends on the particular supplier involved. Vendors such as Fujitsu, AT&T and Northern Telecom are already moving to second-generation switches to improve their ability to handle both computer and video traffic simultaneously.

"As ATM technology progresses, you'll see architectural changes in both the hardware and software areas," Bracket predicts. "For example, Fujitsu plans to introduce its Enhanced Switch Platform next year." This is an evolution of its first-generation backbone ATM switch, the FETEX-150, with a more flexible architecture that is 80 percent smaller in size.

Bracket characterizes ATM switches in several capacity ranges: under 2.0 Gbps capacity, under 20 Gbps, and ultimately, under 200 Gbps. "There are lots of companies making switches in the 2 Gbps to 10 Gbps capacity range," says Brackett, "but only two or three are talking about 200 Gbps capacity." It should also be noted also that the capacity alone does not determine the traffic handling ability of the switch, as other factors such as type of traffic also have an impact.

"Information throughput on a quality of service basis is probably a better measure of switch performance than raw capacity," says Philip Presworski, director of broadband network systems engineering at Nynex. "This depends on the way that bursty traffic is buffered within the switch fabric. If the buffer algorithm is not designed correctly, traffic handling ability drops dramatically. On a 622 Mbps pipe with bursty traffic, you could lose

Figure 1: *Time Warner's Full Service Network.*

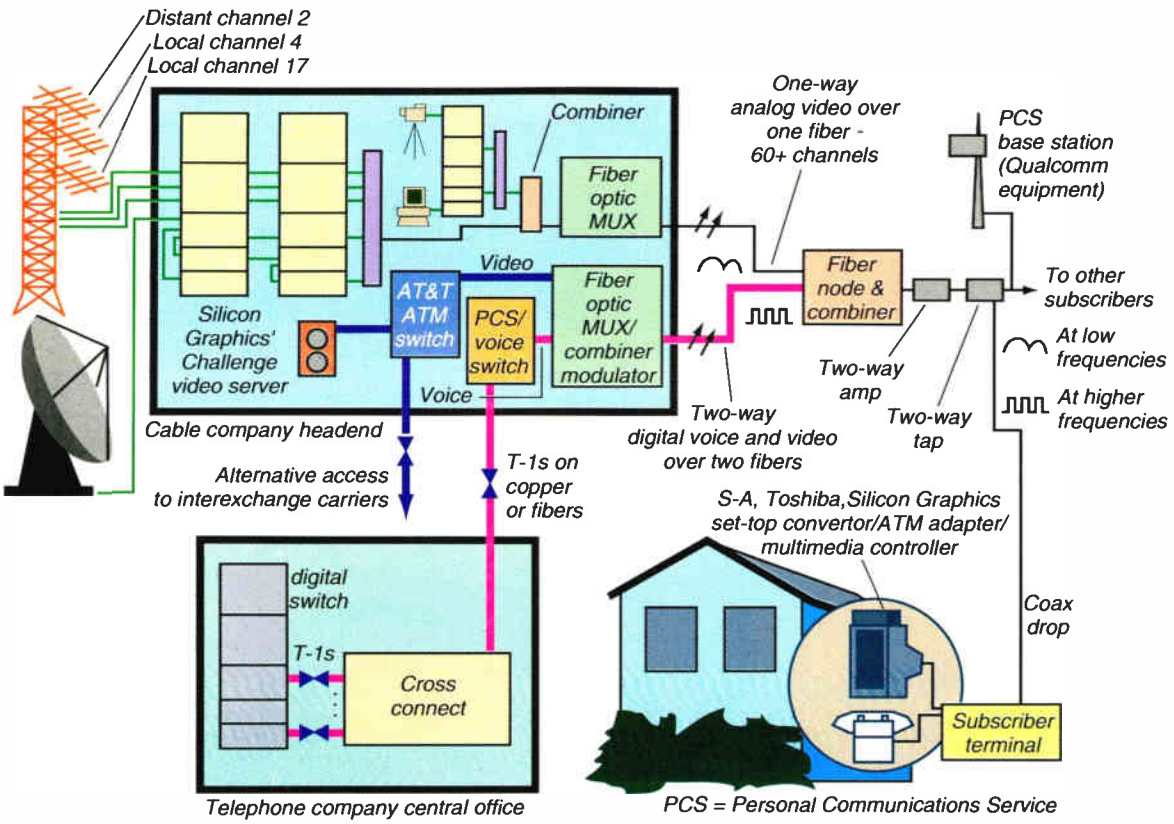

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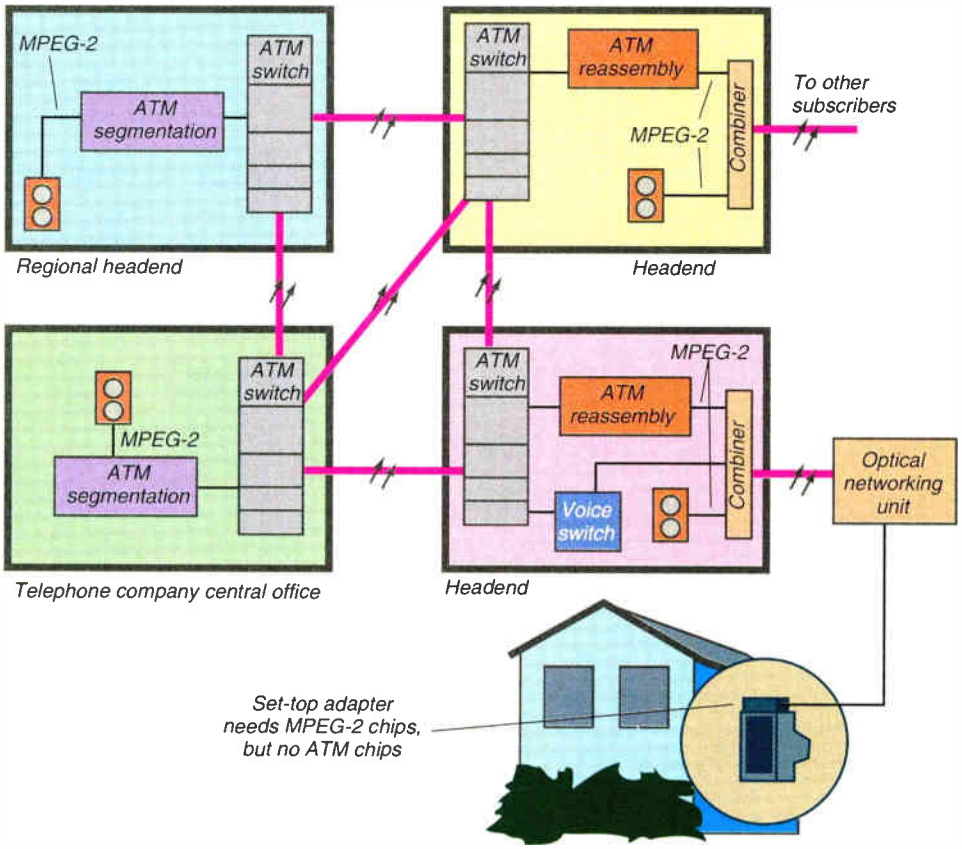
Figure 2: ATM for headend-to-headend backbone



more than 50 percent of the capacity.

"Even so, backbone ATM switches operating at 20-30 Gbps are needed to implement a broadband infrastructure, and these will be very applications driven. For residential video applications, they will perform a virtual path crossconnect function. They'll aggregate the traffic from the information providers, bring it into the network, and disperse it to the various loop elements. You take an increment of CBR traffic and put it through a switch that can handle the broad bandwidth required."

Because of such considerations, Nynex is planning two separate networks for video and data. "Broadcast television is basically a unidirectional type of traffic of information provided to the home. Optimizing the switch for this type of signal may not allow it to serve other types of computer data as efficiently," Presworski adds.

Marketplace dynamics

Although a broadband NII is some years away, major carriers are already using backbone ATM switches in a variety of customer trials. This trial phase is a first step to enable vendors, network providers and subscribers to work together on ATM applications, standards and implementation. But will the major investment needed to deploy these large ATM backbone switches lead to enhanced, revenue producing services for the participants?

"We do not yet understand the marketplace dynamics of broadband applications," says Bracket. "People think broadband is like a telephone call with a video signal on it. There are lots of applications that are different from this including distance learning, video conferencing, collaborative computing and video-on-demand. We need to factor in these issues before we determine future capabilities."

Cable TV experts agree with this assessment. "In our industry I see several main applications for ATM emerging," says David Fellows, senior vice president, engineering and technology for Continental Cablevision. "For example, my company plans to connect 35 different headend sites (hubs) over fiber from a single satellite earth station. Five to nine medium capacity switches are needed to concentrate this traffic on an inter-hub basis. Signals can also be switched from video servers by ATM–and Time Warner and others are doing this. I would include broadcast-on-demand in this category. A third type, and one which I feel is less likely, is switching signals from the headend to residential customers over ATM."

Video broadcast is likely to be the most widespread application for ATM, at least for the first few years. Thus, backbone ATM switches will be used mainly as traffic concentrators, although later their role will expand as an interactive video market emerges, according to Fellows. Their primary function initially will be for broadband crossconnection.

"I'm skeptical that we will find an early use for ATM in providing VOD between the headend and the set-top box because of the delay sensitive nature of packetized video," he says. "There's the economics of ATM to consider also. Smaller switches cost between $20,000 and $200,000, with larger backbone products priced at upwards of $2 million."

Presworski points out that ATM used for video has two applications. The first is for interactive services which require the ability to dynamically change the configuration of the network in order to provide on-demand services. The second is digital broadcast. Here the switch must be capable of multicasting a signal arriving from a single source. If that source is ATM, then an ATM switch is needed to do the multicasting.

Some network providers believe the same fabric may not do both kinds of operation efficiently. Nynex is one them. "The residential video market requires unidirectional types of traffic that is processed in a virtual path crossconnect rather than a switch," Presworksi says. "The need is to aggregate traffic from information providers, bring it into the network, and disperse it to various feeder cables. In this application you take an increment of constant bit rate traffic and route it through a switch having a broadband capability."

Major switch vendors don't agree. "Although it is not economical to switch uncompressed analog video over ATM because of the huge bandwidth required, switches like the FETEX-150, together with MPEG-2 compression, will enable both the telcos and the cable TV companies to provide VOD services," says Warren Griffin, technical marketing manager of Fujitsu Network Switching of America. He sees three opportunities for backbone ATM switches: wide area networking of high-speed computer data; state/local government distance learning and telemedicine; and telephone and cable TV company interactive video services.

Griffin explains that a tandem switch can be designed with standard interfaces that will create an infrastructure for all three applications. "We have the capability to configure the switch for asymmetrical video applications while carrying standard two-way ATM data. Although the interfaces are configured differently, the basic fabric remains the same," he adds.

"For video, we're running constant bit rate (CBR) data and variable bit rate for bursty

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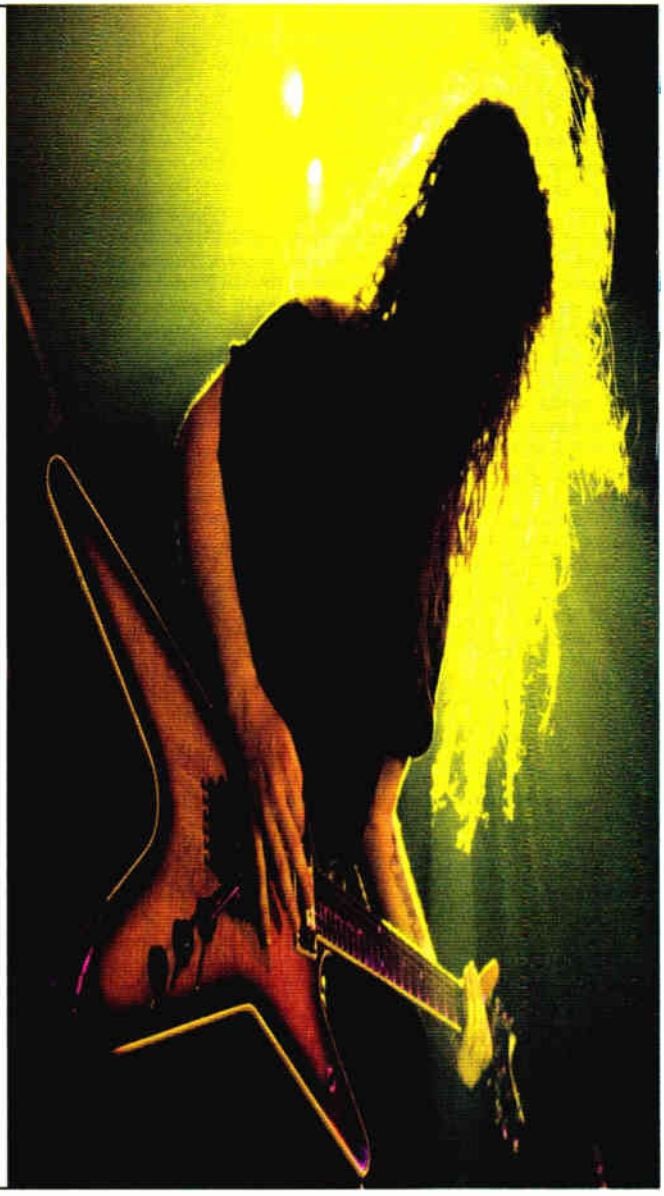

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payload such as computer data. You have to make sure that no delays are caused in constant bit rate signals, and you do this with flexible queuing and quality-of-service parameters," he explains.

Despite the claims of the switch vendors, the cable TV companies are cautious. "Because of economics, I do not see the cable TV industry using ATM in a large number of its systems today," notes Mike Schwartz, vice president of communications for CableLabs. "We're pursuing it as a standard mainly because we see it as an opportunity down the line to combine audio and visual textual material in a transmission format that will meet the needs of the cable industry."

Schwartz sees different companies exploring different systems. "Synchronizing audio and video is a major problem to overcome. Although a combination of MPEG-2 and ATM packets offers some room to maneuver, there are still differences of opinion internationally over which adaptation layer to use," he says.

Before ATM is used widely in the video area, two considerations must be addressed. The first is interactivity. "You've got to have a control mechanism that responds when the subscriber clicks a button by instructing the switch to make the necessary changes to the signal," says Presworski. "This requires the ability to go in and dynamically change the configuration of the network to provide on-demand services."

The second factor is video broadcasting. "In this case you must have the capability to multicast a signal coming from a single source. If that source is ATM, the need is for a switch that can handle this. Both applications require big switches and networks," says Presworski. These may feed into loop products that may not be ATM all the way." Despite these problems, Presworski believes ATM has the ability to make that dynamic change.

Applications

Time Warner's interactive video service in Orlando, Fla. is designed to provide a full range of services over a broadband ATM network (see Figure 1). Digital video signals from various sources are multiplexed as ATM cells at the cable headend and are networked over fiber. This full service network requires an ATM demultiplexer in each subscriber's set-top.

A less ambitious use of ATM is shown in Figure 2. This network is somewhat similar to the Continental Cablevision deployment, as ATM switching is used only in the backbone. Servers and ATM switches are located at headends and telephone COs and are networked over fiber. Before reaching the subscriber, the ATM cells are reassembled as conventional video bit streams and are sent over coax.

In other VOD trials, such as those at Bell Atlantic and Ameritech, a variety of subscriber access methods are used, including both digital and analog video over fiber or coax, and asymmetrical digital subscriber line (ADSL) over copper cable. These alternatives reduce the need for multiple servers and expensive ATM chips in set-top boxes.

AT&T's broadband ATM switching system, the GlobeView 2000, will be used by Cablevision Systems to provide end-to-end digital video solutions for the deployment of enhanced pay-per-view and VOD services.

Before backbone ATM switching becomes widespread in the network, the marketplace dynamics of broadband must be better understood. "In North Carolina we are working to migrate VISTAnet (BellSouth's broadband ATM network) over to the NCIH and probably will achieve this during 1995," says Bracket. "To extend these kinds of capabilities nationally and universally is much more difficult." The network providers have been working as an ad hoc consortium to interest large customers.

In the case of the NCIH, several local exchange carriers made a proposal which was accepted by state government. This customer then invited interexchange carriers to bid to connect the local networks.

The situation in the cable TV industry is somewhat different. Companies cannot cost justify the use of backbone ATM switching, except in limited applications where it is used to switch video to a large number of headends. Cable TV companies do not have a state or local government to act as an anchor tenant in the same way BellSouth does.

Full service implementations such as Time Warner's in Orlando must receive the support of large users, if they are to lead to significant future deployment. Hospitals, schools, local government offices and major corporations need to become anchor tenants, because the residential marketplace cannot do so. If ATM switching is to become a viable force, there must be more attention paid by the cable TV industry to the potential business marketplace for interactive video services. CED

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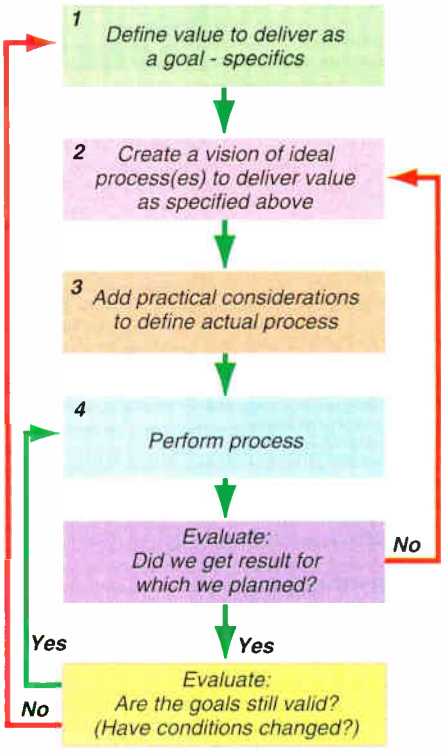
Figure 2



ating, evaluating, and revising their business processes. An essential quality of successful software platforms is that they are flexible enough to change with the business. Assume rapid change will always be a part of your business and create flexible processes that constantly adapt. Never implement anything that assumes only one view of the future of your business. That is the mistake the telcos have made, and it is a big reason why cable can compete effectively against them.

A process is means to an end. The end is delivery of a product of value. The first step in defining processes then is to define the value the process must deliver. The term "value" is used to convey the notion that there is a complex set of factors determining whether a process result is worthwhile. They go beyond just product features.

For example, employees need to feel good about their jobs, and investors have financial performance expectations. A complete definition of what is planned for in a process includes meeting the needs of consumers, investors, employees and the business. Software support systems, as well as the processes they support, must always be evaluated in the context of whether they get a business any closer to creating the value that has been defined as the goal.

Defining the ideal process - the "vision" thing

Once it has been decided what results are expected of the process, the next step is to create it. Start with an "ideal" process definition–one that disregards all technology, financial or regulatory limitations. For example, part of an ideal process of CSR/customer interaction might be to answer all customer incoming calls instantly. This is not cost effective, but if it is considered ideal, then as new technology comes along that gets closer to the ideal, it will be recognized as relevant.

Create the ideal process by walking through the various activities required to supply telephone service and writing them out in detail. Most of the activities are familiar, such as sales and marketing, CSR operations, field operations, billing and others. Even cable operators who have no experience in telephony can probably come close to defining the ideal processes without outside help. Gain specific insights into telephony by hiring personnel or consultants with the proper background. Remember that the ideal process is not based upon technology. It is based on people and how they do business ideally.

A primary resource in this ideal process definition is your own employees. They are the people who will perform the tasks, so they should play a key role in developing them. They are the most qualified, and will have ownership in the process once it is created. This ownership will give them understanding and motivation to revise the process

immediately when they see opportunities for improvement.

The art of compromise–practical process definitions

The practical process is defined by gaining the input of the financial department, vendors, marketers and others. The ideal process definition becomes the starting point. Compromise will be needed to get the right balance. Again, the goal is a detailed statement of the process, created by walking through the service offering from start to finish. But this time, the process will be defined exactly how it will be performed.

It is here where vendors of hardware and software can really help. They know what is possible technologically, and what it is likely to cost. The solicitation of this input is often formalized into an RFI, or request for information.

An extremely helpful tool in creating the practical process is to prioritize the ideal process elements. That way, logical choices can be made as to where the most resources should be focused in software support system design (as well as hardware system design).

An example of the first level of detail in process definition might be the following:

✔ Strategic marketing: continuous identification and definition of customer needs;
✔ Service creation: creating solutions to meet the above needs;
✔ Network provisioning: readying the network to provide the new service;
✔ Sales and tactical marketing: informing and selling customers on the new service;
✔ Customer provisioning: readying the network for delivering a service to a specific customer (a useful way to look at services in a transaction-based environment);
✔ Service delivery: "the session"–a specific billable instance of providing the service;
✔ Network operations: daily activity to establish, construct and maintain the ability of the network to provide service-on-demand;
✔ Customer support operations: all interfaces with customers;
✔ Engineering operations: forecasting and network design;
✔ Business operations: everything it takes to run the business.

Many more levels of detail are required; this is just one example. How processes are defined determines part of any competitive advantage.

A statement of process becomes the set of requirements for software support systems design. It is the basis of Requests For Proposals (RFPs) needed for the vendors who helped you create them. Vendors need this to create meaningful and attainable solutions for your business, based upon solid business agreements.

It is commonly thought that software design processes always overrun on cost and time, and that there is nothing that can be done about it. This is indicative of how often clearly defined processes are not provided to vendors, and how often they do not insist on them before starting a project. That is not a properly run software development program. Give a competent vendor using structured software system development practices a complete and detailed set of specifications, and a product should be delivered on time and within budget.

Some of the RFPs that have emerged for telephony over coax systems have not presented a clear set of requirements for an OSS. They have simply said, "Tell us what you can do. Oh, and here are some ideas we have on different ways we might sort of kind of want to do things, sort of. . . ". There are two certainties when a process starts out like this: one, it will be very expensive; two, it will never satisfy anyone.

Process/functional team organizations

If anyone cares most about and "owns" the results of implementation of software systems, it would have to be the product manager, a role

A new power paradigm in the making

Transitioning to power in the '90s

By Roger Brown

Spurred by plans to deliver telephony, video and other services over their systems, network operators in the cable and telephony industries are developing new alternatives to the way they have traditionally approached a key component of their networks: power.

At least three of the largest MSOs are planning to implement video networks that diverge from the traditional 60 volt, 60 cycle (Hertz) alternating current powering schemes, according to sources familiar with their plans.

Meanwhile, several of the Regional Bell Operating Companies (RBOCs) are planning to move away from using 60 volt direct current (the traditional choice for telephony applications), in favor of AC. With some exceptions, the approach is being altered in favor of 90 volts, which provides more current and allows power to "reach" deeper into hybrid fiber/coax networks.

Some major concerns

The changes are not without controversy, however. Some have reservations about the safety implications of such a change, while others wonder about the ramifications on active electronics, such as amplifiers, which today are optimized for 60 volts.

Power node architecture comparisons

Attributes	60 V, 60 Hz	90 V, 60 Hz	90 V dc	90 V, 1 Hz	Hybrid
Powering distance (feet) for the same load (kW)	900	**2300**	**2650**	**2600**	**2300**
Field upgradable from 60 Vac	Yes	No	No	No	No
$/kW relative to dc	140%	120%	**100%**	130%	**100%**
Safety Let go response (mA) Fibrillation threshold (mA)	10 80	10 80	42 300	Unknown Unknown	42 300
Corrosion compared to dc	**30%**	**30%**	100%	95%	33%
Paralleling (redundancy)	Difficult	Difficult	**Easy**	Difficult	Difficult
Availability	**Today**	End 1995	End 1995	End 1995	1995
Compatibility with existing cable TV equipment	**Yes**	Achievable	Maybe	Maybe	Maybe
Lightning protection	Gas-tubes	Gas-tubes	MOVs	Gas-tubes/MOVs	MOVs
Power factor	0.85	0.85	**1**	**0.98**	**0.85/1**

Bold entries indicate best in category. Source: Bellcore.

Cable TV oldtimers may remember when CATV systems were powered by 30 volt AC systems. Since then, of course, amplifier technology advanced and power levels increased, making the 30 volt design voltage limited, and the switch was made to 60 volts. A similar problem is now occurring.

Today, network active components are designed to carry a powering signal of about eight to 10 amps, maximum. Most of today's hybrid fiber/coax network designs call for fiber to deliver video signals to nodes serving about 500 homes, where the signal is converted to RF and sent over coaxial cable. Assuming there are four distribution coaxial feeders per node at 60 volts, the total power transmission capacity would be 2,400 watts, or about 4.8 watts per subscriber, maximum.

However, new architectures often call for powered network interface devices (NIDs) located on the side of the home. These NIDs can perform several functions and include a ring voltage generator. They can be used to deliver both video and telephony signals into the home from an integrated transport system, or to separate the home from the plant in a logical manner by using different modulation or frequencies for in-home signal distribution.

The result is a device that significantly increases the amount of power, per subscriber, that is consumed by the network. In some cases, each home could chew up as much as 12 watts, even though 5 to 8 watts is more typical. The ramifications on network powering are enormous: at 12 watts per subscriber, each coax feeder leg would have to carry 1,500 watts, or 150 volts of power.

However, that voltage is in excess of the amount allowed by federal regulations (National Electrical Code and National Electric Safety Code). Therefore, both cable MSOs and telcos are compromising on 90V plant power, which slips in under the limit allowed by code, while vendors are working to lower the amount of energy that NIDs consume. Progress is being made on both fronts.

Pacific Bell, for example, has embraced 90 volt power, but plans to reduce the cycle time from 60 Hertz to 1 Hertz for safety reasons. However, PacBell will trade safety for increased galvanic corrosion, making it imperative that system connections be kept to a minimum and sealed from outside moisture.

Time Warner likes 90 volts

Meanwhile, both BellSouth and Time Warner Cable are known to be pursuing 90 volt, 60 cycle powering to increase efficiency. In Orlando, Time Warner has a portion of its plant (not the Full Service Network) running at 90 volts, "and it works just fine," says Jim Chiddix, senior vice president of engineering

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and technology. By adopting the higher voltage, Time Warner was actually able to save a lot of money, too.

Using today's traditional 60VAC supply, Time Warner typically needed about 2.3 power supplies per node in its HFC networks just for video. But because it's impossible to buy one-third of a power supply, the company usually placed three supplies, and wasted a lot of power margin. By going to 90 volts, however, one entire power supply is eliminated from the mix, which reduces cost and improves efficiency.

Chiddix says there's enough margin left over to provide telephony service, and another key ingredient is gained: power centralization. "Even if we weren't getting ready to provide telephony, this centralized approach makes sense," he says. Why? Because if there's just one powering location per node, it's easier to provide backup power through batteries and/or generators that are all located in the same central place.

Consequently, Time Warner is asking vendors of active components like amplifiers to make sure 90V power can be accommodated. According to Tom Lynch, vice president of the distribution systems business unit at General Instrument, all of today's 750 MHz gear will work with 90V power, but would not be optimized. As a result, GI is working to develop equipment that would work optimally at both operating levels and is developing tests to determine if that approach is feasible.

"That's the direction we're leaning in right now," says Lynch. "We don't think it's a big deal." But what must be determined is how 90V would affect 60V equipment–in other words, what's given up when 90V is added to the mix?

If the results of this type of testing are positive, "there's no reason not to" adopt this powering scheme in all of Time Warner's planned rebuilds and upgrades, says Chiddix, based on the cost savings alone. But what about the safety issue? Pacific Bell has decided to forego the traditional 60 cycle power because when it's combined with the higher voltage, safety issues become important.

According to research done by such organizations as Bellcore, the research and development consortium owned by the RBOCs, AC power is more likely to cause the human heart to go into shock (fibrillate) than DC power. Opinions, however, vary widely over the real effect of an increase in voltage from 60 volts to 90 volts.

"It's not like we're taking a benign level and replacing it with a lethal level," says Chiddix. "But we'll have to make sure we train our people properly."

"I have some concerns about (safety)," counters Tom Osterman, president of Comm/net Systems (a manufacturer's rep firm) and former executive at Alpha Technologies. "What happens if you have 90 volts coming down the drop into someone's backyard where kids or the family dog might get to it?"

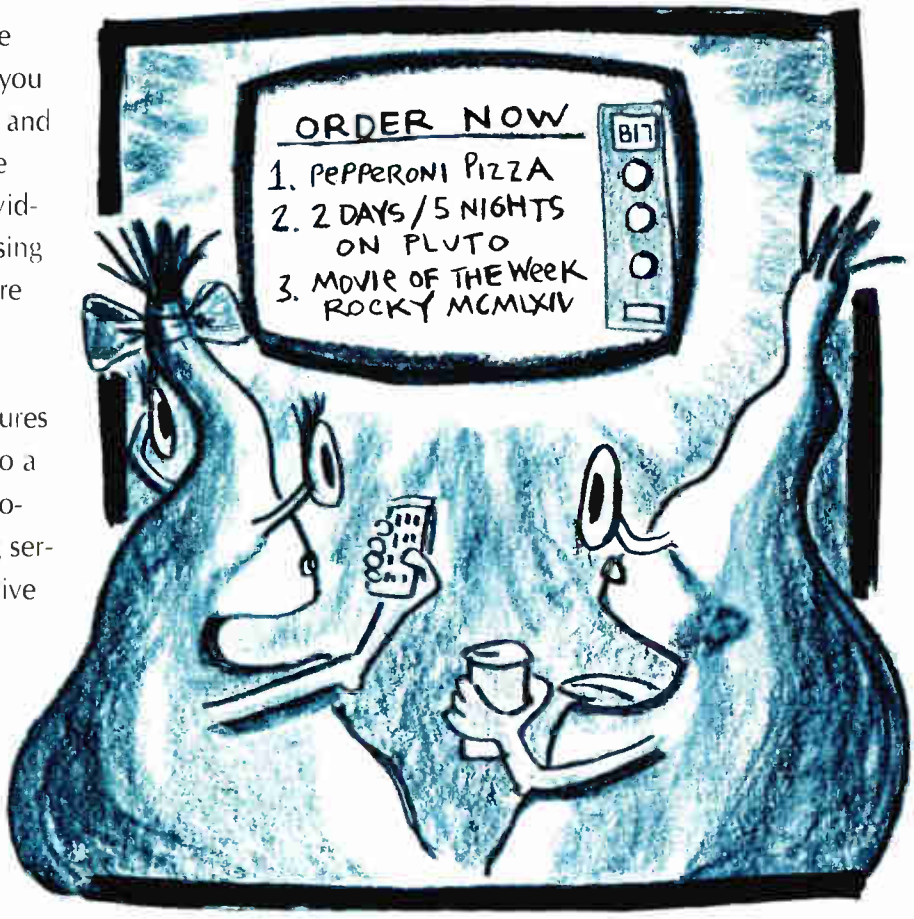
Don Sorenson, chief engineer at Alpha, warns system operators to be careful when implementing new powering schemes with higher voltages in a white paper he prepared on the subject: "It is the author's opinion that both AC and DC power signals have the ability to become lethal under the proper conditions, and both will require appropriate training and equipment safety features."

Dave Cushman, senior staff engineer for broadband powering at Power Guard, concurs. "Systems will need to properly train people.

FIBEROPTIC UPDATE

How will the Future View Your Choice of Interactive Network Technology?

No one can foresee which interactive services the future will demand. So, you need a network design that's flexible and powerful enough to keep up with the future. We suggest you consider providing broadband interactive services using hybrid fiber coax (HFC) for your entire network.



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It's already long overdue."

In the meantime, while network operators sort out the issues and wait for the marketplace to give them clear direction, power equipment manufacturers are preparing units with multiple output taps. These taps allow the operator to choose 90-, 75- and 60-volt outputs, or any voltage the user needs.

Planning for network power

Providers who choose to deploy NIDs located on the side of each subscriber's home will be forced to choose how to power the unit. Providing power over the network avoids the need to tap into the AC power within the home, as well as the need to install batteries in the home, but many cable operators are more likely to choose to power the units via the cable network in order to be less intrusive and avoid problems caused by the consumer.

"Powering from the network is something that makes a lot of sense," notes Chiddix. "There are a lot of logistical problems with putting batteries and transformers in the home."

But this solution requires one of the following scenarios: power carried over coax and through taps, forcing the need for power-passing taps, which are just now coming on the market (see "Network powering: Looking beyond 60 volts," *CED*, Nov. 1994, p.58); the use of a "shadow" coax cable that can be used to deliver the power signals; or the use of a Siamese cable where twisted pair copper cable is used as the power conductor. Each scheme has its own list of benefits and drawbacks, according to the experts.

Using a separate conductor for power is acceptable in areas where the drop is easily located and accessed, say cable TV engineers, but in areas where the drops are buried, using them to conduct power is much less palatable because it makes the cost of a new drop significantly higher. Furthermore, the center conductor connections on today's F-connectors typically aren't good enough for the job, according to Time Warner engineers, although there are some that are "promising," says Chiddix. The upshot is that "power derived from the plant is a manageable proposition," Chiddix says.

In order to avoid the whole issue of drop powering, TCI is said to be actively developing wireless drops that wouldn't require a large centralized power node, making the solution less costly. In this scenario, the consumer would use small wireless telephones–and they would be responsible for charging the battery that comes with it.

Another potential solution has been floated by Bellcore, to mixed reviews. The scheme calls for using 90 volt AC power under normal operating conditions, and 90 volt DC during emergencies or maintenance. This type of architecture simultaneously provides safety and corrosion advantages over other schemes, according to Bellcore officials. However, cable TV power supply manufacturers say the approach has little merit, while contributing to reliability problems. Furthermore, hardware to support such an architecture is not readily available, they say.

In the end, it appears that some leading MSOs will lead the way for the industry to gradually move to higher power levels, with 90 volt, 60 cycle the leading candidate today.

In the meantime, though, there are ongoing tests to determine the effect of higher power levels, as well as the level of galvanic corrosion. CED

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Spectrum analyzer in-service measurement

Practical applications

By Jerry Harris, Product Marketing Manager, Tektronix Inc.

Most CSRs, technicians and system engineers have experienced the wrath of subscribers who have had their service interrupted. Often, however, interruptions are required when making the distortion and noise measurements needed for proof of performance testing or system maintenance. These measurements also usually require coordination of the headend and field technicians to remove and restore carriers.

A relatively new automated spectrum analyzer operating mode, known as time-gating, can be used to make some of these measurements without disrupting subscriber service. This can lead to improved customer satisfaction and reduced operating costs. Already established non-gated in-service measurements also enhance system operations.

This article compares gated and non-gated in-service measurement techniques. We will apply these to composite second order (CSO), visual-carrier-to-system-noise (C/N) and in-channel frequency response (ICR) measurements. Finally, the article considers practical application of the techniques. It also explains how a cable television spectrum analyzer implements gated measurements.

Conventional measurements

Conventional measurement techniques have generally followed the Recommended Practices of the National Cable Television Association (NCTA). CSO, composite triple beat (CTB) and C/N all include measurement of in-channel distortion–from approximately -1.25 to +4.2 MHz relative to the video barrier. The distortion signals are nearly always at lower power amplitudes compared with the active video in the channel. This requires removal of program video or carrier to measure the signals. Measurements of CSO and C/N can be made without removing program video.

Measurement of in-channel frequency response–gain variation with respect to frequency–requires that the test signal be frequency flat. Cable multi-burst, line-sweep or Philips ghost canceling signals will provide the needed flatness.

Since the test signal is frequency flat, we can assume that any gain variations measured reflect the condition of the modulator, processor and/or any other downstream, in-channel system component. When using a full field test signal, the normal program video is removed, disrupting service. If the test signal is inserted on a single scan line in the vertical interval, a gated measurement will avert service disruption.

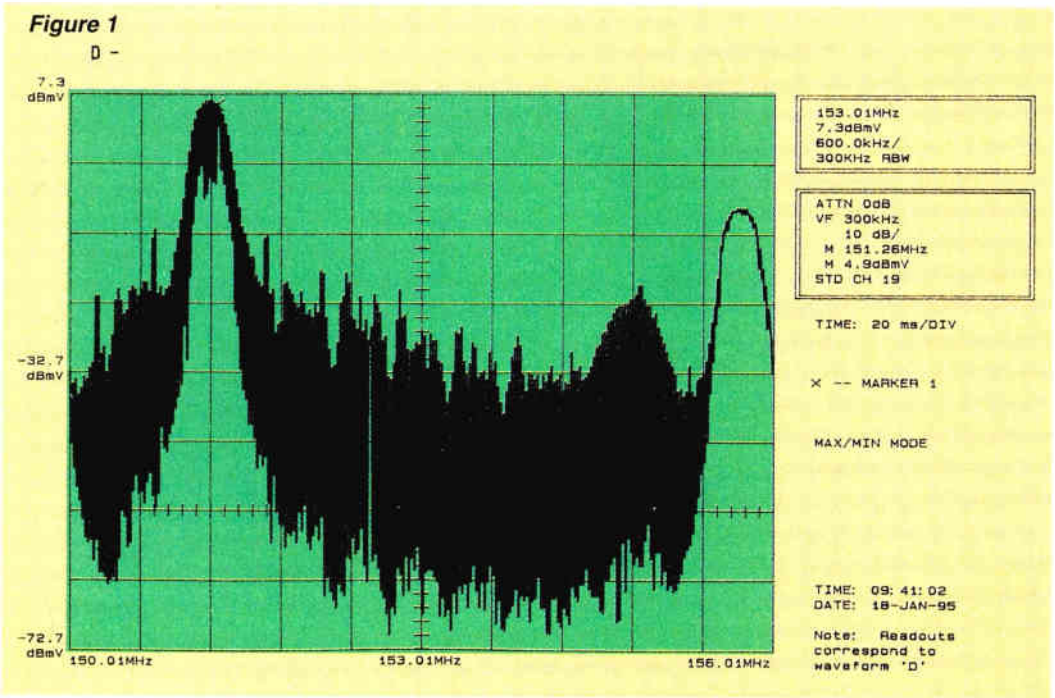
Gated and non-gated comparison

Some modern RF measurement instruments provide gated and non-gated automated in-service routines. Gated techniques provide in-band measurements. Figure 1 shows a plot of a typical channel as displayed on a spectrum analyzer without any gating. The active video completely masks in-band noise and any distortions. Figure 2 shows the same channel with time gating in effect. Notice that without having to remove the video input from the modulator, the video is absent from the display, and in-band noise is visible and measurable.

Occasionally, making CSO and CTB in-band measurements in-service without gating may be possible. If a system's channel plan includes unoccupied spaces, referencing beats measured in these spaces to an adjacent channel visual carrier is possible. Assuming good engineering judgment is exercised, a valid measurement can be taken.

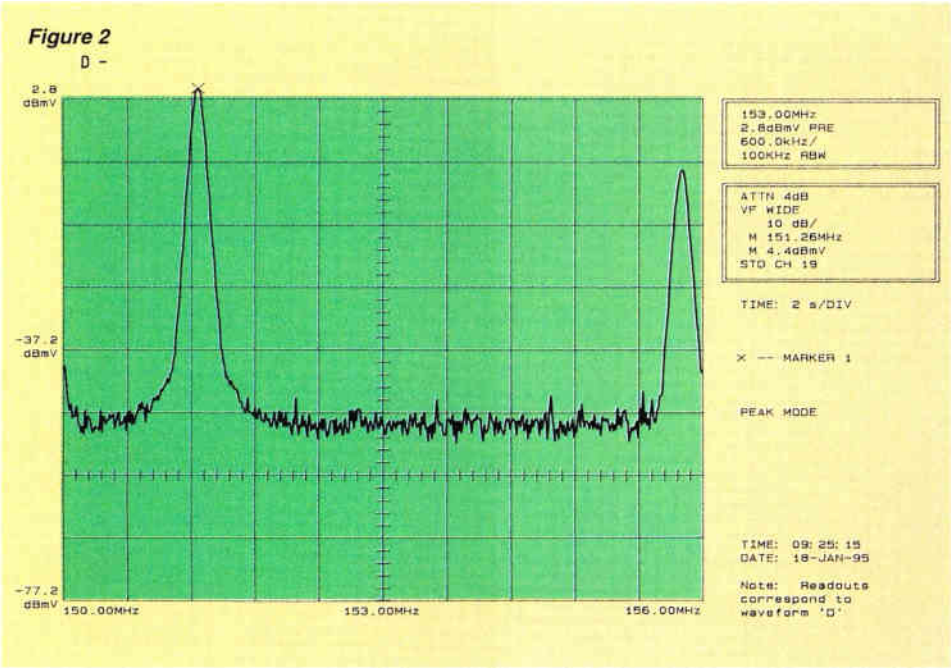
However, many systems do not have empty channels. Therefore, a time-gated CSO measurement is

Figure 1



Typical non-gated spectral presentation of a channel in service.

Figure 2



Typical gated spectral presentation of a channel in service. We have "gated out" the video signal to create a clear view of the in-band noise.

normally needed to avoid service disruption. Typically, because the beats are aligned at the visual carrier frequency, CTB will require removal of the carrier. When it comes to C/N, some instruments automatically measure system noise in the guard band between channels.

In-band measurement is the best way to assess the total noise impact

This technique is an excellent way to isolate distribution noise and does not require gating. Anytime the guard band measurement is used, it is important to verify that some common sources of error are not present. These would include:

✔ Misadjusted adjacent channel audio carriers resulting in measurable sideband energy in the guard band.

✔ Misaligned test channel modulator or processor vestigial sideband filters, which can cause excess video modulation sidebands in the video carrier's lower sideband and channel guard band.

✔ Set-top convertors used for FCC proofs may not fully pass signals in the guard band. Convertors should be tested to verify that sufficient bandwidth exists to pass all of the noise in the guard band.

When time-gating is used, the in-band spectrum can be viewed without interrupting service. The automatic C/N routine measures the in-band spectrum as opposed to the non-gated mode of measuring–in the guard band. Measurement of in-band C/N encompasses noise contributions from all in-channel devices such as demodulators, modulators and convertors, and from the distribution system.

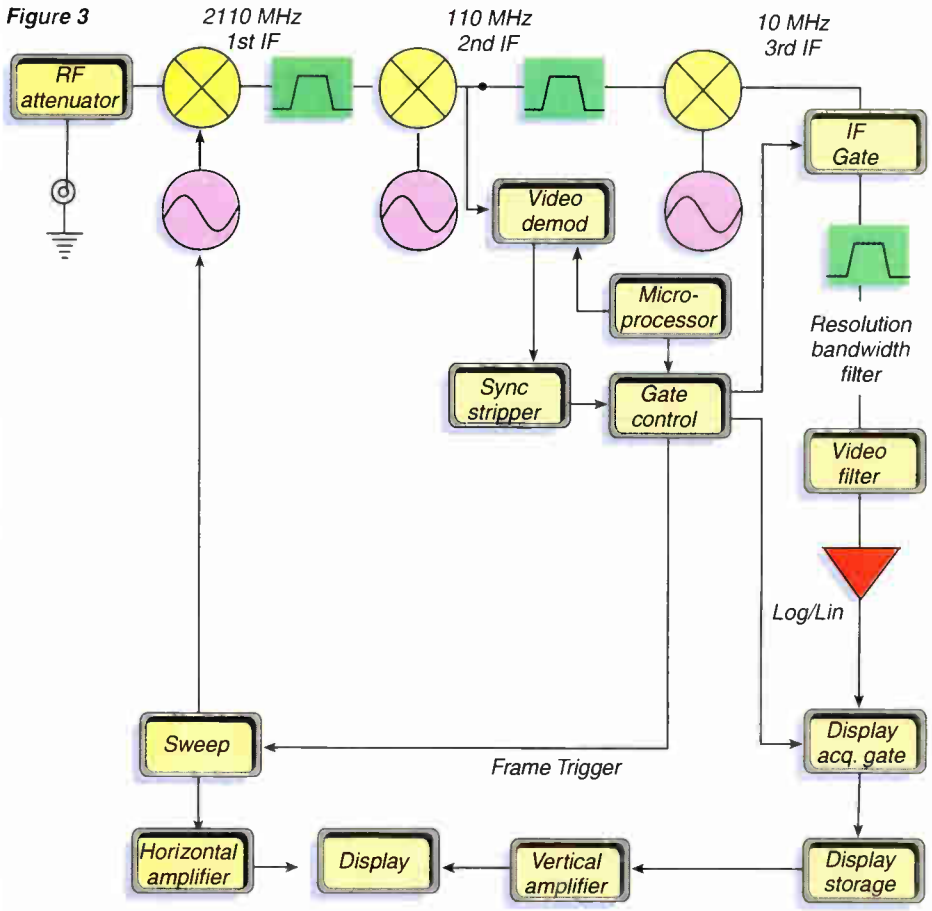
It also includes noise on the video signal as furnished by the program supplier. In-band measurement is the best way to assess the total noise impact on the signal delivered to the subscriber.

In-channel frequency response

If a Philips ghost-canceling signal is available from the program source, and if a digital storage spectrum analyzer is put into a "max" or "peak hold" condition, in-channel flatness can be viewed without gating and without disrupting programming. However, video with periodic, high-contrast transitions can create strong signal peaks in a channel's modulation sidebands. These signal peaks can mask the ICR test signal and render this technique unreliable.

An alternative, non-gated method that avoids the masking problem is to use a VITS inserter that includes a high-amplitude line sweep signal. We would need to install a VITS inserter on the channel under test. The

Figure 3



Signal path for gated measurements.

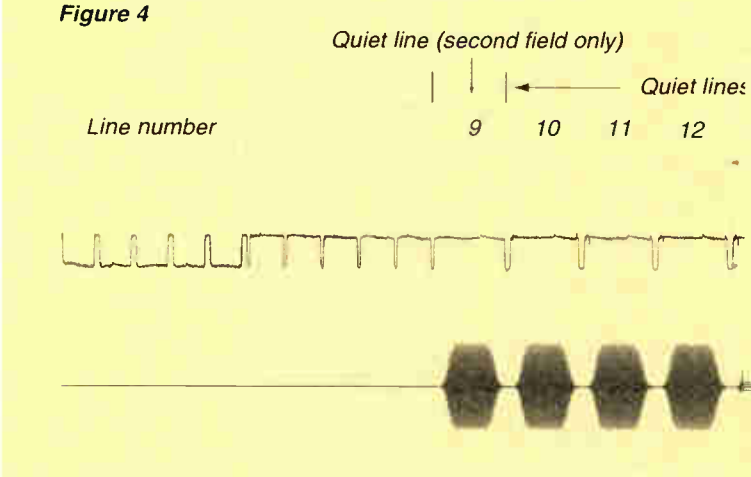
peak hold digital storage and delta marker features of a spectrum analyzer can now be used without distorting measurement of the active video. Although this technique can provide a good in-channel frequency response measurement and the capability of inserting test signals for other purposes, it requires an investment of about $2,200 for the VITS inserter.

Several advantages arise from gated ICR measurement. It avoids the risk of distortion because of video interference, as noted in the previous paragraph. The programmer may already supply frequency-flat VITS signals that can be used. Signals such as multiburst and GCR might be available without adding a VITS inserter.

However, as with non-gated measurement, the gated mode requires a VITS inserter if the programmer does not supply an appropriate test signal.

(Note: Not all multiburst signals produce

Figure 4



Correspondence of video baseband and IF gate output signals.

packets that are flat in the frequency domain. Be certain to verify with the programmer that the signal is appropriate for the ICR measurement.)

How to do gated measurements

When a gated C/N or CSO measurement is selected, the first task is to decide which scan lines do not contain video, test or other signals that would interfere with spectrum sampling. An automatic routine searches each video field and identifies one, or a set of quiet lines during which the gate will be opened. Most channels have more than one line available.

Using several video lines offers more opportunities to time-average the measurement on the test channel and make repeatable and/or faster measurements. When an ICR measurement is selected, gating uses the video line containing the frequency-flat test signal. If needed, the presence of the test signal selected or ICR can be verified by using a spectrum analyzer to demodulate the video carrier. Then the built-in selectable video line triggering mode may be used to find the line number.

Referring to Figure 3, the input signals to the analyzer are routed to a video demodulator at the analyzer's second IF. Demodulated video is provided to a sync stripper that extracts video line information. Then the video line data is sent to the gate control circuit that determines exact gate timing. This information is the basis for identifying exactly when a gate is opened and closed.

Gate control sends an "open" and "close" command to the gate in use during each video frame. Since spectral data is acquired only during periods when no signals are present, active video, test signals, etc., are not masking the signals that need to be measured.

Gate control also sends a trigger to the sweep circuit with each video frame. The gate opening and sweep trigger are coordinated so each sweep captures the maximum number of spectral samples.

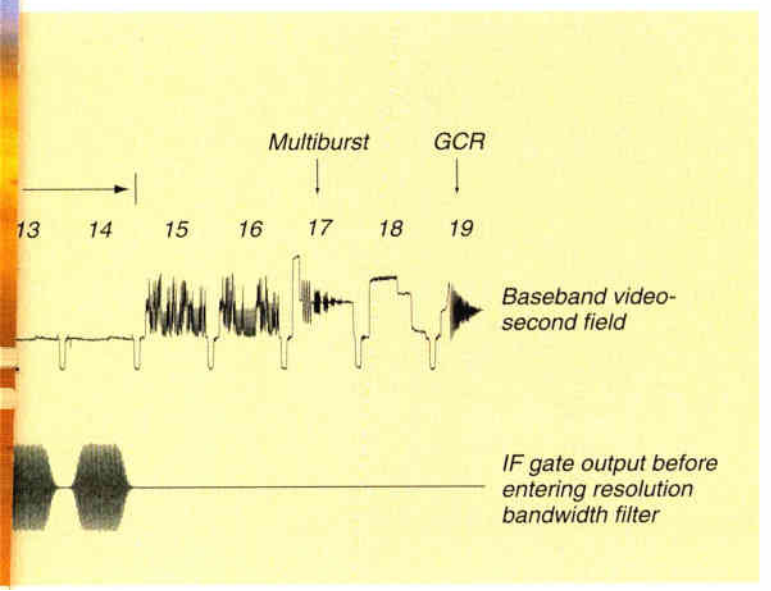
Not only must the open and closing time of the gate be controlled, but also the abruptness of opening and closing. This allows measurements to be made on low amplitude components close to the video carrier.

Since spectral data is acquired when no signals are present, the signals that need to be measured are not masked

Referring again to Figure 3, the video demodulator, sync stripper and gate control are dedicated to determining the timing for opening and closing the gates. They are off-line from the signal path that affects the dynamic range and accuracy of the measurement. By design, the gates in the main signal path of the analyzer are transparent so they will not hamper measurement.

Depending on the measurement selected, the 2715 analyzer uses one or both of its two gates. The first gate regulates signals reaching the resolution bandwidth filter. The second gate regulates signals acquired into the memory of the digital storage display. Using two gates optimizes the analyzer's response to the three types of signals that can be measured–noise (C/N), low-level beats (CSO) and comparatively high-level test signals (ICR).

Figure 4 is a typical rendering of scan line usage during a video field. (High video fre-



quencies are rolled off because of the method used to acquire waveforms.) Notice that lines 9 through 14 contain no video signal, and are therefore "quiet." Line 9 is available for gating in the second field only. This is because the first field line 9 is comprised of half-lines (equalization pulses).

Half-line periods are not long enough for the gate to operate. In this example, the quiet line finder routine has selected lines 9 through 14 of the second field. Note the correspondence between the video baseband signal (top signal flow) and the gate output signal (bottom). The gate output signal is shaped to remain isolated from sync pulses that would interfere with the measurement. Line 20 in the first field, and line 19 in the second field are the last full-line periods available for gating. Active video begins on subsequent lines.

Practical measurement considerations

The precise timing of video lines on the test channel is part of the time-gating measurement process. Line timing is based on recovered sync.

As a result, it is not possible to make measurements on channels where sync is not available, or where the sync signal is very unstable. Often, sync is suppressed or altered as part of a channel scrambling scheme. When this is the case, conventional or non-gated in-service measurements should be used.

The strengths and weaknesses for gated versus non-gated measurements should be considered

Another impact on gated measurements is the status of quiet lines. The type of signal assigned to each line in the vertical interval is the programmer's responsibility. Although the cable system can use a VITS inserter to add signals, the video signal originator determines quiet line periods.

Once the analyzer determines which lines are quiet, it is important that the lines remain quiet until data acquisition is complete. If the video source is changed on the test channel–for instance, from the main program to ad insertion–certain quiet lines can become occupied. This will corrupt the measurement.

Summary

In-service techniques greatly increase the number of measurements that can be made during any part of the day without disrupting service. In-service testing also affords more latitude in scheduling proof of performance testing and system maintenance.

Because service doesn't have to be interrupted, some troubleshooting can be spontaneous, even on high-demand channels. The strengths and weaknesses for gated versus non-gated measurements should be considered before making final selection of measurement techniques. The ability to select from a variety of measurement methods will result in a more optimized test and measurement plan. CED

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Will broadcasters, FCC derail digital TV?

Confusion threatens to gum up the works

By Fred Dawson

With telco preparations for digital TV racing ahead of efforts by standards bodies and the FCC to define the new operating environment, the stage has been set for a confusing and potentially delaying debate over standards just as the market is ready to take off.

Telco plans for early rollout of interactive digital TV services are generating a powerful push toward de facto standardization of first-generation network platforms, said a participant in meetings of the ad hoc standards group, Digital Audio Visual Council. Speaking on background, he said, "The pressure is intense right now, because we all want to work out the key interface issues before the telephone companies lock in on solutions."

The official said that while DAVIC, a successor to the MPEG (Moving Picture Experts Group) compression body, is hoping to complete recommendations on the full suite of interfaces for digital distribution systems in time for testing this summer, even that early deadline is behind the RBOCs' curve. "Our goal now is to have at least the raw outline of the most likely pieces together by our March meeting," he said. "At this point, the early adopters are really driving the process."

Steve Johnson, vice president of marketing at Microware Systems Corp., said the telcos are driving the standards discussion because they are the only network entities telling vendors what they want with some measure of specificity. "RBOCs are specifying what they want in great detail and vendors are building to those specs," Johnson said. "I don't see MSOs writing specs for digital platforms, so the likelihood is that cable will end up buying off-the-shelf systems that are designed to RBOC specs."

"There are two broad classes of participants in this process," said Richard Green, president of Cable Television Laboratories and a member of the DAVIC governing board, without distinguishing between telcos and MSOs. "There are those who want to discuss more advanced ideas for a platform that would be ready to implement two or three years from now and those who want something they can use as soon as possible."

Green said the interests of the fast starters "is really accelerating" the DAVIC process. As a result, he added, "the structure doesn't really allow an outlet for more advanced ideas."

SDTV

As the market moves faster toward a first-generation, de facto standard, the FCC is intensifying work on what is now being called "standard definition TV," which would be the technical framework supporting broadcast delivery of multiple channels of video and data over the 6 MHz advanced television channel that was originally designated for HDTV. In a speech at the SCTE's Emerging Technologies conference in Orlando in early January, an FCC official warned network platform developers not to rush ahead without factoring the commission's agenda into their design plans.

The remarks stirred considerable concern in the network engineering community, where many view commission action on digital TV as intrusive and potentially obstructive to commercial deployment. But Richard Smith, the senior engineer with the commission's Office of Engineering and Technology who spoke in Orlando, said later that the commission has no choice but to proceed with SDTV, if it authorizes multiple uses of the second channels set aside for HDTV.

"Obviously, if SDTV is permitted (in the HDTV channel allocation), there would be a standards issue linked to broadcasting," Smith said in an interview. "The chairman (Reed Hundt) has indicated he has an interest in keeping the whole subject of HDTV and digital television on a fast track."

Smith said a multichannel broadcast digital TV operating environment brings many factors into play beyond the decoder interface, which is now the subject of intense debate with respect to analog TV operations. FCC digital TV standards would encompass modulation techniques, means of conditional access, compression, transport packet framing and other facets of end-to-end connectivity in the digital path, Smith said.

Smith said the commission welcomes industry input

Figure 1: *DAVIC delivery system architecture reference model*

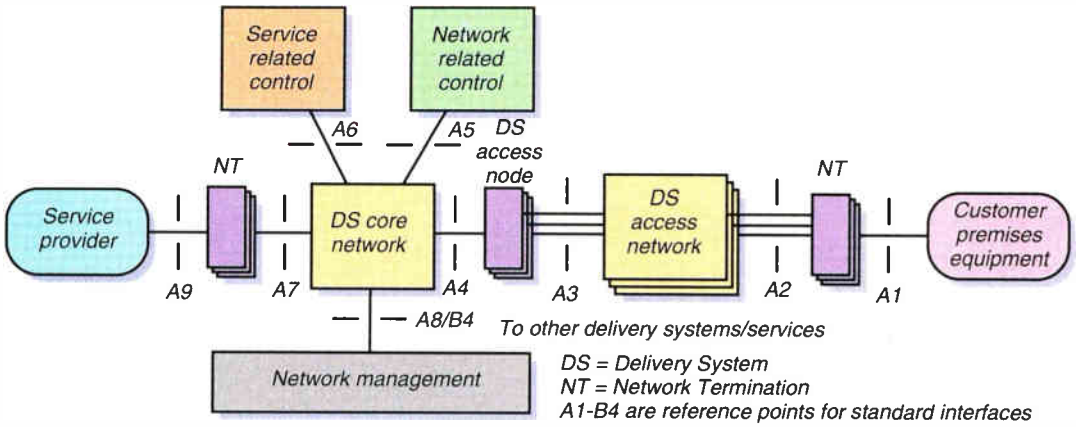

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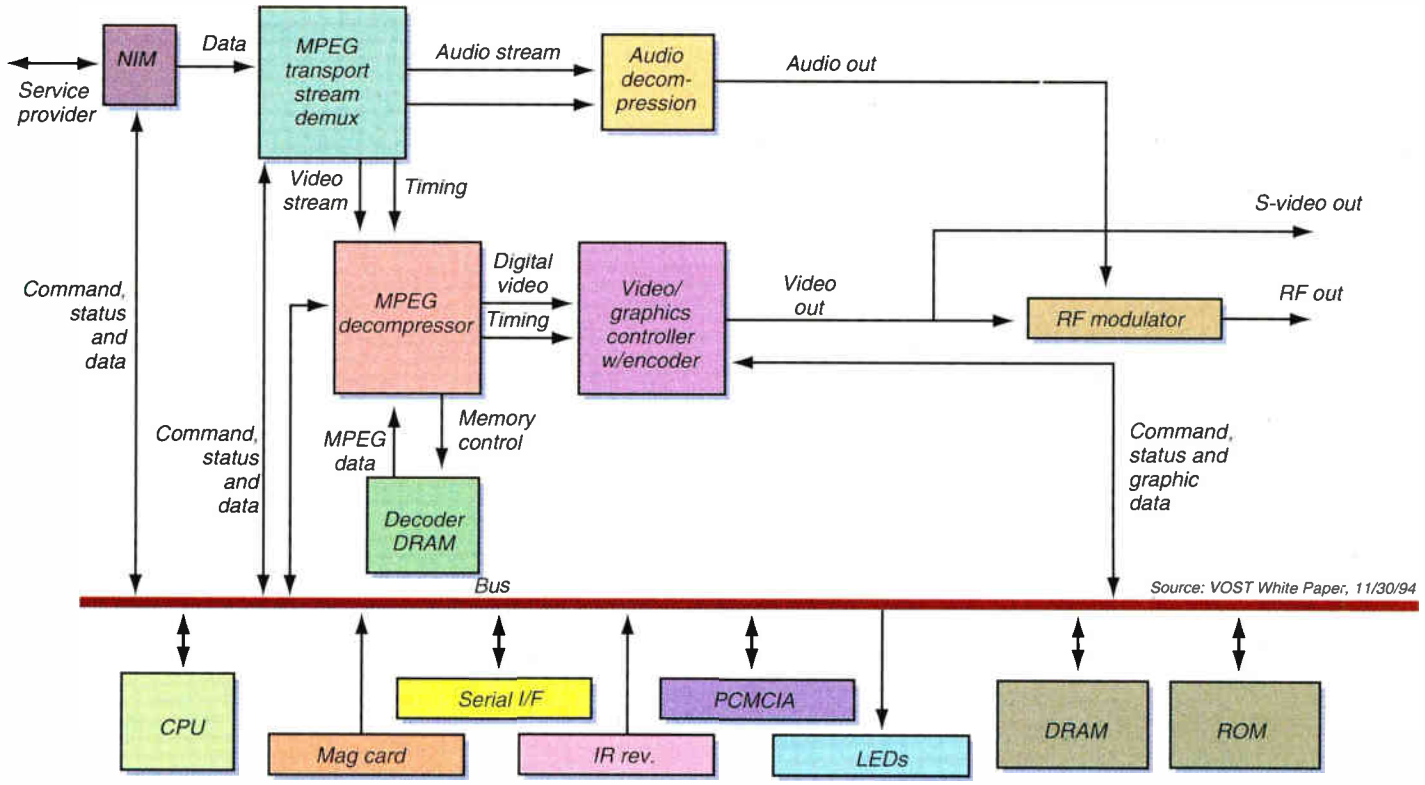
Figure 2: VOST preliminary category "A" set-top in a box



as it looks at these issues, but, so far, the input appears to have been slow in coming. Cable interests have been focused on the intense debate over the analog decoder interface standard, and the Advanced Television Systems Committee (ATSC), the industry body which has commited itself to looking at SDTV, has been distracted completing its work on HDTV.

But the difficulty of differentiating between the two types of services for purposes of creating rules that govern how digital TVs operate opens an inviting door to those who believe the time has come to define a uniform operating environment in the digital domain to avoid the incompatibilities that have plagued consumers in the analog era. "There are a whole lot of people pushing long and hard for the commission to apply whatever standards it adopts to set-top boxes," said Wendell Bailey, vice president of science and technology at the NCTA.

Bailey, one of the cable industry's representatives on the ATSC, said there had been considerable controversy over whether the group should take up SDTV. But, he added, prospects were good that broadcasters and cable interests could find common ground on most points, if the FCC doesn't rush the process.

"The industries have been working very closely, and efforts are underway to make SDTV compatible with cable's digital transmissions," Bailey said. "But there could be a problem if the FCC sticks its foot in the issue before these things are worked out."

While broadcasters will be exploring SDTV with cable participants in ATSC, the level of broadcast involvement in multimedia platform development by network companies and their suppliers appears to be minimal. For example, there are no U.S. broadcasting concerns in the membership of DAVIC.

Instead, a separate cluster of standards groupings has developed around broadcast digital interests, including MSTV (the Association for Maximum Service Television), the COFDM (Code Orthogonal Frequency Division Multiplexing) Evaluation Project, which is backing this European-developed modulation technique over VSB (vestigial sideband) and QAM (quadrature amplitude modulation), and the North American Digital Group, an organization seeking compatibility with European digital TV which is spearheaded by TV/COM.

Along with setting MPEG-2 compression parameters for digital TV, NADG is hoping to drive standardization of data rate ranges, transport stream syntax, service information tables, modulation and interleaving approaches and other elements of the end-to-end process that often overlap with DAVIC. Jim Shelton, senior vice president at TV/COM, said NADG was interested in standards from the perspective of the "source," which is to say, how the signal is formulated at the production and broadcast level, whereas he characterized DAVIC as working on the links "between the headend and the set-top."

One key area of tension between the broadcast interests and the networking community concerns modulation. Because the Grand Alliance has chosen 16 VSB for HDTV and network operators are choosing 64 and 256 QAM, network interests are concerned SDTV will require a VSB approach to ensure conformity with HDTV.

However, said Graham Stubbs, vice president of programs for TV/COM, the modulation conflict might be resolvable by accommodating both systems in hardware developed for network terminals and transmitters. "If SDTV is done with VSB, then it would use the same tuner as HDTV," Stubbs said. "But with some creativity in the design you could build a set of semiconductors that would be able to handle both modulation techniques."

Telco platform

With conflicts of this dimension in the offing, the telcos' agenda, especially the one set by the new alliance involving Bell Atlantic, Nynex and Pacific Telesis, leaves little time for the government to act before digital delivery platforms are in operation, unless the commission decides to hold up telco video until such issues are resolved. "The commission is push-

ing as fast as it can to get the video dialtone applications off the table while it begins taking serious steps toward setting standards that could greatly affect the design of telco video systems," noted a leading participant in standards issues, asking not to be named. "How can they authorize implementation of digital TV to millions of households if they are serious about making everyone conform to their standards?"

Indeed, some telcos are very close to completing work on their platforms. "We're at the point where we could go to market now with interactive services and have a very robust business, including all the billing and operation support software as well as the network hardware," said Ken Van Meter, president of interactive platforms for Bell Atlantic Video Services.

While work remains to be completed on the channel management system that will govern multiple video providers' access to analog channels, Van Meter said the BVS system, soon to be adopted as the core platform of the new alliance taking shape with Nynex and Pacific Telesis, will be complete for full video dialtone operations by the time VDT tariffing is wrapped up, "even if we get the green light on our Section 214 applications tomorrow."

The end-to-end system that alliance members will begin with is based on Oracle's media server, objects and network software, Microware's set-top operating system David and a wide range of operation, management and billing software developed by BVS in cooperation with outside contractors such as EDS, Nobel and Make Consulting. Van Meter, who serves as Bell Atlantic's representative to the three-man executive committee overseeing the alliance's platform company, said Nynex was contributing valuable work in the area of level one gateways, the point at which subscribers gain an overview of everything offered by all video information providers. PacTel is contributing expertise in analog channel management.

Van Meter said the platform is designed to work with all the types of networks alliance members are deploying, including hybrid fiber/coax, fiber-to-the-curb and twisted pair copper, as well as the switching interfaces they have adopted. "About 90 percent of what we've done is ready to use in any of these environments, which means there's only a limited amount of customization required to fit other companies' requirements," he said.

DAVIC

The telco group's open-interface philosophy is in stride with the approach at DAVIC, which now consists of 132 member companies and institutions, including a significant share of major telecommunications and computer hardware and software manufacturing companies worldwide as well as significant portions of the cable and telephone operating communities. In a January meeting in Orlando, DAVIC completed work on a document that defines 17 key interfaces and the major options under consideration for each from the server through the network to the home terminal.

"There's beginning to be a sense that this thing is really going to work," said Bob Luff, CTO of Scientic-Atlanta's Broadband Communications division and a member of the DAVIC management committee. Luff acknowledged the issues are even more contentious than those surrounding MPEG, but he said success in Orlando meant the organization is on track to complete a draft of proposed

the network also allows for proactive maintenance by identifying failing components and repairing them before a customer has a problem. Instead of dispatching a technician to the numerous homes reporting outages, a cable TV service provider equipped with FOMS can easily pinpoint the trouble and dispatch a technician directly to it.

Because relying on customers to report service outages isn't going to suffice when cable TV service providers begin moving into new arenas like telephony, the outage identification capabilities of FOMS will become essential. This functionality will also prove vital as new regulations are imposed on the cable industry to improve service and response time.

Overcoming deployment challenges

Deploying a technology like FOMS is not without challenges. Standardizing SMS interfaces, selecting mobile terminal equipment for field technician use and choosing data communications links are real issues facing the cable TV service provider.

Adapting to the SMS interface, for example, is a complicated process; getting work orders in and out currently represents the most significant challenge facing FOMS equipment vendors and cable TV service providers. This is largely due to a multi-vendor environment for SMS interfaces, each with its own unique requirements for interaction. The problem is even more complex in that no standards have been put in place, and every SMS in service is a proprietary system. As such, costly and time-consuming customization is required for every FOMS system deployed today.

Nothing is being done at this time to rectify the SMS interface problem. Before cable TV service providers can truly benefit from FOMS and other new technologies, there needs to be a better working relationship between the various equipment providers. Also, there needs to be some direction in the formulation of standards (i.e., from the National Cable Television Association or Cable Television Laboratories).

Selecting mobile terminal equipment involves the degree of functionality desired by the cable TV operator and the total cost. Low-end units that provide limited functionality are inexpensive, but limit the scope of the technician's participation in selling new services. On the other hand, high-end, pen-based devices with bar code scanning ability and signature capture offer a dynamic sales environment but can cost several thousand dollars.

Some of the benefits cable TV service providers will experience with the deployment of field operations management systems include:
✔ Increased technician productivity by reducing the amount of "hold time" on telephones to get clearance to activate a service; better routing of technicians to minimize drive time between jobs; and the ability to do home dispatch electronically.
✔Reduced number of dispatchers needed, freeing them for other responsibilities.
✔ Increased revenue generation opportunities with technicians in a better position to sell new services.
✔ Increased customer satisfaction. Cable TV service providers are able to react more quickly to potential or actual outages–well before customers have a problem and must call to complain.

The method in which communication is conducted in this new environment can be a challenge, as well. For example, which network should the cable TV service provider choose for its electronic dispatch–two-way radio or cellular? Cable TV service providers should make a selection that minimizes near-term expenditures by utilizing what is available to them today.

Industry cost estimates for a FOMS-type system range from $8,000 to $12,000 per technician, which translates to about $6 to $10 per subscriber. This cost includes everything from technician mobile terminals to centralized computers and software. When balanced against the savings associated with increased productivity–approximately $9,000 per technician annually–and the reduction in personnel required for dispatching, it only takes between 12 and 18 months for a service provider to recoup its investment in a FOMS system. After that, it's purely operational savings.

So despite the challenges, there are still significant benefits in moving forward with the deployment of FOMS. As the industry moves toward "two-hour commitment windows," the importance of new technologies that provide cost savings and increased efficiencies is even greater. Cost efficiencies will increase even more as interfaces become standardized. As such, cable TV service providers must apply pressure on manufacturers in order to help move this technology forward. CED

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7 Central Indiana SCTE Chapter, Testing Session. BCT/E and Installer Certification exams to be administered. Location: Connersville, Ind. Call Gordie McMillen (317) 353-2225.

7-9 Wheat State SCTE Chapter, Testing Session. BCT/E certification exams to be administered. Location: Great Bend, Kan. Call Jim Fronk (316) 792-2574.

7-9 Hybrid Fiber/Coax Operation and Maintenance, produced by the Scientific-Atlanta Broadband Training Institute. Location: San Francisco. Call Bridget Lanham at (800) 722-2009; or (404) 903-5516.

7-9 Broadband Communications Technology, a C-COR training seminar. Location: Fremont, Calif. Call the C-COR Technical Customer Services Department (814) 231-4422.

9 SCTE Satellite Tele-Seminar Program. Topic: Digital Transmission Techniques (Part II). To be transmitted on Galaxy 1R, Transponder 14, 2:30-3:30 p.m. Eastern time. Call SCTE national headquarters (610) 363-6888.

9 Magnolia SCTE Chapter, Testing Session. BCT/E and Installer Certification exams to be administered. Location: Ramada Coliseum, Jackson, Miss. Call Bob Marsh (601) 932-3172.

10 Rocky Mountain SCTE Chapter, Technical Seminar. Topic: RF distribution equipment and RF distribution theory and demonstration, with Fred Rogers of Quality RF and Darrell Severns of TCI. Location: NCTI office, Littleton, Colo. Call Darrell Severns (303) 754-6521.

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March

20-23 Supercomm '95. Location: Anaheim Convention Center, Anaheim, Calif. Call (202) 326-7281 for attendee information.

27-31 Networld + Interop '95. Location: Las Vegas, Nev. Contact ZD Expos at (415) 578-6940.

14 Overview of Fiber Optic Systems, a one-day course, presented by EESCO Communication Systems. Location: LAN Training Center, Oak Brook, Ill. Call EESCO at (800) 366-3638.

14 Fundamentals of the Hybrid Fiber/Coax Network, produced by the Scientific-Atlanta Broadband Training Institute. Location: Denver, Colo. Call Bridget Lanham at (800) 722-2009; or (404) 903-5516.

14-16 Philips Mobile Training 1995, sponsored by Philips Broadband Networks Inc. Location: Denver, Colo. A hands-on course covering broadband technology. Call Mobile Training at (800) 448-5171 (800-522-7464 in New York state).

14-16 Digital Video and Fiber Optic Networking, a C-COR training seminar. Location: Fremont, Ca. Call the C-COR Technical Customer Services Department (814) 231-4422.

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APRIL

11-13 Network World Unplugged. Produced by IDG World Expo and Network World; sponsored by Forbes ASAP. Location: New York Hilton and Towers, New York, N.Y. Call (800) 225-4698; or (508) 879-6700.

24-28 General Instrument's Broadband Communications Network Design. A five-day training course which includes a high-level overview of the broadband communications network, with a special focus on operational theory and network design. Location: St. Louis, Mo. Call Lisa Nagel, GI (215) 830-5678.

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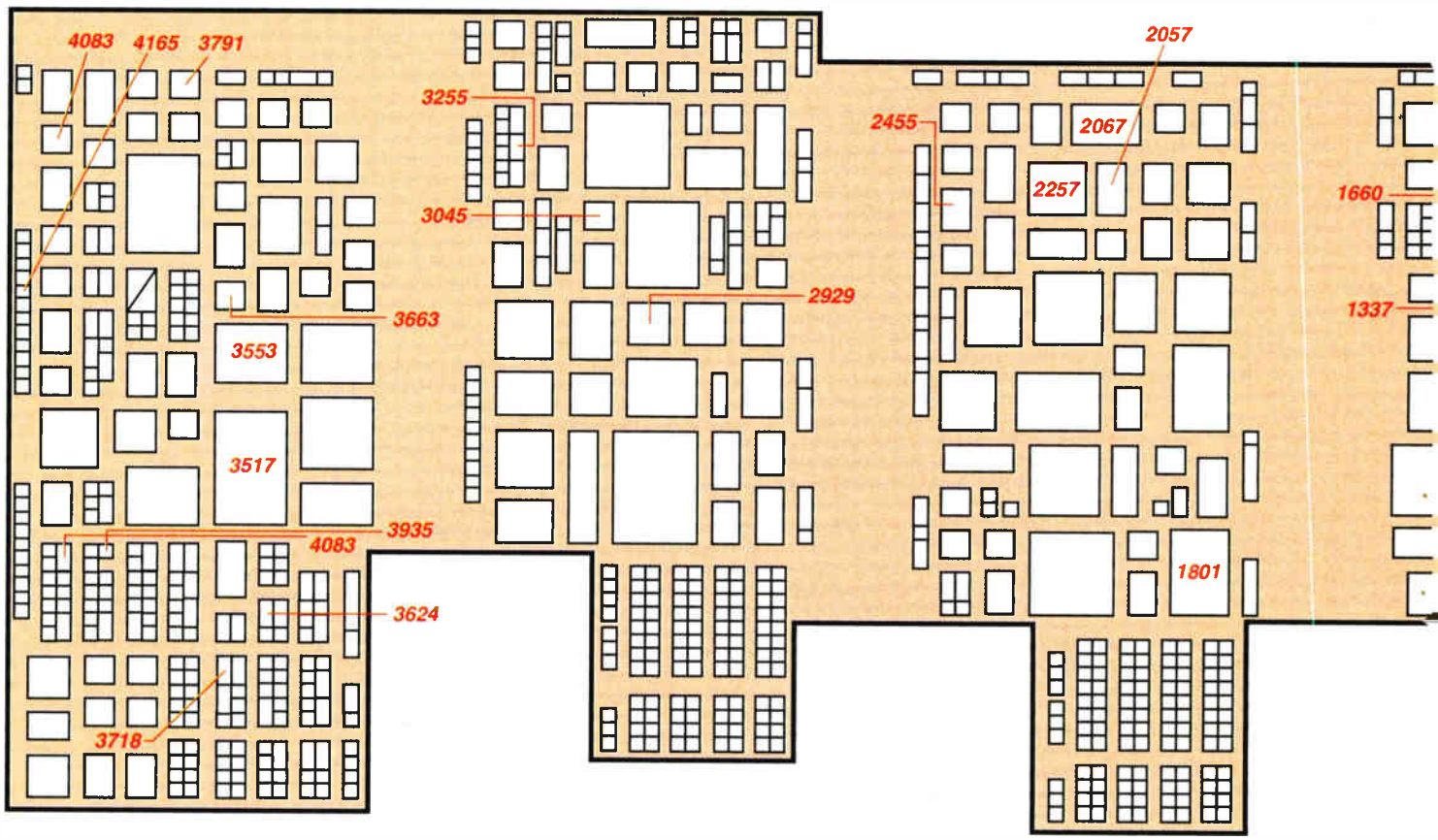

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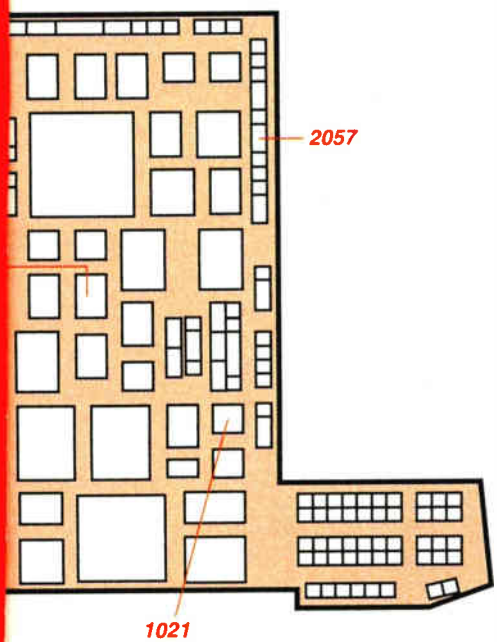

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Independent NECA Services, Inc. 3520
Independent Technologies, Inc. 3139

Integral Corporation 3045
Phone 800/527-2168

Integral is now showcasing Messenger-On-Duct as the best protection for your aerial fiber optic cable and the fastest way to restore a damaged cable. Specializing in Pre-assembled Cable-In-Conduit, Integral products will eliminate your cable pulling anxiety; plus you will receive vital conduit stability for many years to come. In the ground or in the air, trust Cablecon™ and experience the benefits of 30 years of performance and reliability. Come by and see us at booth #3045 and let us show how Integral offers the best and most reliable conduit systems for all your future installation challenges.

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PHILIPS

Philips 3553
Phone 315/682-9105

In booth 3553 at Supercom Philips will exhibit: Media Pool™ video server; Diamond Line™ AM and FM fiber optic receivers and transmitters, including the new Diamond Net™ fiber optic receiver; BCG™ Broadband Communications Gateway NetProphet™ Management System; Spectrum 2000™ RF amplifiers; Media Access™ digital converters; 1995 Mobile Training Schedule.

Philips Technologies-Airpax Protector Group 4062
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PIRELLI

FIBER OPTIC CABLES
OPTICAL COMMUNICATION SYSTEMS

Pirelli Cables North America 1337
Phone 803/951-4800
Pirelli will be displaying its quality fiber optic communication cables and CATV transmission systems in booth #1337. Pirelli is an ISO 9001-registered manufacturer of 4-264 fiber aerial, duct and direct buried loose tube cables; 288-432 fiber RILT™ (ribbon in loose tube) cables; and 1-96 fiber interconnect/riser cables. CATV transmission systems include linearized 1550 nm links using high power EDFA technology for head end and other applications.

Plug-In Storage Systems, Inc./PSSI 1816
Polar Power 1073
Positron Industries Inc. 2051
Powell Electronics, Inc. C6121
Power & Telephone Supply Co. 1345
Power Battery Co., Inc. .2555ower Conversion Products Inc. 2542

POWER GUARD

Power Guard, Inc. 2455
Phone 334/742-0055
Power Guard is a world leader in supplying Global Network Powering Solutions for advanced telecommunications projects. Our unique Unity Wave technology increases reliability while reducing operating costs. Booth #2455.

POWERCOM 4127
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Precise Power Corp. 4031
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ryan.hankin.kent 2513

RYCOM® instruments, inc.

RYCOM Instruments, Inc. 3718
Phone 800/851-7347
Rycom Instruments is proud to unveil its newest portable Locator, the Model 8875 which features Push Button Depth. Depths up to 15 feet are quickly displayed in inches or centimeters in an LCE readout. To easily identify cable path, Absolute Signal Strength is continuously displayed on the 8875 receiver. The highest number displayed in peak mode or the lowest number in null mode identifies the cable. Absolute signal strength can also identify a loss of signal to ground caused by damaged cable, find insulated pipe bushings or shorted pipes. The 8875 is available in standard or rechargeable batteries. Rycom will also be showing the Tucon Optical Isolation Equipment, designed to offer electrical systems protection against ground surges, electrical storms, lightning and fault currents.

SBC Communications 1509
Schroff, Inc. 3981

Scientific Atlanta

Scientific-Atlanta, Inc. 2067
Phone 800/722-2009
At Booth 2067 at Supercom, Scientific-Atlanta will be exhibiting its full range of broadband communications products which make S-A the focal point of convergence. These products include the following:
• A prototype MPEG-based digital home communications terminal.
• Interactive analog 8600x home communications terminal operating live with interactive program guides and other applications, NMOD capability, virtual channels and other new features.
• CoAxiom providing live telephone service over Scientific-Atlanta's Fiber-to-the-Serving Area (FSA) hybrid fiber coax networks.
• Digital storage and retrieval system for ad insertion and other applications.
• MPEG-based digital headend video compression system over satellite.
• 750 MHz distribution and fiber electronics.
• Scientific-Atlanta developed adapter with live downloading of Sega games from Sega Channel to Sega game players.
• DMX digital audio service with DMX On Screen of 8600x terminal.

Securicor Telesciences Inc. 3803
Security Dynamics C6401
Seiscor Technologies Inc., a Raytheon Co. 3845
Siecor Corp. 4075
Siemens Industrial Automation 3319
Siemens Rolm Communications 3537

SIEMENS

Siemens Stromberg-Carlson 3537, 4165
Phone 407/955-6054
IMMXpress™ is an Interactive Multi-Media network design capable of delivering interactive and broadcast video, high-speed data and telephony services over a single subscriber connection. On display at the Siemens Stromberg-Carlson booth are video-on-demand, home shopping and high-speed data applications, together with voice services deliverable over a coaxial cable.

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Source Inc. C6204
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Transys Networks Inc. 1815

TFC Times Fiber Communications, Inc. Division of Amphenol Corporation

Times Fiber Communications Inc. 3624
Phone 203/265-8500
800/677-2288

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Trilogy Communications 3935
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Trioniq, Inc. C6202
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TriQuint Semiconductor 2511
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WAVETEK

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Wavetek's precision-engineered, innovative test equipment enhances productivity and is designed to meet the customer's specific needs. For over 25 years, Wavetek has provided quality test equipment for the cable television, wireless communications, telecommunications, LAN, ATE, metrology and general purpose test and measurement industries. Products include: OTDRs, signal level and analysis meters, system sweep equipment, system analyzers, bench sweep gear, cellular handset test systems, cellular base station test equipment, cellular activation testers, RF communication service monitors, LAN testers and digital multimeters. Wavetek looks forward to continuing market leadership by anticipating customer needs, developing innovative technology and providing efficient information age test solutions.

Weidmuller Inc., Paladin Tools 3826
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Wireless World 1800
Wyle Laboratories 1131
Xerox Corp. 1064
Xinex Networks C6320
XTEND Communications C6400
Zarak Systems Corp. 4129

ZENITH

Zenith Electronics Corp. 3791
Phone 708/391-8000

Zenith is recognized as a leading international provider of cable and data communication products for cable TV, wireless and telephone companies. Showcased at the Zenith booth will be addressable MultiMedia analog and Media Access hybrid set-top systems featuring real-time, interactive two-way communications, and on-screen program guides and displays. Featured will be ScreenPlay™, an authoring tool that dynamically creates and modifies interactive television screens to support unique requirements and new services. The Metro Access system for data communications over coax and hybrid fiber/coax features powerful products for distance learning, work-at-home, telemedicine and on-line service applications. Zenith's rugged 16-VSB digital technology and its various uses will be demonstrated at several locations throughout the show.

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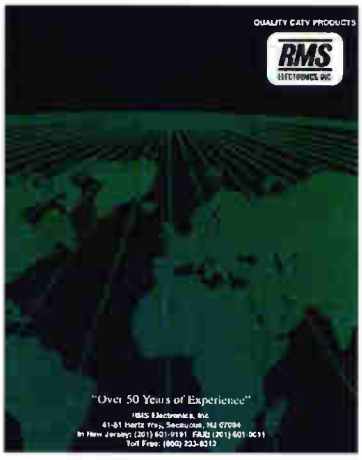

RMS Electronics is a leading manufacturer/supplier of cable equipment. We are becoming the fastest growing supplier of cable components in the world. The new RMS American catalog contains an extensive line of over 400 products which are used in the construction or rebuilding of cable television systems. Call for your FREE catalog today!

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Circle Reader Service No. 111

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 has–ever. By the time this is published, DirecTv may have sold its one-millionth subscription. Meanwhile, cable operators are forced to wait to implement digital technology, probably until next year. What impact has this had on local cable systems?

The questions:

1. How well would you say DBS is doing at taking away customers who reside in your cable system?

☐ Excellent ☐ Good ☐ Poor

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

3. Do you think consumers see DBS as a better investment than cable TV over the long run?

☐ Yes ☐ No ☐ Don't know

4. To what degree has the launch of DBS affected your system's rebuild or upgrade schedule?

☐ A lot ☐ Some ☐ Very little

5. In your opinion, what is DBS' "weak link" when compared to a cable system?

☐ Hardware cost ☐ Programming cost

☐ No return path ☐ Broadcast-only ☐ Other

6. What percentage of your former subscribers have already switched to DBS services?

☐ 10% or less ☐ 10%-20% ☐ More than 20%

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

8. Do you think most DBS subscribers are rural residents who haven't been wired for cable?

☐ Yes ☐ No ☐ Don't know

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

10. Has your system either lowered prices or offered any special promotions to ward off DBS competition?

☐ Yes ☐ No ☐ Don't know

11. If it was available, would you implement digital compression today to increase your channel count?

☐ Yes ☐ No ☐ Don't know

12. Is any portion of your system's franchise area currently being served by an MMDS operator?

☐ Yes ☐ No ☐ Don't know

Your comments:

FAX US

303-393-6654

Make a copy of this page and fax it back to us at the number above, or mail it to *CED*, 600 South Cherry Street, Suite 400, Denver, Colo. 80222.

We will tally the results and print them in a future issue. Your suggestions for future questions are always welcome.

We also want some written comments from you on this subject. Names won't be published if you request your name to be withheld, but please fill out the name and job information to ensure that only one response per person is tabulated.

Your name and title

_____

_____

_____

System name:

_____

Your MSO:

_____

Location:

_____

Your job function:

_____

Frequency agile modulator

BOCA RATON, Fla.–Passive Devices Inc. has announced the availability of an upgraded version of its PDI-60M, 60 dBmV, 70-channel, frequency agile modulator. The PDI-60M is BTSC stereo compatible, and its high carrier to broadband noise ratio eliminates the need for bandpass filters. Digital channel selection is provided by push-button switches which set up conveniently from the front panel. The FCC offsets are selectable from an externally accessed switch. Spurious outputs are better than 60 dB below the video carrier.

The PDI-60M features SAW filtering to provide excellent vestigial sideband response characteristics and superior adjacent channel performance. A composite IF loopthrough on the rear is available for scrambler processing.

Circle Reader Service number 66

Split band modulator

Three-input split band modulator for multi-room video distribution

LAGUNA NIGUEL, Calif.–Channel Vision Technology has introduced a new, three-input split band modulator for multi-room video distribution. Unlike an analog modulator, the company's PLL digital circuitry provides long life and drift-free professional quality performance, according to the company. Split-band frequencies offer the installer the versatility of UHF for antenna installations, and ultra band for cable installations in one digital unit.

Circle Reader Service number 67

Channel deletion filter

EAST SYRACUSE, N.Y.–Communications & Energy Corp. is offering its Model 2599 band stop filter, which deletes a TV channel for insertion of new programming. The filter is used in applications where adjacent channels can be sacrificed.

Attenuation on video, color and sound carriers is 60 dB, 50 dB and 40 dB, respectively. Elsewhere in the channel, attenuation is 35 dB minimum. The filter is available for VHF standard NTSC channels 2 to 36. It can also be provided for HRC, inverted or offset channel formats. Connectors are 75 ohm, type F (male and female). Each filter assembly is made using weatherproof tubular construction. In addition, the filter is also available panel-mounted as the Model 2599P.

Live fiber detector

Also new from Communications & Energy Corp. is the Model TXHP-40, which suppresses return path noise generated by subscriber electronics like television sets, appliances and neon lights. The TXHP-40 is placed in the drop lines of CATV subscribers who have not opted for network access through the return path. It suppresses return path signals 50 dB from 0 to 40 MHz. It also has low CATV system loss to 1000 MHz.

The tubular body of the filter mounts 75 ohm, type F (male and female pair) connectors.

Circle Reader Service number 68

Automating satellite feeds

LOS ANGELES–Standard Communications Corp. has introduced the Agile Omni Global VU series re-broadcast satellite receiver, which eliminates the need for various special types of receivers within the same installation. With its remote control technology and agility, the system is specifically designed for station automation, multiple remote locations and earth stations separated from the control room.

The Agile Omni's channel selection, as well as all other customization functions, can be controlled by computer remote control, or via the front panel.

The Omni Global VU CAM830/830I series control access module

The Omni Global VU CAM830/830I series control access module is designed as an economical upgrade solution for Standard's Omni Broadcast MT830 satellite receiver.

It offers the engineer convenient access and adjustment of all essential features and functions of the receiver manually, or by remote control. This would include all video and audio output levels with individual channel memory, and automatic scan modes for RF and audio subcarriers.

The module is intended to allow the engineer to operate up to 30 receivers, located at multiple off-site locations, or at the broadcast facility. Further, the CAM830 is easily field retrofitted in any existing Omni Broadcast MT830 satellite receiver installation, or can be installed as a factory ordered accessory.

Circle Reader Service number 69

LFD-100 Universal Live Fiber Detector

VANIER, Quebec–The new LFD-100 Universal Live Fiber Detector from EXFO E.O. Engineering Inc. can safely identify live and unused fibers. The field-portable instrument recognizes traffic as well as test signals (CW or modulated), and indicates both the core power level and the direction of the light in the fiber.

As per Bellcore TR-NWT-000764, it uses a safe macrobending approach to minimize the risk of service interruption and avoid fiber damage induced by stress. To provide maximum flexibility, a single, non-removable head adapts to 250 µm coated, or 900 µm tight buffered fibers and 3 mm jacketed test jumpers or patch cords.

Circle Reader Service number 65

Mini OTDR

BEAVERTON, Ore.–Photon Kinetics has introduced the Model 7500 OTDR, a full-featured unit in a mini-OTDR package. The Model 7500 offers greater than 32 dB dynamic range, 20 meter attenuation deadzone and five meter event deadzone. The unit is 8.5 inches by 13 inches by 2.5 inches, weighs under seven pounds and has a large 9.4-inch VGA LCD screen for easy viewing, as well as an auto test function that simplifies operation. Optical test options include a light source, power meter and visual fault locator.

Circle Reader Service number 70

Splice holder

BELLE MEAD, N.J.–Advanced Custom Applications Inc. has introduced a splice holder for the ULTRAsplice, mechanical fiber optic splice. The Splice Holder is made from a DuPont material called ALCRYN Melt-Processible Rubber, a material that never melts and is environmentally stable. The holder accepts up to 13 splices and is available in both blue and white for customers with color-keying systems. The splice holder can be applied to almost any splice tray by either glue, or by the use of double-sided tape.

Circle Reader Service number 71

Photodetector module

WEST TRENTON, N.J.–EPITAXX Optoelectronic Devices Inc. has introduced the new ETX100RSC-Series High Speed InGaAs Photodetector Module to the commercial market. The ETX100RSC incorporates a 100 µm InGaAs PIN photodiode mounted in an SC connector receptacle module with a two-holed mounting flange. The module features high responsivity at 1300 nm; capacitance of 1pF.

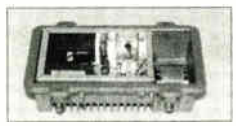
Applications include digital fiber optic receivers operating to 622 Mbps. The ETX100RSC is well-suited for high-volume, fiber-in-the-loop receiver applications.

Circle Reader Service number 72

Node power pack

ROSWELL, Ga.–A new power pack from Performance Cable TV Products makes fiber nodes independent of system powering by incorporating miniature gel cells inside the module. The power pack, known as a DC-UPS, functions as a true, on-line UPS and supplies uninterrupted power to the critical fiber node, regardless of system powering problems.

Improved isolation from the power line gives greater protection to the electronics than with the switch mode power packs now in use. No transfer relay is used, so problems such as glitches caused by relay contact bounce are eliminated, ideal for digital environments.



DC-UPS power pack

The DC-UPS directly replaces power packs packaged with the node module and is available with 60 and 90 volt AC input. DC output is specified according to the requirements of the individual node. The unit contains two, 1.2 amp hour 12 volt gel cells, continuously charged by a pulsating charger adjusted to the equilibrium voltage of the cells used. Life expectancy of the batteries is four to six years.

The modules containing the batteries and regulating circuit are designed to fit inside the cover of most popular node housings, and come with a replacement power transformer that attaches inside the housing cover. Mating plugs interconnect with the node module.

Circle Reader Service number 73

Fiber cable ID

HOUSTON, Texas–V.I.P. Products is offering a line of fiber optic cable identification tags. Presently, four basic color and legend combinations are offered from stock to identify coax, hybrid, composite and fiber optic cables.

The tags are designed with space to write in the information specific to the cable being identified. One of the important features of the tags is a partially applied clear film seal which is quickly and easily laid down over the hand-written information to protect it from severe ambient conditions.

The tag is virtually waterproof, can be wiped clean, is very fade-resistant and can withstand severe abrasion or vibration. It is suitable indoors or out, above or below ground. The tag is prepunched with five holes so that it can be hung as a tag, or strapped on to the cable with ties. Tags are packaged in convenient, pocket-sized resealable plastic bags containing 100 tags.

Circle Reader Service number 74

RF coax connectors

SIMI VALLEY, Calif.–Hirose has introduced the POD1 series of push-on, locking, RF coaxial connectors. They are about half the diameter of the most popular BNC and TNC locking connectors. For example, the diameter of jacks and plugs is as small as 7.6 mm.

The push-on POD-1 connectors provide optimum 50 ohm impedance for external wiring of microwave band and high-speed pulse transfer signals in mobile communications equipment. They are ideal for measuring instruments and are currently being utilized in GPS and similar applications.

The push-on locking system works by locking the connector, no matter which part of the connector is held; it will not inadvertently disconnect, even when force is applied to the cable. The connector is easily disconnected by grasping and pulling the tube portion.

VSWR is 1.3 or less from DC to 3 GHz (not including the terminator).

Circle Reader Service number 75

Fiber attenuator

SANTA CLARITA, Calif.–Nanometer Technologies has introduced a new, ultra low back reflection, dispersion shifted fiber attenuator that is available with most major connector types. The typical back reflection with an APC type connector is less than -65 dB.

The Nanometer Technologies Models 2001, 2010, 2020-DS variable attenuators have an attenuation range of 35 dB and are designed for low noise fiber distribution systems, video transmission, receiver power matching and production line testing of fiber systems. The low back reflection characteristics of the attenuator make it virtually invisible to the system, according to the company.

Circle Reader Service number 76

People on the move

ADC Telecommunications Inc. has named **Geoffrey Goss** as president and general manager of ADC Telecom Canada Inc., the largest foreign subsidiary of the company. Goss is now responsible for leading the subsidiary to provide local sales, service and marketing support for the company's network service provider customers in Canada. He brings more than 20 years of experience in the telecommunications industry to ADC, most of which has been in Canada.


Geoffrey Goss

ADC Telecommunications has also named three new vice presidents: **Mehmet Balos** as vice president of corporate marketing and communications; **Joanne Anderson** as vice president of customer service; and **John Grubb** as vice president of CAP, CATV and distribution sales.

AT&T has appointed **Daniel Stanzione** to succeed John Mayo as president of AT&T Bell Laboratories. Mayo will retire, under AT&T's mandatory retirement rule. Stanzione, president of AT&T Network Systems' Global Public Networks unit, will also become a member of AT&T's Management Executive Committee.

Stanzione will be succeeded by **Gerald Butters**, president of AT&T Network Systems North American Region. Carleton Fiorina, currently president of AT&T Network Systems' sales unit for the eastern United States and Canada, will be promoted to succeed Butters.

James Gray has been appointed as chairman of **Primestar Partners L.P.** He joins John Cusick, who has been president of the venture since 1991, and who will continue in that capacity. Gray had served previously as vice chairman of Time Warner Cable, from 1992 to 1994. During that time, he also served on Primestar's board of directors.

Antec Corp. has named **James Faust** as executive vice president and president of Antec International. Faust joins Antec from General Instrument Corp., where he was senior vice president and general manager of the Satellite Products Division. Prior to that, he was president of the Cable Products Division of Zenith Electronics.

David Elder has joined **Digital Video**, a division of Antec Corp., as vice president, Marketing and Business Development. In his new position, Elder is responsible for the marketing, business development and customer service of the company's line of digital video file servers. Prior to joining Antec, Elder was director of customer marketing and sales for The Quaker Oats Corp. in Chicago.


David Elder

Matthew Aden has been named to the newly-created position of vice president of international sales for the GI Communications Division of **General Instrument Corp.** Aden now oversees sales operations in Europe, Latin America and the Far East. Most recently, Aden served as director of sales for Europe, working from the company's facility in the United Kingdom.

Pete Wronski has been promoted to vice president, North American cable sales, for the GI Communications Division. In his new position, Wronski will manage the cable sales group, including the company's office in Toronto, Canada. Wronski most recently served as director of territory sales with the company.

Dr. Rudolph Frank has joined **AT&T Network Systems Group** as vice president of professional services and applications software. In his new position, he's responsible for developing and marketing software applications that enable local telephone and cable companies to develop and offer new services. Frank joins AT&T from Cincinnati Bell Telephone, where he held the position of chief information officer-senior vice president.

Scientific-Atlanta Inc. has named **Robert Bird** as director of international telecommunications strategies in the International Division of the Broadband Communications Group. Bird will work with U.S. cable operators and regional Bell operating companies in their pursuit of international markets. Previously, Bird was district manager in the North American Division serving the western United States.

Qualcomm Inc. has named **Dino Vendetti** as director of PCS technology. Vendetti will focus on the creation of new business opportunities and strategic alliances for the company's Code Division Multiple Access (CDMA) technology in Personal Communications Services (PCS) markets.

Gould Fiber Optics Division has hired **Art Hoffman** to fill the director of quality assurance position. Hoffman is now responsible for Gould's quality programs and achieving ISO 9000 certification. Before joining Gould, Hoffman held management positions in new product development, quality assurance and manufacturing engineering with GTE and ITT.


Art Hoffman

Ellen East has been promoted to director of communications for **Cox Communications Inc.** As part of her new position, East will assume the oversight of shareholder communications as a result of the merger between Cox Cable and Times Mirror Cable Television. She joined Cox Enterprises in 1990 as communications manager and was appointed manager of public affairs for Cox Cable in 1993.

Amphenol CATV Connectors has appointed **H. Scott Wells** to the position of director of CATV sales at its headquarters in Danbury, Conn. As director of sales, Wells is responsible for all CATV-related sales of connectors. He joins Amphenol following a position as national sales manager at Cable-Con Connectors.


H. Scott Wells

Blonder Tongue Laboratories Inc. has promoted **Charles Fitzer** to the position of director of sales. In his new position, Fitzer directs all Blonder Tongue sales efforts, including customer service, system design, sales representation, distributor sales and direct sales. Previously, Fitzer was the U.S. Western Regional Sales manager.

Channelmatic has promoted **Terri Karam** to director of sales. Karam was previously western regional sales manager. A 20-year veteran of the cable television industry, Karam will focus on domestic sales and customer service relations.

Porta Systems Corp. has named **Robert Tucci** as district sales manager for the Western District of its Americas Business Unit. Paramount among Tucci's responsibilities will be the management of all copper and fiber sales to the telephone and CATV markets in his territory. CED

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The scalpel versus the machete

By Archer S. Taylor, Director and Senior Engineering Consultant, Malarkey-Taylor Associates

The dual heterodyne set-top convertor box, patented in 1967 by Ron Mandell and George Brownstein, opened the cable spectrum to frequencies that were not allocated by the FCC for TV broadcasting. Cable TV engineers such as Earl Hickman (Ameco) and Phil Hamlin (Jerrold), both of whom were experienced private pilots, urged that the industry voluntarily avoid frequencies in the air navigation band, from 108 MHz to 118 MHz. They feared that inadvertent cable leaks might cause dangerous errors in navigation. Besides, more than enough other frequencies were available for CATV.

The meat-ax approach

By 1970, when the FCC was trying to devise technical standards for CATV, the FAA and the pilots' associations were pressuring the FCC to prohibit use by CATV of any frequency in the bands allocated to commercial or military aviation, which included spectrum between 108-136 MHz and 225-400 MHz. In one meeting with the White House Office of Telecommunications Policy (OTP), pilots' representatives demanded "zero probability" of interference. Obviously, they did not understand the mathematics of probability: zero probability does not exist. Recognizing the devastating consequences to the budding CATV industry, the FCC resisted. In 1970, Sidney Lines, an engineer in the FCC Office of Chief Engineer, who was also a charter member of the IEEE Coordinating Committee on Cable Communications Systems (CCCCS), advised the Committee that the FCC would not much longer be able to withstand the political pressures based on fears for public safety (I was chairman of the Committee at the time). Committee members strongly recommended that studies should be initiated to identify the particular conditions, if any, under which cable television systems could safely operate in the presence of aeronautical radio services.

To this end, Robert Powers, a charter member of CCCCS and a staff engineer in the Office of Telecommunications (OT), Department of Commerce (later to become chief scientist at the FCC) agreed to pursue the matter with the Institute for Telecommunication Science (ITS), part of the National Bureau of Standards (NBS). In 1974-75, ITS engineers in Boulder, Colo. undertook to investigate the susceptibility of aircraft navigation systems to unwanted interference, and the characteristics and strength of signal leakage from coaxial cable. These studies were conducted partly in the laboratory, but also included ground and airborne testing of the radiation patterns of simulated leaks as well.

The findings (generally consistent with independent studies by the Canadian Department of Communications) were surprising. The design of air navigation instrumentation was found to be so robust as to be quite immune to interference, even from malfunctioning cable TV networks. An interfering signal could cause erroneous indications only if its frequency were within one or two Hertz of the 30-, 90-, or 150-Hz modulation sidebands. Moreover, conditions that might produce unacceptable desired-to-undesired received signal ratios were found to be exceedingly improbable.

Stunned by these findings, the FAA expanded its concern to potential leakage interference from defective cable networks that might be strong enough to "break squelch" in FM communications receivers on board aircraft. This concern exploded into paranoia in April 1976, in Harrisburg, Pa. Unbeknownst to the Harrisburg CATV operator, the FAA had reassigned communications facilities at the Harrisburg Airport to 118.25 MHz, which just happened to be the AGC control frequency in the Jerrold trunk line equipment used in the Harrisburg area. Signals were relayed from the Harrisburg headend to four hubs by AML microwave, without phase lock frequency control. Many pressure taps were still in service. Not only did the leaks "break squelch," but the beat between the four non-locked versions of the 118.25 MHz AGC control carrier apparently distracted and frightened the pilots in their landing procedure. There were no accidents.

The surgical approach

So in 1977, the FCC adopted interim rules providing 100 kHz offsets from aeronautical assignments and preclearance by the FAA (through the FCC) for cable TV frequencies in the aeronautical bands. Shortly thereafter, an FCC Advisory Committee on Cable Signal Leakage was established. Participants included the FCC, FAA and NTIA, as well as cable TV representatives and private aviation interests. These studies, both airborne and ground-based, provided a comprehensive, technologically and statistically sound basis for the signal leakage rules adopted in the 1985 Second Report and Order. These rules require offsets of 12.5 ±5 kHz in the aeronautical communication bands; 25 ±5 kHz in the aeronautical navigation bands. The rules require annual ground-based measurements to show compliance with the specified Cumulative Leakage Index (CLI), or alternatively, a flyover to show that the leakage field strength is less than 10 microvolts per meter at 450 meters altitude. Continuous partial leakage monitoring and various notifications were also required.

Although the industry complained that these rules were unduly burdensome, most operators now acknowledge that leakage monitoring and the CLI have helped enormously to improve signal quality and reliability. An important precedent was established by the insistence of industry engineers, supported by the FCC, that engineering solutions should be devised to solve engineering problems, without destroying the revenue base.

The scalpel cures; the meat-ax destroys. CED

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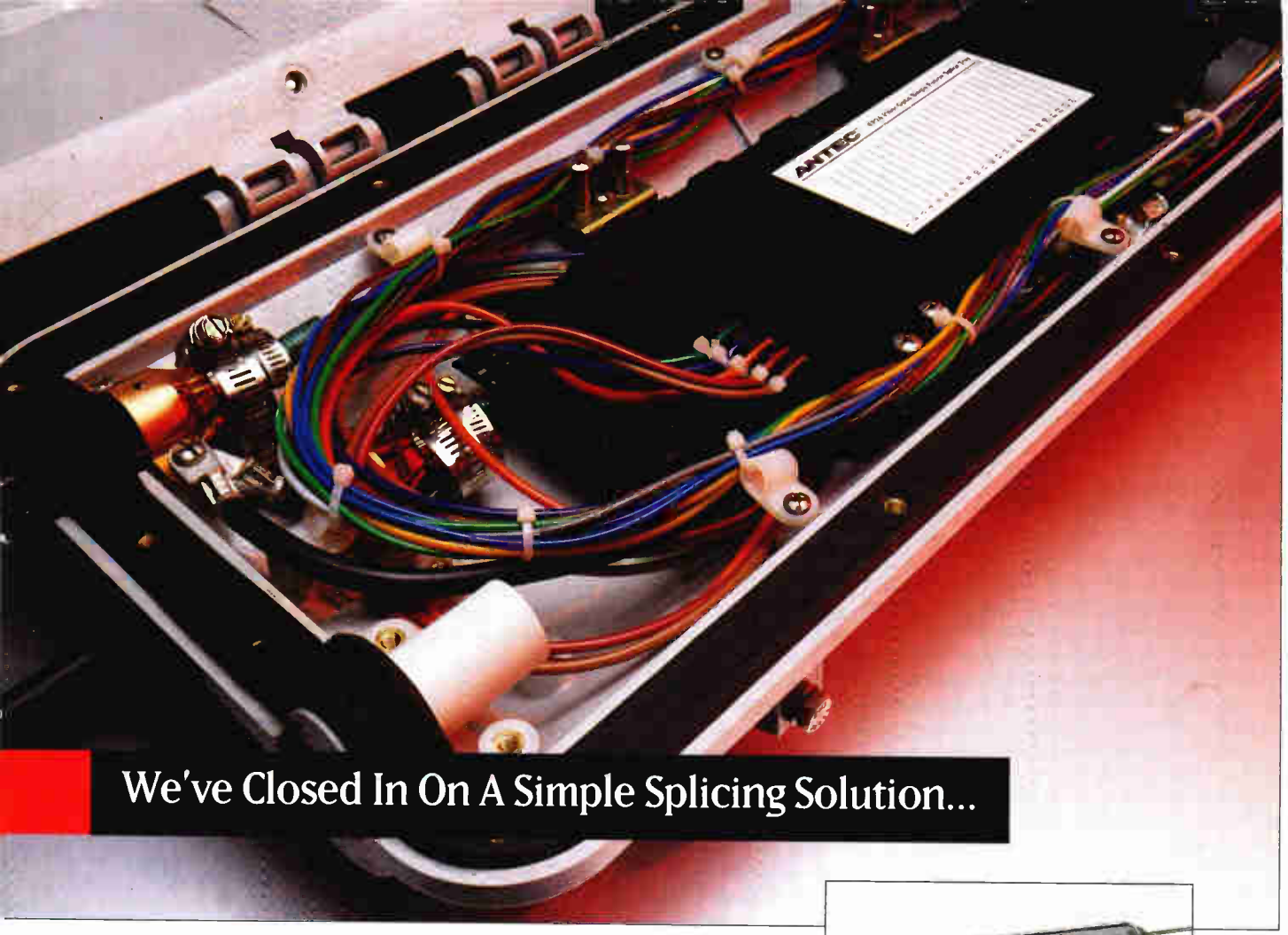

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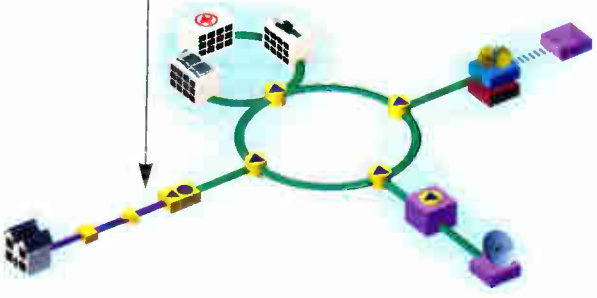

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